



The California State University
OFFICE OF THE CHANCELLOR

May 2, 2011

Benjamin F. Quillian
*Executive Vice Chancellor and
Chief Financial Officer*

*Tel 562-951-4600
Fax 562-951-4971
bquillian@calstate.edu*

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The Honorable Jerry Brown
Governor of the State of California
State Capitol
Sacramento, CA 95814

RE: California State University Mathematics and Science Teacher Initiative

The report on the California State University (CSU) Mathematics and Science Teacher Initiative is provided in accordance with Provision 5 of the Budget Act of 2009.

Budget Act 2009 - Provision 5 - Of the funds appropriated in Schedule (1), \$2,713,000 is provided to continue support for enhancing the capacity of science and math teacher credential programs to implement the Science and Math Teacher Initiative. The California State University (CSU) shall report to the Legislature and the Governor by May 1 of each year on its progress toward increasing the quality and supply of science and mathematics teachers resulting from implementation of the Science and Math Teacher Initiative. This report shall include the following information: (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 item, (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 math or science teaching credential, including the location of the K–12 school of employment and whether it is in an urban, rural, or suburban setting.

The attached report is also available online at <http://www.calstate.edu/budget/fybudget/legislative-reports/> . Should you have any questions about this report please contact Beverly Young, Assistant Vice Chancellor, Teacher Education and Public School Programs, at (562)951-4747 or byoung@calstate.edu.



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Mathematics and Science Teacher Initiative Report
May 2, 2011
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Sincerely,

Benjamin F. Quillian
Executive Vice Chancellor and
Chief Financial Officer

Enclosure

BFQ: Im

- c: Members, California State Legislature
Charles B. Reed, CSU Chancellor
Ephraim Smith, Executive Vice Chancellor and Chief Academic Officer
Garrett Ashley, Vice Chancellor, University Relations and Advancement
Karen Y. Zamarripa, Assistant Vice Chancellor, Advocacy and State Relations
Robert Turnage, Assistant Vice Chancellor for Budget
Beverly Young, Assistant Vice Chancellor, Teacher Education & Public School Programs



The California State University
OFFICE OF THE CHANCELLOR

**THE CALIFORNIA STATE UNIVERSITY
MATHEMATICS AND SCIENCE
TEACHER INITIATIVE**

2010-11 REPORT

**CALIFORNIA STATE UNIVERSITY
CHANCELLOR'S OFFICE**

MAY 1, 2011

The California State University Mathematics and Science Teacher Initiative 2010-11 Report

Background

The projected need for new mathematics and science teachers in California over the next ten years continues to exceed 30,000.¹ Because the demand for mathematics and science teachers is far greater than the pool of teachers credentialed in these fields, many students in the state continue to be taught by teachers who are underprepared in these subjects.

The largest number of misassigned California teachers in core placements (i.e., placement of teachers in a position for which they do not hold an appropriate credential) continues to be in science and mathematics. At the high school level, 18% of physical science, 11% of life science, and 10% of math teachers were teaching out-of-field in 2009.² Of total misassignments in the state in core subjects, 65% were in science, with the highest concentration at the middle school level.³

The problem of an insufficient number of fully prepared teachers has continued in these two fields while dropping overall in California. In both fields, the state is still not in full compliance with the requirements of No Child Left Behind for a fully qualified teacher.⁴ These often-struggling teachers continue to be disproportionately placed in the highest need schools. More than 200 schools in the state had 20% or more underprepared teachers in 2008-09, mostly in urban areas, serving, on average, 87% students of color.⁵

There is a direct relationship between a teacher's being fully qualified and the learning gains of the teacher's students as measured by standardized achievement tests.⁶ Students who do not have qualified mathematics and science teachers demonstrate lower achievement gains than those whose teachers are qualified in these fields. There are many reasons for these lower achievement gains, among them, the underpreparation of their teachers.⁷

The CSU Mathematics and Science Teacher Initiative

The California State University (CSU) is the largest producer of mathematics and science teachers in California, preparing nearly one-half of new teachers in these fields. In 2004, the Governor called on the state's two public university systems to develop programs to prepare significantly more teachers in these critical areas. To address the significant need for additional mathematics and science teachers, Chancellor Charles B. Reed made a systemwide CSU

¹ Data based on projections of student growth, teacher retirements, demand for math and science teachers, and school district projections of new teacher hires. Sources: California Department of Education, Commission on Teacher Credentialing, Stanford Research Institute, Center for the Future of Teaching and Learning.

