

Appendix I: Persons Interviewed

AVID

Steven Baratte, Director of Communications
Ricardo Gomez, AVID Coordinator
Mary Catherine Swanson, Founder
Mark Wolfe, Director of Curriculum Development

Bahia Program

Shara Fisler, Executive Director, Aquatic Adventures

Better Education for Women in Science and Engineering Program (BE WISE)

Patricia S. Winter, General Atomics Sciences Education Foundation

BICOM

Kristie Ford, Associate Director of Workforce Development

California Department of Education

Lynda M. Nichols, Title II, Part A State Coordinator

Cal Teach

Melanie Cruz Walsh, Director of Development, Division of Physical Sciences
Jeff Rimmel, Associate Dean, Division of Physical Sciences

California Partnership for Achieving Student Success (Cal-PASS)

Brad Phillips, Executive Director
Shelly Valdez, Director of Regional Collaboration
Terrence Willett, Director of Research

California State Summer School for Mathematics and Science (COSMOS)

Becky Hames, Program Manager

California State University San Marcos

Mark Baldwin, Dean, College of Education

CASHEE Compact

Karen LaBonte, Special Assistant to Dean

Center for Research Educational Equity, Assessment, and Teaching Excellence (CREATE)

Barbara Edwards, Program Coordinator, CREATE
Hugh Mehan, Director

Classroom of the Future Foundation

Richard Beach, Innovation Wizard

Enhancing Science Education Through Technology (EsETT)

Michael Senise, Lead Educational Technology Resource Teacher
Office of the Deputy Superintendent
San Diego Unified School District

High Tech High

Ben Daley, Vice Principal Academic Affairs

Middle School Science Education Leadership Initiative (MSSELI)

Kim Bess, San Diego County Office of Education
Don Wiseman, San Diego Unified School District

National University

C. Kalami Beyer, Dean
Melinda Brubaker, Director of Credentials

Partnerships Involving the Scientific Community in Elementary Schools Project (PISCES)

Nancy Taylor, San Diego County Office of Education

Point Loma Nazarene University

Dianne Anderson, Biology MA Director
Darrel Falk, Professor of Biology
Brian Thurman, Director of Education, Mission Valley
Maria Zack, Professor and Chair Department of Mathematical, Information and
Computer Sciences

Poway Federation of Teachers

Marc Houle, President
Candy Smiley, Director

Project Lead the Way

Bruce Westermo, National Affiliate Director, Project Lead the Way

School in the Park

Susan Wachowiak, Director

San Diego County Office of Education

Sally J. Bennett-Schmidt, Assessment Coordinator
Kim Bess, Director of Energy Education
Karen LaBonte, Special Assistant to the Superintendent
Keith Nuthall, Director of Assessment
Chris Reising Director, Regional Teacher Recruitment and Support Center
Jameson Rienick Mathematics Coordinator
Tony Spears, Senior Director, Curriculum, Instruction & Assessment
Melissa Swenson, MTP3 Project Specialist
Nancy Taylor, K-12 Science Coordinator

San Diego State University

Center for Research in Mathematics and Science Education (CRMSE)

Lisa Clement Lamb, Associate Professor Mathematics Education

Ricardo Nemirovsky, Director, CRMSE

Rafaela M. Santa Cruz, Director, SDSU/CGU Doctoral Program in Education

Cognitively Guided Instruction

Dinah Brown, SDSU Professional Development Collaborative

Vicki Jacobs, School of Teacher Education, CRMSE

InterActions

Sharon Bendall, CRSME

Fred Goldberg, Professor of Physics

Improving Student Achievement in Mathematics (ISAM)

Nadine Bezuk, Professor of Mathematics Education, Director, ISAM

San Diego Science Alliance

Mickie Beyer, former Executive Director

Nancy Taylor, Acting Executive Director

Sweetwater Compact

Mayra Guitierrez, Director

The Preuss School

Doris Alvarez, Founding Principal

Donald Stump, Development Director

University of California, San Diego

Sherry Seethaler, Director of Education Outreach, Division of Physical Sciences

Randall Souviney, Director, Education Studies

UCSD Math Collaborative

Joanie Commons, Math, Science, Health Facilitator

University of San Diego

Paula A. Cordeiro, Dean, School of Leadership and Education Sciences

Sandy Buczynski, Assistant Professor, School of Leadership and Education Sciences

Noriyuki Inoue, Assistant Professor, School of Leadership and Education Sciences

Appendix II

Profiles of Exemplary Programs

- Teacher Capacity**
- School-based Initiatives**
- Community-based Enrichment**
- System-wide Connectivity**

Teacher Capacity

- **Cal Teach – Science and Math Initiative**
- **Cognitively Guided Instruction (CGI)**
- **Improving Student Achievement in Mathematics (ISAM)**
- **Inquiry Learning Partnership (ILP)**
- **Math for America San Diego**
- **Middle School Science Education Leadership Initiative (MSSELI)**
- **UCSD Mathematics and Science Collaborative**

Cal Teach

Capsule

Cal Teach is UCSD's response to Governor Schwarzenegger's challenge to the University of California system to quadruple by 2010 the number of math and science teachers it produces annually. With \$250,000 in seed funding from the University of California as part of the Governor's Math initiative, Cal Teach has begun to attract science and math majors into pursuing minors in science and math education. The goal of the program is to produce 60-75 newly credentialed teachers by 2010 as part of a system-wide effort to increase the state's K-12 corps of math and science teachers by 1000. The Cal Teach curriculum has been designed collaboratively by scientists, mathematicians, and education studies faculty. It combines hands-on experience in local schools with foundational coursework focused on math and science content knowledge, as well as an understanding of how students learn these subjects. Cal Teach students will complete two teacher-training courses during their freshman or sophomore years, after which they will receive stipends. College students completing the program who enroll in a credential program are prepared for employment as paid teacher interns. The annual cost of Cal Teach is about \$650,000.

Scope

In 2006, 220 undergraduate science and math majors at UCSD enrolled in Cal Teach courses. Of these, a quarter are math majors, 28% are biology majors, 23% are chemistry majors, 7% are physics/engineering majors, and 2% are earth science majors. To date, 147 students have completed courses, and most have taken multiple courses.

Evidence of Effectiveness

Preliminary evaluation of the program has included students' written and oral in-class reflections, web surveys, and quarterly focus groups. Data on student retention and performance in the minors program, in the math and science majors, and in credential process will be collected over long-term by Education Studies and Division of Physical Sciences staff. A 2007 survey of 39 students points to encouraging preliminary results. Eighty-two percent cite interest in exploring teaching as a career as their primary incentive for enrolling. Almost two-thirds report increased interest in teaching as a career as a result of the courses. Most indicate an interest in taking more education courses, and half indicate plans to enroll in the math or science education minors program. Almost all of the students participating in the classes say they would recommend them to someone interested in teaching math or science. In open-ended questions, students report that they have new respect for the complexity of the teaching profession and that they have grown as problem-solvers and thinkers.

Alignment with BEST Design Principles for Effectiveness

The primary program goal of increasing the quality and quantity of science and math K-12 educators in California is clearly defined and measurable. Learning to think like teachers will call for many undergraduate math and science majors to develop new skills requiring coursework on such topics as standards-based instruction, learning assessment, classroom management, issues of student diversity, and levels of cognitive ability. Class sizes are small, affording students opportunities to interact with one another and with faculty. Cal Teach students are afforded multiple opportunities for close contact with UCSD faculty and working teachers. The University of California and California State University have made a long-term commitment to the program.

Cognitively Guided Instruction (CGI)

Capsule

Pioneered by University of Wisconsin researchers in 1989, Cognitively Guided Instruction (CGI) is a research and professional development program grounded in the belief that elementary school math instruction should build on the intuitive mathematical knowledge that young children bring with them to school. As such, it is not a general pedagogical approach but is instead linked closely to children's thinking in particular mathematical content areas at the elementary school level. Unlike conventional math instruction, CGI emphasizes what children can do, rather than what they cannot do. Teachers allow students to use their own problem-solving strategies and encourage them to explain their ideas aloud and share them with one another. By focusing on student thinking, teachers become facilitators instead of knowledge-givers. They constantly analyze their students' strategies and progress. An effective CGI teacher knows where every child is, and what problem each child should be given next. CGI is supported by an evolving national infrastructure that includes regional centers, bi-annual conferences, and websites. CGI instruction relies mainly on district funds for training and instructional materials. Program costs vary across districts but all include trainer's fees, materials, and substitute fees for five days of training per teacher.

Scope

CGI has gained a foothold in San Diego County over the past decade through professional development offered by the San Diego County Office of Education and in several districts, including Encinitas Union School District, La Mesa Spring Valley School District, and Oceanside Unified School District (OUSD). District-based initiatives have reached approximately 20, 150, and over 400 teachers, respectively. The influence of CGI is also felt in several university-based programs, notably SDSU's mathematics specialist program for K-2 teachers

Evidence of Effectiveness

Much of the evaluative research on CGI has been in the form of specific grant-funded studies. Over twenty years of CGI research has documented positive changes in teacher knowledge, classroom instruction, and student achievement. Much of this research is not locally focused, although two on-going NSF-funded studies on the effect of CGI professional development on teacher knowledge, beliefs, and practices draw upon the experiences of county teachers. Other evidence of local student improvement is supported by school-level data and teacher/principal observations.

