

## **Insights Derived from Field Testing:**

### **An Overview of Six Pilot Projects**

The six pilot projects selected for the field-testing of the recommendations provided in the STEMCAP report represent different approaches to improving student success in STEM fields. Although diverse in structure and scope, these projects are also similar in many ways including the types of participating partners, program activities, and assessment tools. All six projects were successful in meeting their stated goals. The overall success of these projects suggests that such approaches represent effective mechanisms for transforming the STEMCAP recommendations into actual practice. A general overview of findings from this group of projects is provided in subsequent paragraphs and individual analyses of each of the six pilot projects are provided in the remainder of this report.

Pilot projects addressed all but three STEMCAP recommendations. The three most commonly addressed recommendations were 1, 4, and 6 which broadly relate to increasing student interest in STEM disciplines and inspiring the desire to pursue careers in such domains. Additionally, recommendation 6 includes an emphasis on recruiting a diverse teaching force for STEM fields. Recommendations 2, 7, 9, and 10 were less frequently addressed and recommendations 3, 5, and 8 were not addressed at all.

Many different stakeholders were partners in the work of these six pilot projects. Partners included representatives from California community colleges and universities, K-12 districts and schools, County Offices of Education, foundations, community organizations, businesses, the University of California Office of the President (UCOP), and the California Academic Partnership Program (CAPP).

In general, projects included four types of activities intended to address selected STEMCAP recommendations. Such activities included community college and university courses, K-12 curriculum (e.g., inquiry projects, field trips), teacher preparation/professional development opportunities, and resource development (e.g., a recruitment web site for STEM teachers).

In order to assess the efficacy of project activities, several types of measures were used. Participant-reported evaluation data (e.g., student surveys, interviews) and student assessment data (e.g., pre/post tests) were the most frequently used assessment measures. Other data sources included college enrollment data, program attendance data, and community college transfer rates. Project outcomes fell into four thematic categories including increased program participation, increased student engagement with and achievement in STEM disciplines (especially math and science), and increased interest in pursuing teaching as a career (especially in STEM fields).

All six projects reported plans to ensure the sustainability of their activities. However, several common challenges emerged in such discussions. It became clear that securing funding is an ongoing issue for most projects. Additionally, projects identified the need to improve the assessment tools used to measure and document evidence of project success. Recruiting and retaining participants and staff were also frequently mentioned as challenges related to sustainability.

In general, the STEMCAP report was considered to be a useful tool by all projects. More specifically, there was a consensus that the recommendations validated project work and provided a meaningful conceptual framework for designing and implementing project activities.

## **San Luis Obispo County P-16 Council's Cal Poly State University Learn by Doing Lab**

**Project Description:** The Learn by Doing Lab (LBDL) is a nexus for recruiting and training new science teachers, supporting the professional development of in-service science teachers, and stoking the fires of college and careers in science for middle school students. Project goals center on the three stakeholders brought together in the LBDL classroom: Cal Poly students, in-service partner teachers and middle school students. The central goals for Cal Poly Students include giving Cal Poly students a positive teaching experience with an opportunity to “think like a teacher”, increasing the likelihood that Cal Poly Science majors will choose teaching as a career, and enabling our students to gain hands-on experience with inquiry-based pedagogy. LBDL is meant to serve as a meaningful professional development activity for in-service teacher partners and to promote inquiry-based science in their classrooms. For the participating middle school students, the primary goals are to reinforce fundamental grade-appropriate scientific concepts and to engender excitement about science and about going to college.

**Participating Partners:** The LBDL project incorporates representatives from Cal Poly State University, the San Luis Obispo County Office of Education, Twin Cities Community Hospital, Pacific Gas & Electric Company, Cuesta Community College, the Economic Opportunity Commission, the San Luis Obispo Coastal Unified School District, and the San Luis Obispo County Community Foundation.