² Woodworth, K., Bland, J., Guha, R., Shields, P., Wechsler, M., Tiffany-Morales, J., & Tse, V. (2009). *The status of the teaching profession 2009: Full report*. Santa Cruz, CA: The Center for the Future of Teaching and Learning.

³ *Commission on Teacher Credentialing Press Release*, August 5, 2010, Sacramento, CA: Commission on Teacher Credentialing.

⁴ California Department of Education, Dataquest, NCLB Core and Compliant Classes by Subject Area, 2008-09, <http://dq.cde.ca.gov/dataquest>.

⁵ Woodworth, K., Bland, J., Guha, R., Shields, P., Wechsler, M., Tiffany-Morales, J., & Tse, V. (2009), *op. cit.*

⁶ Boyd, D., Grossman, P., Langford, H., Loeb, S., & Wyckoff, J. (2008). *Teacher Preparation and Student Achievement*. Washington, D.C.: Urban Institute, Center for Analysis of Longitudinal Data in Educational Research, Working Paper 20.

⁷ Darling-Hammond, L. & Baratz-Snowden, J. (Eds.). (2005). *A good teacher in every classroom: Preparing the highly qualified teachers our children deserve*. San Francisco, CA: Jossey-Bass.

commitment to double production of teachers in these fields from a baseline of approximately 750 in 2003 to a figure of 1,500.

CSU began its Mathematics and Science Teacher Initiative (MSTI) in 2004-05 with a planning process involving all of its campuses (22 of the 23) that prepare teachers. Each campus designed approaches for the initiative based on the strengths of the campus and the region's needs, resources, and opportunities. Campuses annually update their action plans for achieving the goal of at least doubling credential production.

The campus approaches are integrated within the CSU systemwide initiative, which includes seven comprehensive strategies. The evidence from efforts in math and science teacher preparation indicates that there is not one simple solution to increasing production.⁸ There are multiple obstacles to increasing recruitment and production, and these must be addressed through a multi-faceted approach for sustained effectiveness.⁹

The CSU approach has had demonstrated success from its inception. As a result, the seven strategies have been continued. These focus on (1) recruitment of new students into the teaching field, (2) increasing production through new credential pathways, (3) financial support to attract outstanding candidates and to facilitate credential completion, (4) community college alignment, (5) online resources and preparation, (6) partnerships with federal labs and industry, and (7) identification of the most successful approaches to replicate and scale up systemwide.

CSU Mathematics and Science Teacher Initiative Reporting Requirements

This report provides information on the CSU Mathematics and Science Teacher Initiative and its outcomes during 2009-10. It is in response to provisions of the state Budget Act that require an annual report on the CSU efforts with the following four components:

1. 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);
2. an expenditure plan for the use of funds appropriated in this provision;
3. the effectiveness of the initiative's different components and activities, including an identification of best practices; and
4. 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.

Number of Mathematics and Science Teachers Produced by CSU Campuses

The increase in CSU production of new mathematics and science teachers from the baseline year of 2003 to 2009-10 has been highly significant—a doubling, from a baseline of approximately 750 to over 1,500. The increase has been steady and sustained over the five-year period since the initial planning and funding for the CSU Mathematics and Science Teacher Initiative began in 2004-05.

⁸ *Turning the Tide: Strategies for Producing the Mathematics and Science Teachers Our Schools Need* (November 2006). Washington, DC: The National Association of System Heads.

⁹ 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.

Systemwide data for 2009-10 and the previous five years for mathematics and science teacher credentials issued by CSU campuses are presented in Table 1 on page 11. The figures include new secondary math and science credentials, Supplemental Authorizations—primarily strengthening math and science expertise among elementary teachers, and second authorizations issued to currently credentialed secondary teachers (who are not included in the counts for new teachers).

The increases have been large in all areas of mathematics and science. In mathematics, the increase has been from 349 in the 2003 baseline year to 718 in 2008-09, an increase of 106%. This is attributable in part to the introduction of the Foundational Level Mathematics (FLM) credential in California. This credential is designed to address the need for credentialed middle school mathematics teachers. In 2009-10, CSU prepared 382 teachers with regular mathematics credentials and 336 teachers with the FLM credential.

The production of science teachers increased from 419 in 2003 to 660 in 2009-10, an increase of 57%. Within the sciences, the largest gains have been in the highest shortage fields. These include increases in chemistry of 141%, geosciences of 127%, and physics of 63.3%. Gains in annual preparation in biology, which is not considered a severe shortage area, have been 18%. CSU made a deliberate attempt to increase science teachers in the highest shortage areas through its Science Teacher and Researcher (STAR) program, described later in this report. In 2009, a new Foundational Level General Science (FLGS) credential was established in California for middle school science teachers. CSU campuses prepared more than 60 teachers in the first year of the new credential.