Student Achievement. Principals in OUSD observed that students in classes taught by teachers with one or more years of CGI training were performing better on standardized tests than those in similarly populated classrooms taught by teachers without CGI training. Much of the formal research on CGI has focused on teacher beliefs and behaviors. That CGI students perform better on standardized tests is an implied result. Specific studies have shown that CGI improves student achievement on problem-solving and early algebraic tasks and increases student engagement in problem-solving and communicating mathematical ideas.

Teacher knowledge and classroom practice. Preliminary findings from a multi-year NSF-funded study, *Studying Teachers Evolving Perspectives*, indicate that expertise related to the professional noticing of children's mathematical thinking can be learned. However, developing this expertise takes time and professional development support over a period of several years. Other research conducted over the years indicates that CGI training increases teachers' knowledge of mathematics and children's mathematical thinking. It also helps teachers plan instruction around children's thinking.

Alignment with BEST Design Principles for Effectiveness

The goal of seeking student achievement by increasing teachers' knowledge about how children think about and learn mathematics is clearly defined. CGI curriculum is in constant refinement as practitioners and researchers deepen their knowledge of student learning. The program assumes that instructional strategies will be highly individualized, meeting the needs of high performing and struggling students alike. Participation in CGI is voluntary, increasing the chances of engaging committed teachers. Although funding remains a challenge, limiting some districts to offering training for only one year, the local commitment to CGI is evidenced by Oceanside's decision to create a staff position dedicated to CGI training. There is also a growing cadre of formal and informal leadership groups in districts throughout the county who are interested in teaching CGI techniques to their peers.

Improving Student Achievement in Mathematics (ISAM)

Capsule

Improving Student Achievement in Mathematics (ISAM) is a professional development initiative of San Diego State, made possible by a multi-year grant from QUALCOMM. The program's objective is to improve math instruction in urban K-12 classrooms. It has been implemented since 2004 through professional development partnerships with local school districts. Each partnership is designed to meet specific district, school, and teacher needs. Training is provided by credentialed teachers with extensive classroom experience at a centrally located site. The frequency with which training sessions are provided ranges from about four to 15 full-day sessions per year. Participation in training sessions is mostly voluntary, although highly encouraged in some districts and mandatory in one. ISAM also offers individual teachers or groups of teachers from various districts the opportunity to earn a Mathematics Specialist Certificate. In 2007-08, in an effort to accommodate teachers' busy schedules, ISAM is piloting in Lemon Grove on-line delivery with a view toward providing a blend of on-line and face-to-face professional development.

Scope

ISAM reached close to 500 teachers in 2006-2007, 330 of whom earned their "Elementary Mathematics Specialist Certificate" through the project. ISAM worked with over 300 teachers in partner districts that include Lemon Grove, Ramona, Sweetwater, and Cajon Valley as well as a separate partnership with the City Heights Collaborative.

Evidence of Effectiveness

The ISAM evaluation team, which includes an external evaluator, SDSU professors, program staff, and doctoral students, regularly evaluates the impact ISAM partnerships and its Math Specialist Program. Evaluation tools include pre- and post-tests taken by participating teachers to measure growth in mathematics content knowledge and teaching strategies. Open-ended surveys allow teachers to assess the value of the program. Evaluators also analyze the standardized test scores of students in partner districts to track gains in student achievement.

Student achievement In 2005, the students of graduates of ISAM's Mathematics Specialist Program scored significantly higher on standardized tests (CST in math) than comparable students taught by teachers who did not participate in the certificate program. Performance gains were greatest for students in schools with a lower Academic Performance Index, suggesting that the certificate program may help close the achievement gap.

Content knowledge and teaching practice The results of pre-and post-tests indicate that teachers are developing more profound content knowledge. Test results are used to inform instruction and guide program refinement. Open-ended surveys of teachers demonstrate that all teachers report a better understanding of the mathematics they teach and a greater understanding of how children think in math. Many educators have made a number of key changes in the way they teach math. These include the use of manipulatives, and more focused instruction that involves requiring students to explain their thinking in numbers, pictures, or words.

Alignment with BEST Design Principles for Effectiveness

Annual evaluations measure the success the ISAM in meeting the objectives of increased teacher content knowledge, improved classroom practice, and increased student achievement. Program content covers subjects aligned with the California Mathematics Framework including more effective use of district-adopted mathematical materials. ISAM equips teachers to provide differentiated instruction that meets the individual needs of special education and English language learners, while ISAM partnerships are also personalized to meet the distinctive needs of individual districts. The program puts special emphasis on engaging principals. Teacher participation and student achievement has been greatest in schools where principals have been most actively engaged in project activities. ISAM is currently funded by a \$5.1 million four-year QUALCOMM grant that will end in August 2008.

Inquiry Learning Partnership (ILP) Math, Science, and Technology Education Program

Capsule

The University of San Diego's Math, Science, and Technology Education Program's Inquiry Learning Partnership (ILP) is a joint professional development program offered in partnership with the Reuben H. Fleet Science Center to 4-8th grade math and science teachers working in the Chula Vista Elementary and Lemon Grove school districts. Funded by a multi-year California Department of Education grant, the program aims to improve student achievement. It consists of 104 hours of professional development offered through an intensive five-day summer institute, a series of Saturday workshops, and 24 hours of individual classroom follow-up support throughout the school year. Teachers participate in standards-related workshops focused on math and science content and the pedagogical techniques necessary to translate this content into rigorous instruction in the classroom. The training is designed to support teachers' efforts to engage students more effectively in generating their own hypotheses and developing their own understandings of math and science content. Teachers choose one of three project strands: professional development, leadership, or the USD Master's Program in Mathematics, Science, and Technology Education. As a result, ILP is building a critical mass of potential change agents at school sites within two local school districts.

Scope

Nearly one third of Chula Vista schools (32 schools) and all of Lemon Grove schools (eight schools) are participating in the project. Of these schools, slightly more than half are low performing. Between the two districts, 118 teachers, primarily in grades 4-6, were served in 2005-2006, impacting an estimated 3,627 students. Seventy-seven teachers participated in the professional development strand, 15 in the leadership strand, and 25 in the Master's program. Twenty-four master's candidates matriculated in May 2007, earning higher placement on district pay scales.

Evidence of Effectiveness

The ILP is assessed regularly by an outside evaluator using tools that include teacher surveys, pre- and post-course assessments, classroom observations, teacher interviews, and state and local assessments of student performance.

Student achievement Standardized test results show noteworthy year-over-year improvements in student performance, especially at those school sites that have larger numbers of teachers participating in the ILP program. For example, between 2005 and 2006, overall district scores in science in Chula Vista improved by 5 percentage points while scores of three schools actively involved in the ILP experienced gains of 15, 10 and 9 percentage points, respectively.

Content knowledge and classroom practice Pre-test scores in math and science content areas ranged from 20%-43% correct, while post-test scores ranged from 45%-73%. Performance was stronger in math than in science. Teacher self-reports confirmed gains in content knowledge. Classroom observations confirmed that teachers designed lessons to include learning activities that engaged students in genuine inquiry-based learning.

Leadership development Most teachers in the leadership strand did not engage in facilitating Saturday sessions or active coaching at their school sites, attributing their reluctance to assume leadership roles to insufficient content, the absence of colleagues involved in the ILP, and varying levels of support from school administrators.

Alignment with BEST Design Principles for Effectiveness

USD faculty, Reuben H. Fleet Center staff, and participating teachers and schools clearly understand the outcomes the ILP is seeking to achieve. Curriculum focuses on challenging content areas including geometry, statistics, algebra, life science, physical science, and earth science. Inquiry-based learning is a highly personalized experience for students, while teachers receive individualized support through small group sessions offered at the Fleet Center and follow-up classroom support at their school sites. Teachers who implement ILP, especially those earning a graduate degree, become more invested in the math and science education literature, current issues and trends, and research methods. Each of the partner organizations remains committed to supporting and refining the program. The California Department of Education renewed funding in 2006 with a two-year award of almost \$900,000.

Math for America San Diego (MfA SD)

Capsule

Math for America San Diego (MfA SD) is a newly formed consortium of the area's three public universities, Cal State San Marcos, San Diego State, and UC San Diego. The program seeks to improve the quality of math instruction in partnership districts by providing a comprehensive system of financial and professional supports to MfA Fellows and their departmental colleagues. This initiative marks the first concerted regional effort to stem the 50% outflow of new teachers leaving the mathematics teaching profession during their first three years of service. The program is part of a growing national network of Math for America sites.

Twelve fellowships are awarded each year to students entering a single-subject credential program in mathematics (grades 7 -12) at one of the partner universities. At the conclusion of the credential program, MfA Fellows are placed in high-need secondary schools in one of the program's partner districts. In each of the five years of the fellowship, MfA Fellows receive an annual stipend of \$15,000, classroom-based professional development, inclusion in a professional community, and the support of an MfA Mentor, an experienced and exemplary teacher. In steady state, the program will serve 60 fellows, 12 mentors and hundreds of additional teachers who teach in the partnership schools.

Thus far, program leaders have raised \$500,000 to cover anticipated annual costs of approximately \$1.5 million per year.