**STEMCAP Recommendations Addressed:** The LBDL project addresses STEMCAP recommendations 1, 2, 4, and 7.

**Project Activities:** The SCM X302 undergraduate course is the backbone of the LBDL project. It was piloted in the spring of 2008 as a joint venture between the College of Science and Mathematics at Cal Poly, the Cal Poly Center of Excellence in Science and Mathematics Education (CESaME), and the San Luis Obispo County P-16 Council. Based on a longstanding model implemented at Chico State University, this course offers Cal Poly undergraduate Science majors an opportunity to use inquiry-based, standards-appropriate pedagogical approaches to actively engage 6-8<sup>th</sup> grade students on the Cal Poly campus. In the spring of 2008, twelve Cal Poly undergraduate students enrolled and supported 600 visiting middle school students from eight school sites across Central California in an inquiry-based science lab experience that consisted of two content modules (i.e., Density Exploration, Phase Exploration) tied to 8<sup>th</sup> grade content standards.

**Project Outcomes:** Pre and post interviews with and written surveys of Cal Poly undergraduates were utilized in order to assess the impact of the Learn By Doing Lab. Data analysis revealed that Cal Poly undergraduate science majors who participated in LBDL demonstrated an increased interest in pursuing a career in teaching. Students also reported experiencing “thinking like a teacher”, developing an openness to alternative pedagogical approaches to teaching science, and developing an increased confidence using inquiry-based tools to teach science.

**Addressing Emergent Challenges and Ensuring Sustainability:** There are two keys to the success and sustainability of LBDL: physical infrastructure and careful long-term assessment of the impact of LBDL on all stakeholders. Additional space on campus has been allocated for the 2008-09 academic year so that two concurrent sessions of the program can be offered. In terms of assessment, work is in progress to expand upon existing measures related to undergraduates and to develop additional assessments (e.g., surveys, concept inventories) to include teacher partners and middle school students.

**Usefulness of the STEMCAP Report:** The STEMCAP recommendations constitute the backbone of the LBDL model and program activities.

## **The Aurora Project**

***Project Description:*** The major goal and focus of the Aurora Project, a collaborative that extends throughout California, is to encourage and support community college freshmen and sophomores, especially underrepresented students, in STEM fields to prepare for and pursue a career in teaching middle and high school mathematics and science. As freshman and sophomores, community college students take seminar-type courses, are engaged in field experiences at local schools, and receive scholarship stipend support as they pursue eventual degrees in math/science and a teaching credential. The Aurora Project began in the Foothill De Anza Community College District and is currently in operation at twenty-two community colleges across California. The long term objective is to implement the Aurora Project at one hundred ten California community colleges so that at least 500 community college students transfer annually to four year college/university to complete their degrees and/or obtain a teaching credential.

***Participating Partners:*** The Aurora Project has numerous partners throughout California including representatives from the University Office of the President, Community College District Offices, Community Colleges, California State Universities, University of California campuses, School District Offices, K-12 schools, The Alliance for Regional Collaboration to Heighten Education Success, NASA Ames Moffett Field, The Agilent Technologies Foundation, The Symantec Foundation, The College Access Foundation of California, The Noyce Foundation, and the California Academic Partnership Program.

***STEMCAP Recommendations Addressed:*** The Aurora Project addresses STEMCAP recommendations 1, 4, 6, 9, and 10.

***Project Activities:*** A seminar series and a corresponding field work component constitute the foundation of the Aurora Project. Seminars, taught by community college faculty, address mathematics and science curricular models, pedagogies, and state content standards. Enrolled students are assigned to classrooms at local schools where they spend 3-5 hours/week observing instruction and working with a “mentor teacher” in each classroom. These field experiences are an integral part of classroom discussion and learning (e.g., students share lesson plans and teach practice units). All students receive scholarship stipends, made possible by financial support from industry partners, for course participation and field work. Additionally, students are provided with opportunities to meet with admissions representatives from the University of California and California State University campuses.

***Project Outcomes:*** Three primary data sources were used to measure the impact of program activities. These data sources include freshman and sophomore enrollment data from participating community colleges, data provided by the University Office of the President regarding STEM transfer rates from California community colleges, and community college student evaluations. Data analysis revealed that student enrollment in Aurora Project seminars is increasing, that growing numbers of students are transferring to UCs and CSUs to complete a bachelors degree, and that many participating students report plans to pursue a career in teaching.