The credential production increases provide clear evidence of the impact of state support for the CSU Mathematics and Science Teacher Initiative. Campus data in Table 2 (page 12) for 2002-03 through 2009-10 show that 20 of the 22 CSU campuses that prepare math and science teachers demonstrated substantial increases during the period. The two that did not are in regions of declining enrollments where the demand for teachers, even in these fields, is not large.

Examples of large increases include CSU East Bay, which grew from 36 to 100 between 2003 and 2007-08, CSU Fullerton, which grew from 54 to 102, CSU Fresno, which grew from 38 to 80, and CSU San Bernardino, which grew from 28 to 72.

These increases are directly related to the state support provided for the CSU Mathematics and Science Teacher Initiative and to the strategies implemented with these resources. In the case of CSU East Bay, for example, funding has gone in part to increasing the number of community college transfer students, and has generated matching private support from the S.D. Bechtel, Jr. Foundation. In the case of CSU San Bernardino, funding has been used in large part to create new credential pathways and provide financial support, including use of the funds as the required match for federal NSF fellowships.

In the case of CSU Fresno, the funding has been used for a comprehensive strategy that includes recruitment from traditional and new pools of candidates. It includes a partnership with NASA that focuses on recruitment and preparation of K-8 science teachers. In the case of CSU Fullerton, funding has been used for innovative recruitment and delivery approaches, including development of new partially online FLM and FLGS credential programs. Across the CSU system, new strategies have been implemented that could not be initiated or continued without state support, and they have resulted in major increases in mathematics and science teacher production.

The significance of these increases is underscored by the overall declines found statewide in preparation of new teachers in the past six years. In California, the total number of credentials awarded declined 68% between 2003-04 and 2009-10, from 27,150 to 16,151 teachers. The production of single-subject candidates declined by 17% from 2003-04 to 2009-10, from 8,053 to 6,887 teachers. CSU experienced overall declines, as did the other institutions of higher education. The sustained growth in math and science teacher production by CSU is directly attributable both to the continued demand for teachers in these fields and to the financial support provided for the program in the Budget Act.

Expenditure of Funds Appropriated to Mathematics and Science Teacher Initiative

The 2009-10 State Budget appropriated \$2.713 million for the CSU Mathematics and Science Teacher Initiative. The expenditure plan adopted for these funds consisted of two primary components, as described below.

- **Support provided for each of the 22 campuses preparing math and science teachers** to implement: (a) comprehensive recruitment efforts, (b) a range of credential pathways to increase math and science credential production—including innovative programs preparing candidates for the newly established Foundational Level General Science Credential, (c) financial support for candidates, (d) programs aligned with community colleges, (e) online resources and preparation, and (f) the CSU systemwide web-based MSTI Recruitment Toolkit (<http://msti.fullerton.edu>): **\$2,527,000.**
- **Statewide management and administration**, including activities aimed at: (a) acquiring external resources through matching federal funds to augment state funding, (b) developing partnerships with federal science agencies, (c) monitoring program implementation and effectiveness, and (d) disseminating and scaling up effective practices: **\$186,000.**

Campus support funding was, as in previous years, performance-based and reflected the increases in production of math and science teachers by each campus. This approach has been used during the past four years in order to target resources on approaches and to campuses that show significant effectiveness and to reward success in advancing the goal of doubling credential production.

Allocations to campuses ranged from \$67,000 to \$180,000 in 2009-10, and individual campus amounts were based on (a) production increases the previous year, (b) increases achieved during the entire period of the systemwide initiative, and (c) total campus annual production. In order to receive an allocation, each campus was required to submit a plan that included:

- Credential production targets for the next three years
- Action steps for increasing production of both mathematics and science teachers
- A detailed budget and budget justification for the allocation
- A progress report, including the identification of effective strategies and best practices

Purposes for which the campus allocations are being used follow systemwide guidelines. There are strict limitations on uses for administration, faculty salaries, consultants, and travel in order to ensure that resources are targeted primarily to assisting students enter and complete credential preparation. Only activities that are directly related to math and science teacher

recruitment and preparation can be supported, and the funds cannot be used to offset costs of instruction or student support that are part of ordinary campus academic programs. All budgets are reviewed thoroughly to ensure conformity with these requirements.