Indicators of Effectiveness

MfA SD will participate in evaluation programs at both the national and local level. At the national level, data on fellowship applicants to any Math for America program are collected and analyzed in order to improve our understanding of the profile of a successful math teacher. The national evaluators also track the retention rates of MfA Fellows in teaching careers. The results of this measure in the pilot program in New York City are promising (e.g. approximately 85% after 4 years).

The local evaluation will be conducted by UCSD's Center for Research in Educational Equity, Access, and Teaching Excellence (CREATE), an organization which specializes in the evaluation of K-12 reforms. This evaluation design includes a control group, qualitative measures for teachers and students, and quantitative measures including student performance on standardized tests.

Middle School Science Education Leadership Initiative (MSSELI)

Capsule

The Middle School Science Education Leadership Initiative (MSSELI) is a year-long, intensive, leadership development program for middle school science teachers sponsored by the San Diego County Office of Education, San Diego Unified School District, the San Diego Foundation, and the San Diego Science Alliance. The objective of the program is to form a professional learning community that will serve as a catalyst to improve middle school science instruction and achievement. Participants are exposed to inquiry-based science teaching, leadership strategies, and opportunities to collaborate with public and private scientific institutions. They receive a stipend for their participation in a summer institute, and substitutes are hired for two three-day collaborative lesson study sessions during the school year. Annual program costs are around \$100,000. Estimated costs per teacher participant are about \$4,000. Faculty from local universities and nationally recognized experts participate in professional development activities. Fellows meet during the school year and participate in an on-line professional community.

Scope

Since its inception in 2004, MSSELI has worked with three teacher cohorts for a total of 61 middle-school science teachers. San Diego Unified School District has accounted for about half of participating teachers. Cajon Valley Union, Coronado Unified, Escondido, La Mesa-Spring Valley, Lemon Grove, Mountain Empire, Poway, San Marcos, San Ysidro, Sweetwater, Valley Center, and San Dieguito Union have also been represented.

Evidence of Effectiveness

An outside evaluator conducts pre-test and post-test surveys and interviews with teachers. The design of the MSSELI evaluation does not include comparison with teachers who do not participate in the program, nor does it measure the impact of the program on student outcomes.

Teacher knowledge and classroom practice Pre and post-test scores show significant gains in teachers' levels of understanding of key learning outcomes. Survey results indicate that MSSELI teachers have deepened their understanding of current learning theory, gained fluency in the language of inquiry, and implemented new teaching strategies in their classrooms. Teachers report that access to quality instructional materials, lab supplies, and professional development is helping them to sustain research-based professional development. Teachers use a protocol to analyze student work and modify instruction accordingly.

Leadership skills Veteran MSSELI-trained teachers have led professional development training at their school sites and made presentations at the program's summer institutes. Evaluators note that some teachers are still reluctant to assume stronger leadership roles within their schools. The program encourages teachers to enroll in pairs so that they can begin to build a critical mass of change agents at their schools.

Linkages to science institutions The most recent MSSELI evaluation does not address this issue. Project directors describe this as an informal activity. Representatives of area science institutions make presentations to teachers during MSSELI summer institutes, and the program convenes teachers at science venues during the school year.

Alignment with BEST Design Principles for Effectiveness

The objectives of the MSSELI program are clearly understood by participating teachers, faculty, and sponsoring organizations. The program challenges teachers to shift from a teacher-directed to an inquiry-based classroom. MSSELI-trained teachers combine teamwork with differentiation based on individual student abilities and interests, using the 5E model of instruction (engage, explore, explain, extend, and evaluate) to adapt to varying student styles of learning. The program fosters collaborative interaction and support among teachers through the use of lesson study. MSSELI has broadened its support base among teachers, school administrators, and donors. The long-term impact of the program will be a function of its ability to mobilize a community of practice among teacher leaders who will serve as models and train others.

UCSD Mathematics and Science Collaborative

Capsule

The UCSD Mathematics and Science Collaborative provides practitioner-led professional development for elementary and middle school teachers of science and math in low-income schools with large concentrations of English learners. The objective is to change the culture of whole districts from “these kids can’t” to “these kids can” do math and science. The approach was pioneered in a three-year (2001-2004) partnership with the ten-school National School District. In 2005, the Collaborative expanded its focus to El Cajon Valley. Under the guidance of an expert from UCSD CREATE, teachers meet periodically at centrally located sites within the district in math and science circles, as well as in textbook adoption committees. The content of training is based on specific areas of need. Textbook adoption committees build leadership capacity through the evaluation of subject-specific learning frameworks and standards.

Scope

The work of the Collaborative has permeated deeply throughout the district. Approximately 90 teachers in 27 Cajon Valley district schools participate regularly in the voluntary professional development opportunities that include math and science circles and textbook adoption committees.

Evidence of Effectiveness

Although the work of the UCSD Collaborative has not been formally evaluated, assessment results in National School District analyzed by CREATE point to the effectiveness of the approach. Students there made slow but steady gains in mathematics on the California Standards Test in all elementary grades. Three schools were recognized for Outstanding Achievement based on 80 -100 point gains over three years in California’s Academic Performance Index. Significantly, students of teachers who had taken even one Collaborative math course scored higher than students of teachers who did not take a math course. The gaps between English-language learners and their English-fluent peers were also smaller in classes with teachers who had participated in the math specialists program of the Collaborative.

Alignment with BEST Design Principles for Effectiveness

The goals of the program, encompassing teacher skills and student achievement, are clearly understood by participating teachers and administrators. Math and science circles focus on equipping teachers with strategies for teaching mathematics concepts more effectively at every grade level. The Collaborative relies upon the personal choice of teachers to take courses and assume leadership roles at their grade, school, and district levels. Group training has had the positive impact of creating peer group pressure for change among participating teachers. The investment of the Cajon Valley District in the Collaborative is an important indicator of its value.

School-based Initiatives

- AVIDizing Math and Science
- High Tech High
- InterActions in Physical Science
- Project Lead the Way (PLTW)
- The Partnerships Involving the Scientific Community in Elementary Schools Project (PISCES)
- The Preuss School at UCSD

AVIDizing Math and Science

Capsule

Advancement Via Individual Determination (AVID) is a fast-growing, nationally recognized college prep program founded in San Diego. The program has been adopted by more than 3,500 elementary, middle and high schools in 45 states. Its mission is to motivate, support, and equip predominantly low-income, under-served students to complete four-year college eligibility requirements by taking rigorous high school courses. The AVID elective, supported by college tutors with backgrounds similar to those of AVID students, is a course on how to be a more savvy, more effective, more successful student. AVIDizing Math and Science extends AVID's research-based pedagogy beyond the elective course into these core content areas. Level I courses introduce teachers to AVID concepts and methodologies and prepare them to apply those tools in the math and science content areas. Level II courses, intended for teachers who are already familiar with the AVID methodologies, focus on understanding the rigor required to prepare students for honors, AP, and IB courses in algebra II, statistics, calculus, chemistry, biology, and physics. AVID trains vertically at both levels, including both middle and high school teachers in the same class, to ensure that concepts build from one course to another and from one year to the next. Districts and schools interested having their teachers trained usually fund their participation using Title I or discretionary funds. The San Diego County Office of Education's (SDCOE) two-day content workshops cost \$275 per teacher. Participation in summer institutes, which include week-long, half-day training in content areas, costs between \$600-\$800 per person.

Scope

About 60 teachers participated in two workshops offered by SDCOE in math and science content areas during the 2006-2007 school year. Another 57 county math and 38 science teachers participated in subject area content training through AVID's 2007 summer institutes. AVID's core elective serves 16,176 San Diego County students in grades 6-12 or 8% of the total student population. Nearly 4,400 hours of tutoring support, mostly in the area of math, are provided to students each week.

Evidence of Effectiveness

The AVID program has been rigorously evaluated, but its math-science supplement has not. Since AVIDizing Math and Science applies the program's basic tools, data that point to the effectiveness of the core program are pertinent indicators.

Student achievement: The state of California does not break out the performance of AVID students on standardized tests or the high school exit exam. In 2006, 99.8% of AVID seniors in the county graduated high school, exceeding the overall graduation rate for the county of 84.9%.

Rigorous course taking. In 2006-2007, 67% of AVID 8th graders enrolled Algebra I compared to 52% countywide. Ninety-one percent of African-Americans and 89% of Latinos participating in AVID completed a-g requirements for UC-Cal State compared to only 25% and 26% respectively for the county as whole. In Mar Vista High School in the Sweetwater Union High School District, where AVIDized math has taken hold, AVID students have gone from comprising 9% of first-year AP Calculus in 1998 to 46% in 2004.

College admission Eighty-two percent of AVID seniors in the county took the SAT and/or the ACT college admission exams in 2006 compared to 43% of seniors countywide. Most AVID graduates plan to attend college. Nearly two-thirds of AVID seniors were accepted into four-year colleges and about 30% into two-year colleges.