***Addressing Emergent Challenges and Ensuring Sustainability:*** In order to accommodate project expansion, the Aurora Project must secure ongoing private support to build the number of scholarship stipends available to participating community college students. As such, there is a continued effort to seek financial support from outside agencies. Ensuring that students engaged in the Aurora Project continue their studies of math and science, transfer to a 4 year college/university, and obtain a teaching credential is another programmatic challenge which has inspired the provision of ongoing academic advising and counseling to participating students.

***Usefulness of the STEMCAP Report:*** The report provided standards and benchmarks which individuals engaged in collaborations can use in order to demonstrate program progress and emergent challenges to funding agencies.

### **Southern Alameda County Regional Alliance (SACREA)**

***Project Description:*** The primary objective of the Southern Alameda County Regional Alliance is to develop a plan of action to deal with the alarming standardized test passage rates, particularly in mathematics, of the region's African American students. First year initiatives are focused on providing direct student services and educator professional development related to math and science. To this end, SACREA co-sponsored the 2008 Summer Algebra Academies which consisted of three, five week summer algebra courses that provided pre-algebra and algebra refresher instruction for 7<sup>th</sup>, 8<sup>th</sup>, and 9<sup>th</sup> grade students.

***Participating Partners:*** SACREA has many partners including representatives from California State University East Bay, the Alameda County Office of Education, San Leandro Unified School District, San Lorenzo Unified School District, RTFisher Educational Enterprises, Inc., Southern Alameda County Alliance of African American Educators, JL Davis Family Resource Center, and Johnson Controls, Inc.

***STEMCAP Recommendations Addressed:*** SACREA addresses STEMCAP recommendations 1 and 4.

***Project Activities:*** A team of educational specialists developed a customized, standards-based pre-algebra and algebra curriculum which included instructional, collaborative, and project-based lessons arranged in the same thematic units found on the California Standards Test and the California High School Exit Examination. This curriculum was implemented by program staff (one instructor and two college student coaches per classroom) and was supplemented with field trips to locations such as the NASA Ames Research Center, CSU East Bay, the Lawrence Livermore Lab, and the Chabot Space and Science Center. These "Friday Field Trips" provided students with opportunities to explore the real world of math and science by helping them understand the practical application of the concepts they were learning in the classroom.

***Project Outcomes:*** Student assessments, including pre and post tests and weekly quizzes, were administered in order to assess the impact of the program on student learning. Program evaluations were also completed by students, staff, and parents. Data analysis revealed that the small staff to student ratio created a meaningful and productive learning environment for students. Evaluation data also indicated that the flexibility of the instructional context allowed for the curriculum to be further customized to the unique needs of the students. Overall, students also demonstrated increased knowledge of algebraic concepts as measured by pre/post measures and ongoing assessments.

***Addressing Emergent Challenges and Ensuring Sustainability:*** SACREA has identified four considerations related to enhancing their program and ensuring its sustainability. Recruiting quality instructional staff in order to maintain a small staff to student ratio is essential for continued student success. Additionally, there are plans to develop a more targeted student recruitment strategy that can be implemented earlier with the goal of reaching more eligible students. Accessing additional student academic data (e.g., transcripts) and administering the pre-test at an earlier time (such that scores are available before program onset) would allow the program staff to further customize instruction so as to meet student needs. This type of data would also inform staff development and placement.

***Usefulness of the STEMCAP Report:*** The report provided the conceptual framework for the design and selection of daily activities and the summer field trips.

**Alliance for Education: San Bernardino County Superintendent of Schools  
“Making the Connection”: Applications by Business and Labor for Educators (ABLE)**

**Project Description:** On a broad level, the ABLE project represents the mission of the Alliance for Education which is to produce an educated and skilled community that provides a qualified workforce for the continued economic well-being and improved quality of life for all residents of San Bernardino County. More specifically, this project is intended to increase student engagement with mathematics through the development and implementation of three innovative instructional models. Another project goal is to develop useful online resources, including demonstration PowerPoint presentations and newly designed videotaped vignettes that illustrate the project model and efficacy, that can be accessed and utilized by other educators. The design of a marketing campaign to create teacher awareness of the Alliance web site ([www.sbcssalliance.org](http://www.sbcssalliance.org)) where resources will be posted, is another aim of the ABLE project.