Primary budget items for which campuses use funds continued to include:

- Scholarships to students to assist them in completing math or science credential pathways
- Stipends to students who served as math or science aides or tutors in P-12 schools
- Dedicated project coordinators responsible for planning, management, and reporting
- Recruitment efforts such as workshops, events, advising, and outreach materials
- Faculty assigned time to plan and develop programs for new credential pathways
- Support staff to advise and assist students about credential pathways and resources
- Outreach, publicity, and assistance to students in applying for scholarships and other support
- Coordination with community colleges and advising for community college students
- Creation of online program resources and tools
- Development and maintenance of project web sites
- Assisting students with preparing for the California Basic Educational Skills Test (CBEST) and California Subject Examination for Teachers (CSET)

Systemwide guidance regarding the use of Mathematics and Science Teacher Initiative funds is provided to ensure that activities are undertaken that have significant promise for recruiting and preparing new math and science teachers. In addition, a primary feature of systemwide coordination is the strategic use of program funds to leverage federal and philanthropic funding.

An example of the leveraging strategy was the use of funds from the program to maximize the federal funding to California for mathematics and science teacher preparation, including the Robert Noyce Scholarship program. This program requires a large campus match for the significant new Noyce program providing fellowship support for combined credential-Master's programs in math and science. Math and Science Teacher Initiative funds have been exceptionally important in leveraging these federal funds. This Noyce fellowship program requires up to a 50% match for NSF grants, and program funds, along with state marginal cost funds, are being utilized for matching requirements—which campuses could not meet otherwise. The new NSF Noyce funding systemwide during the past two years has been very large—more than \$17,850,000—reflecting substantial MSTI leveraging and grants to 20 campuses.

In large part due to the use of Math and Science Teacher Initiative funds for leveraging, Noyce scholarships and fellowships were awarded in 2009-10 by CSU campuses to more than 250 outstanding math and science majors, typically having a GPA of 3.0 or above, who are planning a teaching career. Math and Science Teacher Initiative recruitment and NSF Noyce scholar recruitment are closely coordinated, and CSU students majoring in mathematics and science entering credential programs are now among the top graduates in these disciplines.

One component of NSF Noyce funding to campuses is support for *undergraduate/credential scholarships*. This program provides scholarships of up to \$10,000 per year to future teachers during upper division and credential study. Total funding for this program to CSU campuses has been more than \$20 million. Twenty of the CSU campuses preparing teachers currently have these highly prestigious NSF Robert Noyce math and science teacher scholarship programs.

Seven CSU campuses have now also received NSF awards for new *credential/Master's degree fellowships* for mathematics and science teachers. These programs provide a fellowship of \$10,000 for a year for credential/Master's degree study and a stipend of \$10,000, accompanied by mentoring by an expert, experienced teacher during each of the first four years of teaching. Four additional campuses have received planning grants for these credential/Master's degree programs, with the combined funding for both exceeding \$10 million. These programs require a continued match, and Mathematics and Science Teacher Initiative funds are the state support being used for meeting this CSU campus obligation during the several year period of the grants.

Two additional NSF awards were made to CSU campuses in support of the NSF Noyce programs. One was for an annual Western Regional Noyce Conference each year that brings the Noyce fellows on the campuses together. This is part of CSU's strategy to create a community of outstanding new math and science teachers, to facilitate connections among these new teachers, and to foster their long-term retention in the teaching profession.

Another NSF Noyce award was provided for the CSU Science Teacher and Researcher (STAR) Program. This program creates a distinguished dual teacher/researcher career pathway for science and math teachers. It is an innovative partnership between CSU and federal science agencies. It provides cutting edge research experiences for prospective and new teachers and encourages them to develop applications of these research experiences for their own classrooms. The program was begun in the summer of 2007 with future CSU science teachers having summer research placements at the Lawrence Livermore National Laboratory in the San Francisco Bay Area and with support from the S.D. Bechtel, Jr. Foundation.

The STAR program includes a deliberate focus on connecting laboratory research with classroom teaching, and 77% of participants indicated that it increases their interest in becoming a science teacher. STAR was expanded in 2008, 2009, and 2010 to include more students at additional federal Department of Energy research laboratories and at NASA research centers, with support from the S.D. Bechtel, Jr., and Fluor Foundations and federal funds. NSF has awarded more than \$735,000 to California Polytechnic State University, San Luis Obispo, the campus that leads the STAR program, for program continuation and expansion. NSF plans to continue its support and, similarly, the S.D. Bechtel, Jr. Foundation made a commitment of \$265,000 to the program each year through 2016.