Alignment with BEST Design Principles for Effectiveness

The outcomes for measuring the success of AVID-ized Math and Science are clear: increased Algebra I success rates, increased enrollment in advanced placement, and increased completion of a-g math and science course requirements. The program prepares teachers to deliver the most rigorous courses in the curriculum. Individually recruited college tutors, who are assigned at a 6-7:1 ratio and who meet regularly to discuss their students' individual progress, are a key element of the program. Participation in AVID is voluntary for both students and teachers, greatly increasing the likelihood of personal engagement. Parents co-sign with their son or daughter a contract committing to the AVID program. The program's record of expansion over the past two decades attests to its institutionalization across the region.

Enhancing Science Education through Technology (ESSET)

Capsule

Enhancing Science Education through Technology (ESETT) is a federally funded program in San Diego Unified middle schools whose objective is to expand student learning opportunities by integrating technology into the 7th and 8th grade science curriculum. Designed and implemented by San Diego Unified Schools' Technology Education Department, ESETT has three core components: (1) the provision of technology that allows students to create and present inquiry-based science activities; (2) research-based professional development to enable science teachers to embed technology in their classroom instructional strategies; (3) the alignment of technology application and teacher training with state and national science content standards. Seventh graders learn to use technology tools including graphic learning applications and electronic learning resources that help them generate and make sense of scientific information. Eighth graders learn to choose appropriate technology tools for research, problem solving, and decision-making. ESETT provides 65 hours of hands-on seminars and workshops, including a summer institute as well as paid independent study to produce an individual action plan. All science teachers at ESETT schools participate, but designated lead teachers assume special responsibility for building capacity on-site. All teachers are supported by Educational Technology Department, whose staff spends about three-quarters of its time in classrooms. Piloted in 2004-05, ESETT was awarded a \$2.4 million scale-up grant in 2006. ESETT currently reaches 16,800 7th and 8th graders, as well as 93 teachers, in San Diego Unified.

Evidence of Effectiveness

Although ESETT has not yet been formally evaluated, self-reports of participating teachers indicate striking gains in computer knowledge and proficiency in using technology in the classroom. Seventy percent of participating students scored at the intermediate or proficient levels in applying technology on California standardized tests

Alignment with BEST Design Principles for Effectiveness

The objectives of the program are clearly defined. Program content challenges both teachers and students. Technology support is personalized, and professional development is research-based. The success of the program in securing a scale-up federal grant is an indicator of its potential sustainability in a competitive environment.

High Tech High

Capsule

Since its establishment in September 2000 as a small charter high school, the Gary and Gerri-Ann Jacobs High Tech High (HTH) has emerged as San Diego's most prominent showcase of educational innovation. The mission of HTH is "to provide students with rigorous and relevant academic and workplace skills, preparing graduates for rewarding lives in our increasingly technological society." Making full use of the freedom of action provided by its charter, HTH limits class size and hires teachers on one-year contracts at the rough equivalent of the San Diego Unified School District's pay scale. The HTH curriculum is based on three design principles: personalization, adult-world connection, and common intellectual mission. Faculty delivers the curriculum via project-based learning and assignments that fit individual student interests. Almost all classes end with presentations to parents and/or community professionals. The curriculum is supplemented by internships. More than 650 students have completed internships at over 200 community businesses and agencies in the county. HTH uses active recruitment and a blind lottery to select incoming classes. Plans have been implemented to give minorities and low-income students an advantage in the lottery-based admissions to ensure the HTH student body more nearly mirrors the demographic profile of the San Diego school district starting in September 2007. In collaboration with the University of San Diego, HTH also operates its own teacher-credentialing program. Its ten-year goal includes building a network of more than 300 HTH-credentialed teachers capable of delivering outstanding instruction within and beyond the HTH chain of schools. In 2007-2008, HTH began offering courses at its own HTH Graduate School of Education, designed to serve 40 teachers and 20 school leaders annually.

Scope

HTH has blossomed into a school development organization educating over 2,000 K-12 students in eight charter schools in San Diego, Chula Vista, and North County. The two newest high schools, one in Chula Vista and one in Escondido, each opened in the fall of 2007 under the California Statewide Benefit Charter awarded to HTH. Directors anticipate that the total student body in the county will grow to 11 schools in three villages (North County, Chula Vista, and Point Loma) serving over 5,000 annually in ten years.

Evidence of Effectiveness

Student course-taking, achievement, and college admission provide clear benchmarks to measure the success of HTH in meeting its mission. Although HTH has not been the focus of a stand-alone independent evaluation, a 2004 Gates Foundation evaluation of small schools covered many of the strengths and challenges faced by schools like HTH.

Student achievement California's Academic Performance Index ranks HTH among the highest-achieving schools in the state. SAT scores for 2006 in math exceed those of the district but trail those of the crown jewel of San Diego Unified, La Jolla High School. Proficiency rates in advanced courses like Algebra II, which are required of all HTH students, are about half of those of San Diego Unified.

Rigorous course-taking All HTH graduates complete "a-g" requirements for admission to UC/CSU schools, compared to 38% for the county as a whole. HTH does not offer Advanced Placement courses, which it deems to be rushed and fact-based. However, 15 of 100 seniors took college courses at the University of San Diego in 2005-06.

College admission All of HTH's graduates have been admitted to college. More than one in four graduates attend four-year schools, including some of the nation's most selective institutions. HTH reports that over 30% of HTH alumni enter math or science fields compared to about 17% of all high school graduates.

Student engagement A 2004 Gates Foundation evaluation found that small schools like HTH succeed in decoupling the traditional link between positive attitudes toward education and their mothers' education levels.

Alignment with BEST Design Principles for Effectiveness

Faculty, students, and parents clearly understand HTH goals. The school carefully documents its results to guide its own practice and inform the wider community. Student-initiated projects, hands-on presentations, deep exploration of topics, and multidisciplinary teaching are widely recognized for sparking student curiosity and equipping students with critical thinking skills. Faculty interact one-on-one with students to negotiate and supervise their project work, as well as to identify and take action on any academic or other issues early on. Relationships with adult role models are considered critical to helping students understand the importance of higher education and empowering them to open doors. Teachers receive time each day to collaborate on lesson plans or work in ad hoc "study groups" on curriculum or campus management issues. The vision of HTH is to become a "small giant" capable of changing the national landscape through the dissemination of practices implemented in the San Diego region. Translating this vision into reality will require large capital investments in the range of \$10 million - \$15 million.

InterActions in Physical Science

Capsule

InterActions is a recently published 8th grade science curriculum developed by researchers at San Diego State's Center for Research in Mathematics and Science Education (CRMSE) under grants from the National Science Foundation. The objective of the curriculum is to help students arrive at an understanding of the physical world and how it works by using a combination of guided inquiry and direct instruction. The InterActions course includes six separate units organized around the themes of interactions and energy transfers. Students conduct experiments in small groups and formulate their own explanations of scientific phenomena instead of memorizing the conclusions of others. The course is accompanied by computer software that allows students to simulate experiments, as well as an extensive browser-based teacher resource guide. A year-long teacher professional development program includes a three-day Getting Started Workshop during the summer followed by four days of workshops during the school year. Opportunities for ongoing professional development are available through on-line tutorials. The cost of a classroom kit is between \$3,500-\$5,000, depending upon the resources already available at the school site. Districts must also cover the trainer fees for seven workshops, stipends for teachers who attend summer training, and the cost of substitutes during the school-year workshops.

Scope

Adopted in 2006 by the California State Board of Education as part of its Adoption of Science Materials, the InterActions curriculum is currently being implemented by all 8th grade science teachers in San Diego Unified School District (SDUSD), reaching an estimated total of 8,000 students. With CRMSE support, SDUSD has built its own capacity for training teachers and is also piloting the use of a specially adapted single module to help prepare students for participation in science fairs. The curriculum also has been adopted in Florida and is being considered for adoption in Texas. Including San Diego schools, approximately 500 teachers are using the InterActions curriculum nationally and about 150,000 students have been reached to date.

Evidence of Effectiveness

InterActions was rigorously evaluated during its pilot phase (2002 – 2005) prior to its placement on the list of approved textbooks by California State Department of Education

Student achievement: A 2002 evaluation of pilot activities using student performance on pre- and post-course assessments showed that InterActions students performed better than those who did not take the InterActions curriculum. A 2004 evaluation conducted showed that 8th graders who had taken the InterActions course scored over eight percentage points higher than their non-InterActions peers (a statistically significant difference) on a 9th grade assessment.

Content knowledge and practice In interviews conducted during the pilot phase of the project, teachers reported improved pedagogical skills in managing classroom discussions, questioning, and group work. They focused more on teaching for understanding rather than memorization. They also saw the value of letting students wrestle with ideas before reaching conclusions.

Alignment with BEST Design Principles for Effectiveness

Student and teacher outcomes are both clearly defined and measurable. InterActions content satisfies both national standards (as defined by National Research Council and the American Association for the Advancement of Science) and California science standards. The curriculum offers students a highly personalized experience through sequenced guided experiments and extensive small-group and whole-class discussions. Successful implementation of the curriculum requires that teachers spur students' thinking, create opportunities for learning, facilitate discussions, force students to confront their own misconceptions, and build confidence in their ability to think like scientists. Although all California school districts are authorized to use state funds to purchase the InterActions curriculum, sustainability will require supplemental funds to cover fees for trainers and workshops, as well as to reduce the cost of classroom kits.