**Participating Partners:** ABLE incorporates representatives from the California Teachers Association, Ecclesia Christian Fellowship, Colliers International Bradco, Operating Engineers Training Trust, Kelly Space & Technology, Economic Development Agency, Loma Linda University, Andrew Jaramillo & Associates, Inc., California State University, Bakersfield, Lewis Operating Corporation, the San Bernardino County Superintendent of Schools, ARMAC Insurance Services, San Manuel Band of Mission Indians, Chaffey Community College, Arrowhead Credit Union, Central Labor Council, the Precinct Reporter, Victor Valley Wastewater Reclamation Authority, San Bernardino Community College District, and Victor Valley Union High School District.

**STEMCAP Recommendations Addressed:** ABLE addresses STEMCAP recommendation 4.

**Project Activities:** The “Making the Connection” project consists of three instructional strategies including a speaker’s bureau, field studies, and project-based learning. These strategies are implemented in order to provide learning experiences for students that apply academic knowledge within authentic workplace contexts through classroom speaking/demonstrations, workplace field trips that incorporate hands-on activities and apply academic standards, and industry projects in the classroom. Creating useful resources for mathematics educators is an integral project activity and video presentations of the abovementioned activities in addition to other instructional videos currently exist and are available on the Alliance web site ([www.sbcssalliance.org](http://www.sbcssalliance.org)). Current work is being done to develop a marketing packet for the “Making the Connection” instructional strategies and other ABLE resources so that school site staff are aware of and can access these tools.

**Project Outcomes:** Student surveys and district reported attendance data were used as measures to document the impact of the ABLE project activities. Overall, students reported coming to class more often after attending project presentations, developing the belief that math and science are valuable and relevant in real life, feeling that their career choices were influenced by presenters, and planning on attending college after graduation. Attendance data is still being analyzed in order to substantiate student claims about increased attendance.

**Addressing Emergent Challenges and Ensuring Sustainability:** The Alliance plans to expand the ABLE program into other counties in California but before doing so believes it is important to continue documenting the practice and efficacy of the instructional modules. As such, there are plans to work with a qualified researcher in order to develop an effective assessment strategy including the revision of participant surveys and the creation of additional evaluation tools.

**Usefulness of the STEMCAP Report:** The report, more specifically the recommendations, provided validation for the work of the Alliance and was distributed at the year-end Alliance for Education Stakeholder’s Report in May 2008.

**Monterey Bay Educational Consortium/UCSC Educational Partnership Center  
Supporting STEM Education: Teacher Pipeline and Industry Partnerships**

***Project Description:*** The project described here represents a smaller part of the larger Community College Cal Teach program, a new program to increase the number and retention of new, highly-qualified math and science teachers (part of the UC Math and Science Initiative). In addition to the group of sixteen Academic Interns already hired and trained by the UC Santa Cruz Educational Partnership Center, this project provided funding for the hiring of and additional five community college student. These students are majoring in STEM fields and expressed an interest in teaching as a possible career. Academic Interns provide tutoring support and mentor underrepresented high school students in the Summer Algebra Academy at Seaside High School. The intent of this academic internship program is to increase Algebra passage rates in the region and more importantly to encourage more local college students who are strong in mathematics to consider teaching in STEM fields as a future career choice.

***Participating Partners:*** This project is part of a larger collaborative project that includes representatives from the University of California, Santa Cruz, California State University, Monterey Bay, Salinas Union High School District, Pajaro Valley Unified School District, San Benito County Office of Education, Monterey Peninsula College, Cabrillo College, Gavilan College, Hartnell College, Monterey County Office of Education, Santa Cruz City Schools, North Monterey County Unified School District, San Benito High School District, Monterey Peninsula Unified School District, Santa Cruz County Office of Education, and Alisal Union School District.