The STAR program now involves the U.S. Department of Energy (DOE) Lawrence Livermore and Berkeley national laboratories as well as the DOE Sandia laboratory in Livermore and the Stanford Linear Accelerator Center. In addition, the three NASA research centers in California—NASA Ames, Dryden, and the Jet Propulsion Laboratory (JPL)—are now all participating. Last year, 71 students participated in STAR; the total number of participants since the program began as part of the Math and Science Teacher Initiative in 2005 has been 156.

This year, the external funds raised will again enable a total of approximately 70 outstanding students to participate. The design CSU has created for the program enables future science and math candidates to be in the program initially in the summer before their senior year and then to

continue for four additional years. It is a long-term CSU strategy aimed at both recruiting and retaining outstanding science and math teachers.

The STAR program was recognized in 2011 by the National Science Teachers Association,¹⁰ in 2010 by the American Association of Colleges and Universities,¹¹ and in 2009 in a report to the Presidential Council of Advisors on Science and Technology (PCAST).¹² Each recognized it as a national model for addressing K-12 science and mathematics teacher workforce needs. Added benefits of the model that have been cited include contributions to improving high school student achievement¹³ and fostering development of a long-term pipeline in science, technology, engineering and mathematics (STEM).¹⁴ In 2010-11, the program will double its internships in Southern California, including substantial growth at NASA JPL and NASA Dryden, reflecting important expansion from its original location in the San Francisco Bay Area.

Effectiveness of CSU Mathematics and Science Teacher Initiative Components and Identification of Best Practices

The components of the CSU Mathematics and Science Teacher Initiative are integrated into a comprehensive systemwide strategy and utilize approaches recognized as being among the most significant for increasing math and science teacher preparation that have been undertaken nationally.¹⁵ The distinctive features of the Initiative are: (a) institutional commitment that is articulated and reinforced at multiple levels, (b) comprehensive recruitment and financial support, (c) approaches that connect future teachers with communities of practice that include scientists and mathematicians as well as other dedicated teachers in their disciplines, (d) broad-ranging collaboration and partnerships with other educational agencies and with federal science agencies, and (e) rigorous data systems and evaluation procedures for monitoring outcomes.

A first factor that has supported program effectiveness is ***institutional commitment at all levels***. This includes institutional infrastructure and campuswide involvement to promote shared responsibility and engagement. Support of campus academic leaders and staff, active participation of faculty in Colleges of Science and Mathematics and Education, and cooperative efforts to attract, recruit, and prepare outstanding candidates are characteristic of the CSU systemwide Math and Science Teacher Initiative. The program has mutually supportive leadership among top academic leaders. The commitment of leaders at each level is reinforced by and reinforces the work of leaders at the other levels and is encouraged by CSU Chancellor Charles Reed and the CSU Executive Vice Chancellor and Chief Academic Officer.

A second factor that has been instrumental in supporting program effectiveness is the ***integration of comprehensive recruitment strategies and financial support***. Included in this is ongoing attention to recruiting more math and science teachers from underrepresented groups. Approaches for recruiting candidates from diverse populations are directly aligned with scholarships and loan assumption programs to enable candidates from diverse backgrounds to complete a credential program without incurring significant student debt.

¹⁰ *NSTA Reports* (January 2011), Vol. 22(5), pp. 1-2. Washington, DC: National Science Teacher Association.

¹¹ Baker, W. & Keller, J. (Spring 2010). Strengthening STEM Education through Authentic Research Experiences for Preservice and Early Career Teachers. *Peer Review*, pp. 22-26. Washington, DC: American Association of Colleges and Universities.

¹² Bill Valdez (22 October, 2009). Presentation for PCAST Meeting on STEM Education. Washington, DC: Office of Workforce Development for Teachers & Scientists., Office of Science, U.S. Department of Energy,

¹³ Silverstein, S.C., Dubner, H, Miller, J., Glied, S., & Loike J. (2009, October 16). Teachers' participation in research programs improves their students' achievement in science. *Science*, Vol. 326, pp. 440-442.

¹⁴ *Ibid.*

¹⁵ Coble, C.R. & DeSteano, L. (2011). *The Analytic Framework: A Taxonomy of Design & Innovation for STEM Teacher Preparation and Development*. Washington, DC: Association of Public Land Grand Universities. Retrieved April 11, 2011, from <http://www.teacher-imperative.org>.