Project Lead the Way (PLTW)

Capsule

Project Lead the Way (PLTW) is a fast-growing national pre-engineering program that currently reaches about 100,000 middle school and 200,000 high school students in 2,000 schools across the country. The objective of the program is to expand the number of students interested in and prepared for post-secondary education in technical disciplines. Locally, with an endowment of \$1.4 million from QUALCOMM, PLTW is a project of the San Diego State College of Engineering. The College of Engineering also serves as the State Affiliate for the program, assuming responsibility for promoting and assisting the program throughout California. SDSU runs an intensive two-week program to equip science, math, and technology teachers to deliver a PLTW curriculum, which is about one-third theory and two-thirds application. A fully certified PLTW school must offer the full PLTW curriculum using the required equipment and software. Doing so represents a substantial investment -- \$95,000 for the entire high school program and about \$50,000 for middle schools. PLTW middle school courses are offered as electives of four nine-week modules covering electronics, automation and robotics, electronics, and the science of technologies. The high school elective program is a four-year sequence of courses which, when combined with math and science, introduce 9-12th graders to the scope, rigor, and discipline of engineering. The SDSU Engineering Compact guarantees admission to the College of Engineering to students who complete at least two PLTW courses in high school with a B or better. In the fall of 2007, five community colleges started offering PLTW courses, making an articulated program available to students whose schools do not offer PLTW. With the growth of the program, estimated costs are around \$400,000 year to support the existing program, about \$300,000 of which is spent on county activities.

Scope

PLTW currently serves 4000 students in 36 schools drawn from seven participating districts in the San Diego region: San Diego Unified, Grossmont, Sweetwater, San Dieguito, Cajon Valley, Vista, and Poway. Three PLTW high schools in the San Diego Unified School District recently received National Academy Foundation grants to create engineering academies. Seventy-three teachers from the county were trained in the summer of 2007, at a cost of \$1,800 each, usually paid by the originating school or district. In addition, PLTW runs eleven week-long summer camps in San Diego County for 160 middle schools students whose schools participate in the program.

Evidence of Effectiveness

PLTW has been rigorously evaluated at the national level, but its local effectiveness has not been measured. A 2005 High-Schools-that-Work (HSTW) research study,¹ compared PLTW high school students to similar students across all career/technical fields.

Student achievement PLTW high school students achieved measurably higher scores on a 2005 NAEP-referenced assessment than did their counterparts in other career technical education programs. National statistics from a 2006 assessment indicate that PLTW students earn GPAs of over 3.0 in calculus, physics, and chemistry.

Rigorous course-taking Four of PLTW's engineering courses have been approved as meeting UC/CSU "a-g" requirements. PLTW students complete significantly more high-level mathematics and science courses than their counterparts in other career technical programs

¹ Project Lead the Way: A Pre-Engineering Curriculum That Works *A New Design for High School Career/Technical Studies* by Gene Bottoms and Karen Anthony. Available at www.sreb.org.

(79% vs. 57% math; 63% vs. 44% science).

College-level enrollment Nationally, about 60% of PLTW seniors indicate an interest in post-secondary study in STEM fields compared to 25% of all seniors. For the fall 2007 semester, 48 PLTW students enrolled in SDSU's College of Engineering - ten of whom received renewable \$2000 scholarships.

Alignment with BEST Design Principles for Effectiveness

PLTW's stated goals are clear points of reference for measuring the success of PLTW in transforming the vocational education track into a college prep pre-engineering program. A standards-based curriculum provides rigorous preparation for post-secondary study of disciplines known for their high rates of attrition. PLTW employs a project-based and problem-based approach that has been shown to increase student motivation, cooperative learning skills, and higher-order thinking. Class size is the main determinant of how much time and guidance an individual student is likely to receive. Instructors and teachers are almost all volunteers, suggesting a level of personal engagement. A mentorship program, currently being piloted with Northrop Grumman, will bring professional engineers in the classroom to interact with students and teachers. PLTW has already established a noteworthy base of in-kind and financial support including scholarship and endowments funds. The business model of the program supports sustainability by requiring PLTW schools and districts to invest in teacher training and equipment. In 2008, the Qualcomm seed grant will be exhausted, and the project will have about \$50,000 available per year for operations.

The Partnerships Involving the Scientific Community in Elementary Schools Project (PISCES)

Capsule

The Partnerships Involving the Scientific Community in Elementary Schools Project (PISCES) is in its eighth year of partnering science graduate students, known as “Science Corps” fellows, with K-6 teachers in San Diego County. The program’s primary goal is to use hands-on, inquiry-based science (so-called “kit-based” science) to increase the quality and quantity of science teaching in elementary school classrooms. Longer-term goals include contributing to improved student achievement and increased interest in teaching on the part of participating Science Corps fellows. PISCES is designed to produce change in instructional practice, moving teachers away from textbook-based approaches toward teacher-guided investigation in which students are encouraged to develop, test, and reflect upon their own hypotheses. Each fellow spends a 6-8 week cycle in the classroom, serving as a role model for students and a content expert for teachers. Participating teachers receive the materials, curriculum, and support required to teach successfully inquiry-centered science. Designed by San Diego State University faculty and expert practitioners at the San Diego County Office of Education, PISCES was inspired by the San Diego Science Alliance and funded for six years under a grant from the National Science Foundation. It has been sustained through the collaborative efforts of the San Diego Science Alliance, SDSU, and SDCOE. The yearly operating budget is about \$50,000.

Scope

PISCES has placed Science Corps fellows in 55 schools, providing over 150 county teachers and their classes with nearly 11,000 hours of support and professional development in science education. The program has served some 7,500 county elementary school students through partnerships with school districts in Cajon Valley, Chula Vista, Lakeside, La Mesa Spring Valley, Lemon Grove, San Diego, Santee, and Vista. There are currently over 24 Science Corps fellows, all of whom are graduate students attending UCSD, SDSU, or CSUSM, working in county classrooms through the PISCES project.

Evidence of Effectiveness

Pre-and post-test surveys were conducted under conditions of the program’s NSF grant, and limited data have been recorded on the impact of PISCES on student achievement on California standardized tests.

Student achievement Initial analyses reveal that the PISCES program is having a significant impact on students’ standardized test scores in science. A small sample found standardized test scores of students in PICES’ classrooms were higher than those of students in non-PISCES classrooms. Test scores for classrooms that had benefited from partnerships in previous years were also higher than those of classrooms that had never participated in PISCES.

Student attitudes Surveys data reveal that the PISCES program is having a positive impact on their attitudes towards science. Anecdotal evidence indicates that university students are serving as positive role models for younger students.

Classroom practice Teachers self-report increased enjoyment of science teaching, better preparation, enhanced science knowledge, and greater use of diverse instructional materials.

Teacher recruitment There are no available data on the impact of PISCES on graduate student interest in K-12 science teaching.

Alignment with BEST Design Principles for Effectiveness

Professional development and student achievement outcomes are clearly understood. The outcome for Science Corps fellows remains less clear. PISCES combines professional development and expert support in such content areas as the structure of matter, astronomy, electricity, and ecology for K-6 teachers who are overwhelmingly liberal arts majors. Science Corps fellows' regular visits afford them ample opportunity to develop a rapport with both teachers and students. PISCES partner organizations are committed to sustaining the project over the long-term. The continuation of the program after NSF supported ended is an important indicator of its perceived value.

The Preuss School at UCSD

Capsule

The Preuss School is a charter school in the San Diego Unified School District that opened on the UCSD campus in 1999. Its objective is to break the link between socio-economic status and academic outcome by making its low-income students eligible—and competitive—for university admission. Preuss draws its 750 enrolled students from throughout the county, providing subsidized bus transportation. All applicants must qualify for free or reduced lunch and be the first members of their families to go to college. Their potential for success is discerned through the school application, academic record, teacher recommendations, personal statements, and family support. The student body is more than half Latino and 13% African American. The academic year runs 11 months, the school day is 15 minutes longer than the standard, and average class size is about 27 in comparison to 34 in other district schools. The school day is block-scheduled, and two-plus hours each week are devoted to staff development. Overall, Preuss students log nearly 75,000 instructional minutes per school year, compared with the state requirement of 64,800. Preuss relies on the support of tutors, interns and apprentice teachers from the UCSD Teacher Education Program. In addition, all Preuss twelfth graders participate in internships that include professional and technical career opportunities throughout the university community and San Diego County. Although the Preuss curriculum does not give more weight to math and science than other pre-college courses, students benefit from an ongoing relationship with GenProbe, a San Diego-based biotechnology firm, that includes tutoring and field trips. In addition, Preuss students have special access to after school and summer enrichment programs. Preuss receives state funding for a 180-day school year, thus it must raise another \$500,000 funds each year to cover the cost of 18 additional school days in its 11-month year, its longer school day, as well as its extensive transportation system.

Scope

The larger purpose of the Preuss School is to pioneer educational innovations that can be shared with other schools. To this end, UCSD has made a long-term commitment to implement practices pioneered at Preuss in Gompers Middle School, a low-income charter school in San Diego Unified. These include the use of university tutors, strong staff development, strategies for engaging parents. In addition, Preuss has hosted conferences open to all local schools and regularly furnishes speakers at workshops throughout the county.

Evidence of Effectiveness

A rigorous evaluation of the achievement of Preuss students, including the use of a comparison with a demographically and academically matched group of students from San Diego Unified, was completed in 2004.