***STEMCAP Recommendations Addressed:*** This project addresses STEMCAP recommendations 6 and 7.

***Project Activities:*** The Summer Algebra Academy at Seaside High School served 150 rising ninth grade students and provided them with an engaging, hands-on Algebra experience as well as pre-college learning. Importantly, the academy is not a remedial program; instead, the emphasis is about getting students ready for success in Algebra in high school, a critical gate keeping course in the A-G course pattern for college eligibility. The summer initiative also proactively addresses any potential barriers to going to college and supports students' successful transition from middle to high school. Academic Interns participating in the program leadership gained classroom experience (e.g., workshop development, classroom management) and mentorship opportunities with teachers. They also received support on transfer planning by connecting community college students with teams of other undergraduates from four-year universities for peer mentoring and advising.

***Project Outcomes:*** Three primary data sources were utilized to measure project impact including student achievement data, Academic Intern surveys and interviews, and community college transfer rates. Data analysis revealed that ninth grade students demonstrated an increased Algebra readiness. Community college students (Academic Interns) reported learning important teaching skills and also indicated an increased interest in pursuing a teaching career in STEM fields.

***Addressing Emergent Challenges and Ensuring Sustainability:*** To ensure wider implementation and sustainability of the project, additional resources are needed to recruit more community college students into the Cal Teach program and hire them as Academic Interns during the academic year and summer. Dedicated scholarships need to be provided for transfer students and a loan forgiveness program must be developed for students who complete credential programs and teach in STEM fields, particularly in communities with a high cost of living and equally high need for qualified, well-prepared teachers.

***Usefulness of the STEMCAP Report:*** The guiding principles and recommendations included in the STEMCAP report provided a useful framework for thinking about the work and project design. They also outlined the need and call to action for improvements in STEM education, which influenced the project components and overall approach.

**The Sacramento Collaborative for Regional Education and Workforce (CREW)  
STEM Teacher Recruitment at Sacramento State University**

***Project Description:*** This is an internal project at Sacramento State University created with the intention of increasing the pool of qualified teacher applicants in STEM fields. A specialized STEM committee within the College of Education was established to focus on issues related to teacher recruitment for STEM disciplines. Additionally, efforts are being made to coordinate a university-wide plan for increased faculty and student awareness of pathways to becoming STEM teachers. The project also involves the creation of a comprehensive teacher recruitment web site that can serve as an information hub for faculty, students, and community members.

***Participating Partners:*** This project is internally coordinated at Sacramento State University and involves the Center for STEM Excellence, the College of Education, The College of Mathematics and Natural Sciences, Academic Technology and Creative Services, and Undergraduate Studies.

***STEMCAP Recommendations Addressed :*** This project addresses STEMCAP recommendation 6.

***Project Activities:*** The College of Education STEM Group meets monthly to identify ways in which it can recruit candidates into teacher certification that might not have otherwise considered a teaching career. There is an emphasis on identifying strategies for expanding and diversifying the pool of teacher candidates. Currently the COE-STEM group is working on a CSUS Discipline-Based Algebra grant with the department of Learning Skills. Work is still ongoing for the university-wide plan for informing students of pathways to STEM teaching careers. As of September 2008, a beta version of the recruitment web site has been developed. Future plans for the web site include providing vignettes of compelling interviews with veteran and novice teachers and sharing regional data that highlights the urgent need for STEM teachers

***Project Outcomes:*** To date, no data has been collected in order to measure the impact of this pilot project which is still in an early developmental stage. The long term objective of this project is to create and sustain a multifaceted recruitment strategy for STEM teachers.

***Addressing Emergent Challenges and Ensuring Sustainability:*** At this point, more funding and technology resources are needed in order to further develop the web site design and capacity. Additionally, more meetings of the COE STEM group are needed to continue project work as are more cross-campus meetings with other departments.

***Usefulness of the STEMCAP Report :*** The report provided the conceptual framework for the design of project activities.