A third factor supporting effectiveness is preparation that **connects future teachers with science and mathematics communities of practice**. Building communities of practice begins during candidate preparation and continues through high-quality advanced degree and professional development opportunities. In programs like STAR, CSU science teacher candidates are directly involved in scientific practice and discourse, and the programs engage them as members of professional communities with leading scientists. In the NSF Noyce Teacher Fellows programs, candidates have the opportunity to earn both a teaching credential and a Master's Degree in mathematics or science and to continue being members of expert communities with mentor teachers.

A fourth factor that has advanced effectiveness emphasizes **collaborative strategies and partnerships that often extend beyond traditional boundaries**. These include innovative partnerships between Colleges of Education and Colleges of Science and Mathematics that have resulted in recruitment of outstanding undergraduates. They also include systemic partnerships with the entire spectrum of K-20 educational institutions throughout regions. Another important partnership has been with the California Student Aid Commission. This has enabled CSU campuses to award more than \$12 million in loan assumption funds to future science and mathematics teachers. A fourth set of partnerships are with federal agencies, including NSF, the Department of Energy, and NASA. A fifth set have been with philanthropic foundations having a commitment to advancing STEM education and teacher preparation in California, including the S.D. Bechtel, Jr., Fluor, and the David and Lucile Packard Foundations.

An additional factor enhancing effectiveness pertains to **robust data systems for continuously monitoring progress and outcomes**. Thorough and refined accountability systems are critical (a) to determine the strategies and institutions that are most effective in increasing production of well qualified math and science teachers and (b) to examine them to identify their distinguishing features and impacts. The approach used by CSU to monitor performance tracks campus progress on a continuing basis, examines changes in production to identify the most effective strategies, and builds on the robust data systems developed by the CSU Center for Teacher Quality for the system's *Annual Evaluation of Teacher Preparation Programs* to examine the characteristics of the schools where CSU math and science graduates teach.

Identification of Best Practices

Best practices have been identified for each factor associated with effectiveness by examining relationships between the factors and changes in credential production. There has been a consistent association between certain approaches and large increases in preparation of well-qualified teachers and this is the basis for judging best practices.

In the case of **institutional commitment**, a common feature is seen both at campuses that began with little institutional engagement but now have science and mathematics teacher preparation as a campus-wide priority, and those that have a long tradition of commitment to this area and where the institution has more than doubled its programs. The feature characteristic of the institutional commitment is sometimes referred to as *nested leadership*.¹⁶ There is a concerted, campuswide effort that involves the President, Provost, Deans, Department Chairs, and faculty all working toward the same goal. The actions at each level

¹⁶ Resnick, L. & Glennan, T. (2003). Leadership for Learning: A theory of action for urban school districts. In S.T. Hightower, M. Knapp, J. March, & M. McLaughlin (Eds.), *School districts and instructional renewal*. New York: Teachers College Press.

support one another, typically under the leadership of math, science, and education deans, and yield a culture of campuswide support and a long-term commitment to attracting and preparing outstanding new math and science teachers.

In the case of **recruitment and financial support**, campus efforts to secure external scholarship funding for candidates are essential. In science and mathematics, fellowships often exist for students who are pursuing research careers. The use of Mathematics and Science Teacher Initiative funds as matching resources to secure federal funds and the commitment of these funds for the entire periods of federal grants allows for the type of scholarship that attracts outstanding math and science majors into teaching. The simultaneous branding of math and science teaching as prestigious is essential for effective recruitment. Campuses achieve this through highly attractive booklets, posters, newspaper ads, and videos that demonstrate that science and mathematics teaching are highly engaging and rewarding careers. These resources are shared across campuses through the online MSTI Recruitment Toolkit.

The STAR program is an example of making it possible for future science and math teachers to participate actively in scientific **communities of practice**. Through it, these teachers work with some of the nation's most outstanding researchers. An additional partnership between CSU and NASA is another example of best practices that has similar outcomes. Between 2007-08 and 2009-10, more than 70 CSU future math and science students participated in *Spaceward Bound*,¹⁷ during which they were members of field research teams with NASA scientists who study extreme environments that have similarities with remote planetary conditions. Each spring, future science teachers from several CSU campuses now go on a field research expedition with NASA scientists in the Mojave National Preserve and engage in subsequent follow-up with the teams of researchers.