Student achievement Nearly all Preuss students complete Algebra I in 8th grade and take geometry in 9th grade, though their scores as measured on standardized tests are somewhat lower than the much smaller proportion of students who take these courses countywide.

Rigorous course-taking All Preuss students complete the “a-g” curriculum. Moreover, Preuss students generally take more advanced subject tests in earlier grades than do county students as a whole. All students in grades 7-11 enter the Science Fair. All Preuss 10th, 11th, and 12th graders are required to take at least one AP course (and exam). Preuss had the tenth highest ratio of AP exams taken to number of graduating seniors of all high schools in the nation.

College admission All Preuss seniors graduate and apply to college: In 2007, 96% of the

graduating class was offered admission to four-year universities, the remaining 4% to two-year schools. For financial and other reasons, about 80% of students are expected to attend four-year colleges.

Alignment with BEST Design Principles for Effectiveness

Objectives are clearly defined and fully understood by faculty, students, parents, and other stakeholders. Rigorous content, including 100% completion of the UC-CSU “a-g” requirements, is a defining feature of the curriculum. Preuss keeps class sizes small by public school standards and differentiates its academic and social supports by need. A single adviser remains with a student from his or her entry in sixth grade through graduation. Parents are required to contribute 15 hours of service per year. Some 125 student mentors from UCSD visit the Preuss campus each year, along with a cadre of 150 community mentors who visit weekly. Preuss has an independent board of directors and a long list of community supporters.

Community-based Enrichment

- Aquatic Adventures' BAHÍA Program
- Better Education for Women in Science and Engineering Program (BE WISE)
- School in the Park
- The California State Summer School for Mathematics and Science or COSMOS

Aquatic Adventures' BAHÍA PROGRAM

Capsule

Aquatic Adventures' BAHÍA program is a tuition-free after-school/summer enrichment program whose objective is to create a post-secondary science pipeline of under-served students from San Diego's Hoover High School. This year-long program incorporates thirteen weeks of after-school and weekend workshops focused on marine science concepts and field research techniques, in addition to an intensive five-week summer program at a Baja California ecological preserve. Working alongside scientist-mentors, students earn college credit while engaging in conservation-focused field research projects designed to build scientific knowledge, develop interest in science careers, and increase self-confidence. They learn about research study design, data collection and analysis, and interpretation and presentation of findings to outside audiences. BAHÍA participants also participate in a college-readiness course that includes a series of career workshops, science internships, college visits, and other activities intended to encourage post-secondary study in the sciences. The credentialed high school teachers involved in the program attend professional development sessions focused on helping students overcome challenges in pursuing post-secondary education. Program graduates mentor high school students from their community and often return as staff. The BAHÍA program links with Aquatic Adventures' classroom-based programs as participants share their field experiences with elementary school students via a web-based research/discussion tool. BAHÍA students also mentor middle scholars, who participate in their own after-school programs through Aquatic Adventures. The BAHÍA program is funded by over 30 different organizations and individuals. Annual operating costs are \$227,000, an average of \$6,000 per student.

Scope

The BAHÍA program serves between 15-25 new students each year. A total of 50 students have been served since its inception. Once students are enrolled in the program, they continue participation through high school and continue to receive support and opportunities once in college. Aquatic Adventures' classroom-based programs reach over 2,500 low-income elementary and middle students yearly from six San Diego schools.

Evidence of Effectiveness

The BAHÍA program has been evaluated by an outside consultant. Evaluation reports rely on program participation data, pre- and post-program objective science tests, as well as on interviews and focus groups with students and teachers.

Student achievement In 2007, 100% of BAHÍA program participants improved their science skills as measured by test scores on objective tests. The students demonstrated an average 26% increase from pre to post-assessments. All students improved their science abilities as measured by their participation in field-based activities.

Student attitudes Student interviews revealed that all 2006 BAHÍA participants reported that they liked science and found it to be useful. Over 90% felt that they were good at science.

College plans. In 2006, all BAHÍA students reported that they plan to attend college, and over 90% felt that they could obtain the financial resources to do so. In 2007, 91% of all BAHÍA alumni are attending college. At least 40% of 2005 graduates have declared a science major.

Alignment with BEST Design Principles for Effectiveness

Aquatic Adventures' has developed a clearly defined matrix that details program outcomes and a thorough evaluation plan to measure the interest, knowledge, and achievement of under-represented students in science education and careers. The BAHIA curriculum encompasses in-depth exploration of the marine sciences, research study in San Diego and Baja California, environmental service, career exploration, college preparation, crisis prevention and response, and family involvement. Students select and co-design their own projects based on areas of interest. Instruction is tailored to student needs and pace, and each student has a staff mentor. BAHIA has developed a support base of 30 organizations including the San Diego Unified School District, the Scripps Institution of Oceanography, the California Center for Ocean Sciences Education Excellence, the National Oceanic and Atmospheric Administration, and Mexico's Comisión Nacional de Áreas Naturales Protegidas.

Better Education for Women in Science and Engineering Program (BE WISE)

Capsule

Better Education for Women in Science and Engineering Program (BE WISE) encourages middle school girls in San Diego County to develop an interest in science-related careers. Initiated in 1999, the program instills in girls during their formative years an awareness of the wonder and possibilities of doing science. The operative premise is that exposure to role models and science concepts in real world settings is an effective way to offset negative stereotypes surrounding science in general and women in science in particular. Participants' first exposure to BEWISE occurs through an overnight science experience. BE WISE overnights are led by women scientists throughout the region, focusing on such themes as marine science, biodiversity, and conservation. Overnights have been hosted by such organizations as the Conservation and Research For Endangered Species Center (CRES), the Rueben H. Fleet Science Center, Sea World, Birch Aquarium, Chula Vista Nature Center, Mission Trails Park, etc. Girls who participate in the science overnights become part of the BE WISE alumnae network and are invited to attend organized half-day science-related workshops throughout their middle and high school years. Alumnae event hosts include the Visualization Lab at Scripps Institute of Oceanography, the San Diego Supercomputer Center, Dow Chemical Company Laboratories, and the S.D. County Department of Veterinary Medicine. In 2004-2005, BE WISE expanded its alumnae program to offer more Alumnae Workshops and form a BE WISE Botball Robotics Team. The program is currently funded at about \$40,000 per year, primarily with grants from local corporations and local and national foundations.

Scope

The program is open to all 7th and 8th grade girls in the county. Selection is based on the recommendation of a science teacher and a written essay, and a special effort is made to select girls who would not otherwise be afforded exposure to science outside the classroom. Approximately thirty percent of BE WISE girls attend middle schools with an API rank of five or below. BE WISE has hosted a total of 18 overnights and 54 alumnae events. Of the 592 girls who attended overnights from 1999-2007, 74 percent have participated in at least one alumnae event. The program has reached over 400 girls attending 101 public middle schools and 10 private, charter or home schools in the county. Nearly three-quarters of all public middle/junior high schools in the county have had at least one BE WISE participant.

Evidence of Effectiveness

A 2005 external evaluation of the impact of BE WISE program activities on the participating girls was overwhelmingly positive. The primary mechanism for measuring progress toward these goals is through an outside evaluation, which uses surveys of participants, as well as interviews with participants, parents, and staff as its primary tools.

Student attitudes and content knowledge

Over 70 percent of girls participating in science overnights reported increased understanding of career paths in science-related fields. Over 70 percent also reported that they "learned a lot" about science-related topics. About half the respondents felt strongly that the programs helped them make connections between science instruction in school and the real world.

Participation

Survey data indicate significant interest in pursuing BE WISE topics outside the classroom and active interest in participating in science fairs. The gap in follow-on participation between girls from lower and higher performing schools events has prompted consideration of additional support for under-served girls.

Alignment with BEST Design Principles for Effectiveness

Desired outcomes are clearly understood by program organizers and participants, although the program could benefit from a more concerted effort to collect such quantifiable data as numbers of girls enrolled in advanced math and science courses, as well as numbers of program graduates electing to pursue postsecondary study in the sciences. BE WISE girls spend their carefully planned time investigating science phenomena and participating in a scientific mystery adventure that includes demonstrations, workshops, and a hands-on project. Alumnae select Workshops that correspond to their individual interests. Engaged women are at the core of BE WISE experience, sharing their commitment, knowledge, and personal experience in science and engineering. The eight-year record of accomplishment of BE WISE indicates a strong base of committed leadership and support.

Biogen Idec Community Lab

Capsule

The Community Lab is a carefully designed half-day immersion program for 7th grade students hosted on the La Jolla research campus of a leading biotechnology company since 2004. The objective of the program is to bring students out of the classroom to get a firsthand look at how science is applied in a real-world environment. Students learn that both math and science are needed to fight life-threatening diseases. Twice a week during the school year, busloads of 30 students from across the county arrive after breakfast, put on lab coats and safety glasses, take seats at a research bench, conduct a simulated clinical test, and have lunch on site under the supervision of Biogen Idec staff and their own science teacher. The content of the community lab is linked to California science standards, and the program is underpinned by a summer institute at the Biogen lab where teachers deepen their understanding of inquiry-based instruction and familiarize themselves with the material that their students will cover during their time at the lab. The cost of building capacity to reach 1500 students was \$400,000, while annual operating costs are about \$100,000.

Alignment with BEST Design Principles for Effectiveness

The design of the community lab is well aligned with principles of best practice. The goals of the program, creating awareness and sparking interest, are clearly defined and measurable. The content of the intervention is challenging and reinforces the school-based science curriculum. Teachers are fully engaged in the preparation, execution, and follow-through of the initiative. Participants interact with role models, while the low student-staff ratio makes it possible to provide a significant measure of personal attention. By establishing a dedicated facility, the sponsor has made a long-term commitment and serves as a model for other knowledge-based companies in the region.

California State Summer School for Mathematics and Science, COSMOS

Capsule

COSMOS, the California State Summer School for Mathematics and Science, is a residential summer enrichment program established by the California Legislature in 2000. Its objective is to provide a diverse group of outstanding high school math and science students with opportunities to explore advanced topics in STEM fields, as well as to prepare them for future careers as leading scientists, engineers and mathematicians. Following a competitive application process, selected 8-12th grade students from around the state spend one month at one of four University of California campuses (Davis, Irvine, San Diego, and Santa Cruz) where they study under the direction of some of UC's finest scientists and engineers. Participants gain hands-on exposure to cutting edge topics not generally included in the regular high school curriculum, including astronomy, aerospace engineering, biomedical sciences, wetlands ecology, and robotics, among others. They attend lectures, work in laboratories, visit campus research facilities, and participate in academic-related field trips to national laboratories, corporations, medical centers, conservatories, etc. Students also participate in college advisement activities designed to prepare them for admission to the most competitive universities. In 2007, the UCSD program reached full capacity (150 students) and cost \$850,000. California resident fees are \$2,200. Need-based scholarships are available.

Scope

Each summer, the program serves approximately 600 students (150 at each campus) who reflect the geographic, ethnic, and economic diversity of California's high school student population. A very small number of students participate from outside the state. Approximately 1200 applicants applied to the program in 2005; 32 students from San Diego County participated. The UCSD program reached full capacity in 2007.

Evidence of Effectiveness

The program is evaluated biannually in reports to the California Legislature. A 2006 evaluation by Center for Research, Evaluation, and Assessment at UC-Berkeley analyzed program performance from 2000-2005. Evaluation tools included pre/post participation surveys, interviews, focus groups, program data, and longitudinal student tracking.

Content knowledge and attitudes Over 80% of participants reported that the program increased their knowledge of subjects, prepared them for future courses, and excited them about the topics they studied. The vast majority of COSMOS alumni either "somewhat agree" or "strongly agree" that they find science and math interesting, are motivated to do more work in these subjects, feel confident in their abilities, and are well suited for careers in these fields. Across the board, however, alumni generally feel more positive about science than math.

Post-secondary study. Ninety percent of alumni surveyed are enrolled in college or universities. Over half of those enrolled in UC campuses attend the most competitive campuses (UC-Berkeley and UCLA). Nearly half of those enrolled out of state attend Ivy League schools. Nearly two-thirds plan to pursue a STEM academic path and slightly over half plan to pursue a STEM career path. Students in COSMOS mathematics clusters are slightly less enthusiastic about future study of mathematics and less interested in a career focused on mathematics than those enrolled in science clusters.

Alignment with BEST Design Principles for Effectiveness

Defined outcomes: The program's goals are clearly articulated by the California Legislature and refined by the COSMOS leadership. Long-term evaluation plans include collection of longitudinal data regarding program participants' pursuit of STEM careers. COSMOS courses typically exceed California Standards for Science and Mathematics curricula, challenging even the most accomplished of participants. Students pursue a course of study that coincides with their demonstrated academic interests and career goals. COSMOS works closely with UC faculty in small groups. The student/academic staff ratio is approximately 4:1. In addition to students, parents and counselors comprise the COSMOS teaching and learning community. Current legislation ensures state funding for at least half but not more than 75% of the actual costs for the program. The balance has been covered by a combination of participant fees, grants from foundations, and donations from individuals and corporations.

School in the Park

Capsule

School in the Park is an innovative educational program designed to inspire, motivate and challenge inner-city elementary school children by combining formal classroom learning with informal, hands-on, experiential curricula using the resources available through ten museums in San Diego's Balboa Park. For six to nine weeks, museum educators expose 3-5th graders to a standards-linked program of study, rich in multi-sensory, inter-disciplinary information, and opportunities for exploration. The goal of School in the Park is to affect both how children learn, as well as what they learn. The program offers students, many of whom have had few "out of the neighborhood" learning experiences, opportunities for establishing a foundation of experiential knowledge upon which new learning connections can be built. Although not solely focused on math and science, substantial parts of the curriculum offered through the Reuben H. Fleet Center, the Museum of Natural History, the Museum of Aerospace, the Museum of Man, the San Diego Zoo, and the Historical Society are science-focused. The Hall of Champions' Fantasy Baseball Program exposes students to such math concepts as ratios, decimals, percentages and degrees. School in the Park is one of many interventions funded by Price Charities as part of a comprehensive revitalization of San Diego's City Heights community. The approximate per student cost of a one-year School in the Park Experience is \$900.

Scope

The program began in 1999, working with third graders at Rosa Parks Elementary. It has since expanded to include 26 teachers and 675 students in grades 3-5. In 2006-2007, Hamilton Elementary School joined the program, bringing the total number served to 1,100 children and 44 teachers.

Evidence of Effectiveness

A 2004 Program Impact Report, produced by a partner organization, relies on teacher surveys, student/parent focus groups, and interviews with school and museum staff. The program conducts ongoing monitoring using the schools' Academic Performance Index (API), weekly pre- and post-assessments of students. Yearly assessments measure learner outcomes and inform teaching practices.

Student achievement Staff point to Rosa Parks' surging API as one indicator of success. The school's API scores have jumped from 455 in 1999 to 725 in 2006, nearly a 60% increase. Rosa Parks also ranks among the top three schools within ten comparison schools. It is not possible, however, to isolate the effect of the School in the Park Program from that of other interventions associated with SDSU-City Heights Educational Collaborative, of which Rosa Parks is a park. There has also not been an attempt to compare museum-exposed students with those who do not participate in such a program.

Student learning Over 80% of teachers surveyed report positive differences in students' motivation to learn, self-confidence, knowledge acquisition, and willingness to engage in a difficult learning task. All of the Rosa Parks teachers and over 94% of museum educators indicate that the program makes a positive difference in English language skills for bi-lingual students.

Classroom practice Over 90% of teachers surveyed report having higher expectations for student performance as a result of their involvement in the program. They also report increased motivation to push their students to greater levels of learning in the classroom.

Alignment with BEST Design Principles for Effectiveness

Defined program outcomes include increasing students' competence, confidence, character, and curiosity. The curriculum integrates the state's content standards with community-based informal learning resources across subject areas. Increasingly rigorous curriculum is delivered as teachers' expectations of student achievement rise. The program's impact is growing beyond the two schools currently served. Lessons learned have been published a book on the impact of museum-based education on learning. The curriculum is also available on museum websites for educational use.

System-wide Connectivity

- **Achievement Gap Task Force**
- **California Partnership for Student Success (Cal-PASS)**
- **San Diego Science Alliance Resource Catalogue**
- **Sweetwater Compact for Success**

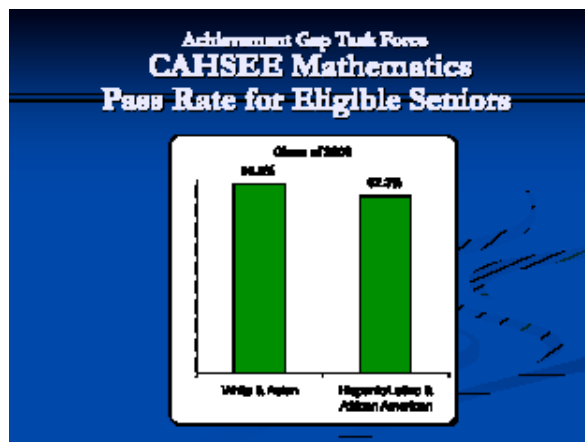
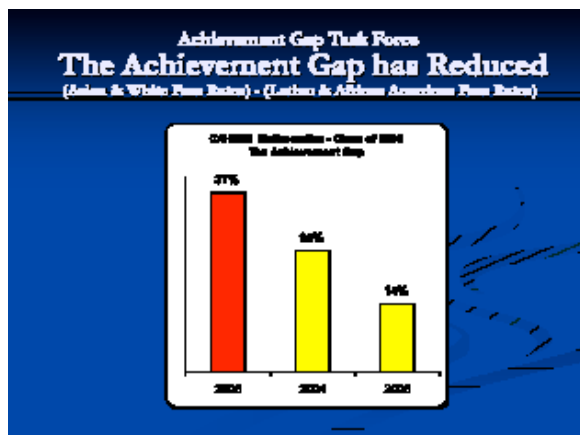
Achievement Gap Task Force

Capsule

The Achievement Gap Task Force has grown out of multi-year initiative spearheaded by the San Diego County Office of Education to improve the performance of students of color on standardized tests. For three years starting in 2003, the main battleground was the math portion of the California High School Exit Exam (CAHSEE), which tests middle school math and some algebra. A countywide Compact committed all 42 district superintendents and their school boards to close a 25-point achievement gap on the CAHSEE through a menu of services, including professional development, study guides, and after-school tutorials. Building on the success of this Compact, superintendents agreed in 2007 to broaden the scope of their concerted efforts to encompass other college-readiness performance measures. These include proficiency rates on state standardized tests, a-g completion rates, and graduation rates. While math achievement will remain a priority for the Task Force, the collective goal will be to prepare every student to graduate prepared to succeed in post-secondary education and work.