Spaceward Bound is one part of a broader effort funded by NASA to enhance the integration of NASA Mission research into the classroom at the secondary level.¹⁸ The focus is to introduce NASA-related field research to pre-service and in-service teachers. In 2009, CSU campuses received one of seven grants made nationally by NASA to prepare both current and future teachers in using NASA research in high school classrooms. In 2010, two CSU campuses received NASA grants to enable K-8 teachers to participate in pre-service teacher institutes located at NASA research facilities.

The data systems used by CSU to **continuously monitor progress and assess outcomes** build on data from the annual CSU Evaluation of Teacher Preparation Programs. The reporting systems developed by the CSU Center for Teacher Quality enable CSU to track its teacher graduates, identify the attributes of the schools in which they teach, and analyze the degree of preparation as reported by candidates and their Principals.

In addition, data provided by the California Commission on Teacher Credentialing are subject to refined analyses by the CSU Office of Analytic Studies to determine exact numbers of credentials recommended by each CSU campus. The Office of Analytic Studies has also performed in-depth analysis of community college transfers to CSU with declared STEM majors. These analyses identified more than 20 California Community colleges which each had more than 100 STEM transfers to CSU during the past three years. These data will be used to target transfer strategies, reflecting a commitment to data-based management building on CSU analytic and evaluation systems.

¹⁷ Heldmann, J., McKay, C., & Coe, L. (2007, October 1-5). *Spaceward Bound: Training and inspiring the next generation of space explorers*. Paper presented at the Annual Meeting of the Lunar and Planetary Institute, Houston, TX.

¹⁸ *Ibid.*

Job Placement of CSU Students Who Earn a Mathematics or Science Teaching Credential

A comprehensive analysis was conducted on the job placement of CSU mathematics and science teachers whose first year of teaching was in 2009. The findings were striking, demonstrating that large numbers teach in high-need schools. Of CSU math and science teacher graduates:

- 63% taught in schools with more than half of the students in poverty and over 82% taught in schools with 25% or more of the students in poverty;
- 39% taught in city schools, approximately 12% in rural schools, and the remainder in suburban schools;
- 20% taught in schools that did not meet their annual Academic Performance Index (API) in 2007-08; the remainder taught in schools that did;
- 79% taught in schools with less than 100% fully credentialed teachers.

There was an increase from 49% to 63% from 2008-09 to 2009-10 in the number who taught in schools with more than half of students in poverty and from 70% to 82% in those who taught where 25% or more students were in poverty. California teacher workforce shortages underscore the importance of these job placements among CSU math and science teachers—which show a sustained pattern in which the majority teach in high-need schools.

Challenges of finding qualified math and science teachers are acute among the state's high need schools. The new math and science teachers prepared by CSU are meeting the needs of California's school districts, teaching in the neediest schools and contributing substantially to overcoming inequities in the distribution of well-qualified mathematics and science teachers.

Conclusions

CSU campuses continued on a trajectory of significant growth in new secondary mathematics and science teacher production in 2009-10, with the production doubling since the 2003 baseline year. . The new math and science teachers produced by CSU campuses are taking job positions in high need schools across the state. They are contributing markedly to addressing school district needs, including those in urban, rural, and low-income districts, and to reducing the disparities in access to fully qualified mathematics and science teachers that have existed in the state throughout the past decades.

Data Tables

Table 1. CSU Mathematics and Science Teacher Credential Production by Subject: 2002-03 to 2009-10^{a,b}

	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10
Subject								
Regular Mathematics	349	447	405	402	525	479	452	382
Foundational Mathematics	0	28	119	170	258	307	321	336
Mathematics Sub-total	349	475	524	572	783	786	773	718
Science: Biology	296	404	347	310	316	367	343	331
Science: Chemistry	56	89	66	82	96	91	129	135
Science: Geosciences	37	45	40	53	54	73	73	84
Science: Physics	30	43	34	40	39	39	43	49
Foundational Science	0	0	0	0	0	0	6	61
Science Sub-total	419	581	487	485	505	570	594	660
Math and Science Sub-total Secondary Authorizations	768	1056	1011	1057	1288	1356	1367	1378
Supplemental Authorizations Preparing Elementary Teachers in Science or Mathematics Additional Science or Mathematics Authorizations Among Current Secondary Teachers								74 50
Math and Science Grand Total Across CSU Campuses								1502
^a Data on new credentials are provided by the California Commission on Teacher Credentialing (CCTC).								
^b Data include total CSU mathematics and science teacher credentials and authorizations in 2009-10.								