Evidence of Effectiveness

In the baseline year of 2004, 65% of Latinos and African-Americans in the class of 2006 passed the math portion CAHSEE as sophomores compared to 90% of whites and Asians. By the time the class of 2006 graduated, the pass rate of students of color reached 92.3% compared to 98.5% for Asian American and White students. The same pattern was repeated for the class of 2007. Despite a significant gap between racial groups as sophomores, by senior year, 98.5% of Latinos and African-Americans had passed the math portion of the CAHSEE compared to 99.7% of white and Asian seniors.



Alignment with BEST Design Principles for Effectiveness

Desired outcomes are clearly defined and measurable. Curriculum is designed to raise the expectations of low-performing students and provide the support needed to master content. Sustained countywide commitment in the face of changes in leadership and budget outlook indicate that Task Force Initiative is likely to persist.

Cal-PASS

Capsule

Cal-Pass, a data-sharing collaborative linking K-12, community college, and university educators, has grown into a significant statewide program since its start-up in 1999 in the Grossmont-Cuyamaca Community College district. With \$2 million in core funding from the state of California, Cal-Pass creates a link between K-12 and post-secondary educators through the shared analysis of data on coursework and achievement in math, science, and English as students, including English-Language learners, move up the educational ladder. Community college districts serve as the collaborative's hubs, bringing together feeder school districts and local universities in a data-sharing consortium. Participating schools, districts, and post-secondary institutions sign memoranda of understanding that protect students' privacy, while making it possible for educators to track the performance of entire cohorts from middle school into high school and beyond. Student data are presented to groups of Professional Learning Councils, composed of faculty by disciplines. The Councils meet monthly to review data reports that show how students who have completed specified coursework perform at the next level. Councils can determine, for example, how well students completing Algebra II in a participating high school perform in college-level science courses requiring foundational Algebra skills. This path-breaking approach enables educators to identify and address barriers to student transition by making adjustments in curriculum, instructional strategy, mentoring, summer study, or professional development. Cal-PASS provides initial support for the solutions that Councils develop through a competitive mini-grant process. Examples of recently funded innovations include the breakdown of math standards into component parts, the backwards mapping of college-level algebra into high school and middle school, and the development of science-focused materials for high school counselors.

Scope

Cal-Pass has gained statewide traction in 101 K-12 districts, 44 community colleges, and 19 universities in 38 counties. In San Diego County, data-sharing arrangements encompass nineteen school districts, four community college districts, and three universities. Nine Professional Learning Councils (out of a statewide total of 40) are supported by three coordinators, bringing together more than 90 educators throughout the county. Of these, almost 60 concentrate on math and science.

Evidence of Effectiveness

Safeguards on data sharing and the premium placed on building trust have limited efforts to make institutional comparisons between students whose schools have participated in Cal-PASS and those whose schools have not. Still, early indicators suggest that the program has made a positive difference in whole districts, as well as in individual schools and classrooms. Specific outcomes include: the use of deconstructed algebra standards to train new teachers and provide focus for textbook adoption in districts in San Diego, Sacramento, and San Bernardino; the institution of Algebra-support courses in San Diego's North County; the development of a summer bridge course in math, co-taught by a high school and community college teacher in San Diego's South County; and the development of a reference guide on science career pathways in South County.

Alignment with BEST Design Principles for Effectiveness

Program goals are clearly understood by participating K-12 and post-secondary faculty. Shared data illuminate key system-wide math and science challenges, including those faced by English Language learners. Solutions are tailored to the needs of specific groups of students. Increases in state support and in participating institutions are early indicators of sustainability.

San Diego Science Alliance Resource Catalogue

Capsule

The organization that has perhaps had the greatest impact in fostering linkages between the classroom and the real world of science is the San Diego Science Alliance (SDSA). Established in 1995, SDSA is a nonprofit networking consortium whose members share a commitment to science literacy. While SDSA sponsors a number of innovative science-focused projects, its signature initiative is its website. The site regularly lists professional development opportunities for science teachers and announcements of science-related events and activities for both teachers and their students. Website users can also subscribe to SDSA's "Science Alert" e-mail, which is sent regularly (about 6-12 announcements weekly during the school year) to over 3,000 teachers and a number of industry leaders in the county, announcing upcoming science events and opportunities. SDSA's Science Calendar provides a running record of monthly science workshops, institutes, exhibit discounts, etc. The website also includes descriptions of SDSA programs and links to on-line science publications, as well as to other websites, including science sites for students, teacher resources, and annotated K-12 sites. Finally, the SDSA website plays a unique role in harnessing information about science resources available outside the classroom through its on-line Resource Catalogue.

Scope

The Resource Catalogue search engine enables visitors to access some 500 wide-ranging opportunities for supplementing the classroom experience through field trips, museum exhibits, speakers, competitions, and internships. Visitors can learn about such resources for enriching their classroom teaching as hands-on activities and kits, curriculum materials, equipment and supplies, and technology and software. For those teachers eager to improve their own content knowledge and skills, the catalogue offers information about conferences, consultants, and professional development courses. By inputting the appropriate parameters, teachers can identify grade-level opportunities specific to any one of thirty subject areas, including marine biology, environmental science, chemistry, etc. A significant recent improvement is the Catalogue's ability to match each program or resource to the corresponding grade-level California science content standards.

Evidence of Effectiveness

The online SDSA Resource Catalogue receives between 5,000 and 6,000 hits month, mainly from teachers but also from parents, students, and organizational stakeholders of the Science Alliance. The consolidation of the site as San Diego's "go-to" resource for professional development opportunities and community-sponsored enrichment in science attests to its impact and sustainability.

Sweetwater Compact for Success

Capsule

The goal of the Sweetwater Compact is to create a college-going culture in Sweetwater Union High School District, a low-income, predominantly minority district of 40,000 middle and high school students. The Compact guarantees admission and needs-based financial aid to San Diego State for all of the district's students who meet specified academic and attendance criteria, including UC-Cal State math and science admissions requirements. The Compact begins preparing students (and their parents) for college in the 7th grade and shepherds them through 12th grade with a detailed list of guidelines, opportunities, and requirements. SDSU makes faculty available to collaborate with district teachers in curriculum development and training models, as well as in providing teachers with a realistic picture of the level of work that will be required of the Compact Scholars at SDSU. In collaboration with the district, SDSU also hosts orientation, visitation, and "commitment to enroll" programs for 7th, 10th, and 11th graders. Once at SDSU, Compact scholars receive ongoing support and monitoring from Compact counselors and participate in a freshman success course. The initiation of the Compact in 2000 coincided with a sweeping district-wide effort to strengthen principal leadership, curriculum rigor, teacher skills, and such academic support programs as AVID and specialized writing electives.

Scope

All 7th grade students were invited to become Compact Scholars in the fall of 2000. A total of 404 Compact Scholars were represented in SDSU's graduating classes of 2006 and 2007.

Evidence of Effectiveness

Compact results have not been rigorously evaluated, but its officials can marshal data indicating that its systemic approach has improved student achievement since the establishment of the program.

Rigorous course-taking: The percentage of Sweetwater students deemed college-ready -- those having completed the a-g curriculum -- grew from 27% in 2003 to 37.4% in 2006. The number of AP test-takers jumped from 3,430 in 2004 to 4,239 in 2006, although the percentage earning college credit remained significantly below the county average.

Increased college attendance: Enrollment of Sweetwater graduates in SDSU increased from 243 in 2002 to 628 in 2006. Over 200 members of the 2006 graduating class were admitted as Compact Scholars. Overall the college attendance rates for the district have increased by 44%, from 765 in 2004 to 1101 in 2006.

Performance in college: as college freshmen, Compact Scholars outperformed non-Compact Sweetwater graduates attending SDSU in average GPA. Compact scholars also earned more credits as freshmen than the average SDSU freshman. Finally, Compact Scholar freshmen had lower rates of academic probation and disqualification in 2006-2007 than their non-Compact Sweetwater peers.

Alignment with BEST Design Principles for Effectiveness

Defined outcomes: The Compact has clearly defined academic and attendance criteria for students seeking to be designated as Compact Scholars, as well as annual target goals for numbers of scholars. The Sweetwater Union District has aligned its curriculum to the state's standards, although all students have yet to complete "a-g" subject requirements. All Compact scholars are assigned advisers who play a critical role in referring students to tutoring programs and other academic support activities. Parents attend Compact orientations, visitations, and evening workshops. They also receive a newsletter detailing Compact requirements. SDSU's ten-year commitment of admission and financial aid to Compact Schools will last through 2013. The Sweetwater Educational Foundation works to raise about \$500,000 in financial aid annually for each class. A number of private foundations have already pledged funds for specific graduating classes.