This table presents California Commission on Teacher Credentialing data from 2002-03 through 2009-10 for mathematics and science Credentials recommended by California State University campuses. The calculations are based on the count of math and science credential authorizations that have been recommended for (a) regular credential candidates and (b) intern credential candidates since both are compliant with federal No Child Left Behind (NCLB) requirements.

Table 2. CSU Mathematics and Science Teacher Credential Production by Campus: 2002-03 to 2009-10^{a,b}

Campus	2002-03			2003-04			2004-05			2005-06			2006-07			2007-08			2008-09			2009-10		
	Math	Sci	Total	Math	Sci	Total	Math	Sci	Total	Math	Sci	Total	Math	Sci	Total	Math	Sci	Total	Math	Sci	Total	Math	Sci	Total
CSU Bakersfield	14	15	29	12	24	36	17	8	25	15	22	37	31	38	69	43	29	72	54	34	88	32	23	55
CSU Channel Islands	0	0	0	0	0	0	4	2	6	11	6	17	12	8	20	11	5	16	6	7	13	11	5	16
CSU Chico	18	18	36	7	21	28	8	18	26	17	13	30	26	14	40	19	14	33	20	8	28	21	17	38
CSU Dominguez Hills	40	35	75	55	39	94	42	39	81	44	17	61	66	42	108	80	67	147	97	60	157	59	38	97
CSU East Bay	16	20	36	30	32	62	15	13	28	34	36	70	93	29	122	41	33	74	23	54	77	52	48	100
CSU Fresno	15	23	38	6	13	19	18	24	42	13	12	25	22	25	47	35	27	62	36	32	68	46	34	80
CSU Fullerton	11	43	54	23	36	59	44	26	70	46	18	64	50	26	76	55	41	96	57	43	100	49	53	102
Humboldt State	5	8	13	8	17	25	7	8	15	5	17	22	11	4	15	8	7	15	8	5	13	1	9	10
CSU Long Beach	16	26	42	36	50	86	54	44	98	57	51	108	59	37	96	69	44	113	78	57	135	59	54	113
CSU Los Angeles	38	33	71	36	48	84	55	28	83	35	24	59	31	15	46	43	16	59	45	24	69	35	15	50
CSU Monterey Bay	0	0	0	1	4	5	4	11	15	3	5	8	10	6	16	15	11	26	9	15	24	15	21	36
CSU Northridge	42	41	83	63	54	117	60	62	122	61	54	115	71	32	103	56	28	84	46	39	85	49	40	89
Cal Poly Pomona	17	14	31	20	24	44	26	24	50	24	19	43	39	17	56	36	28	64	31	27	58	37	19	56
CSU Sacramento	6	15	21	18	22	40	18	24	42	18	25	43	25	18	43	27	27	54	34	23	57	32	26	58
CSU San Bernardino	12	16	28	22	50	72	27	28	55	39	28	67	51	32	83	45	30	75	44	27	71	44	28	72
San Diego State	20	23	43	25	21	46	28	30	58	41	36	77	34	25	59	41	25	66	39	22	61	35	30	65
San Francisco State	32	30	62	53	50	103	33	26	59	34	36	70	45	33	78	48	33	81	38	14	52	39	41	80
San Jose State	16	25	41	21	35	56	33	32	65	24	21	45	36	42	78	24	30	54	14	28	42	13	48	61
Cal Poly SLO	5	8	13	10	12	22	0	3	3	8	12	20	6	10	16	15	14	29	17	18	35	16	23	39
CSU San Marcos	6	10	16	6	10	16	9	10	19	10	10	20	14	17	31	16	15	31	19	15	34	22	29	51
Sonoma State	12	11	23	11	7	18	8	14	22	16	13	29	17	19	36	23	21	44	17	11	28	17	29	46
CSU Stanislaus	8	5	13	12	12	24	14	13	27	17	10	27	40	11	51	36	25	61	41	31	72	34	30	64
Secondary Sub-total	349	419	768	475	581	1056	524	487	1011	572	485	1057	783	505	1288	786	570	1356	773	594	1367	718	670	1378
Supplemental Authorizations Preparing Elementary Teachers in Science or Mathematics																						30	44	74
Additional Science or Mathematics Authorizations Among Current Secondary Teachers																						26	24	50
Math and Science Grand Total Across CSU Campuses																						774	738	1502

^aData on new credentials are provided annually by the California Commission on Teacher Credentialing (CCTC). The data for each campus represent new secondary math and science credentials each year.

^bData in table represent new secondary credentials (sub-total) and additional elementary and secondary credentials to provide total CSU mathematics and science credentials and authorizations in 2009-10.