



Planting the Seeds for a Diverse U.S. STEM Pipeline:

A Compendium of Best Practice K-12 STEM Education Programs

Updated 2010



SCIENCE • TECHNOLOGY • ENGINEERING • MATH

Forward



“The pre-college science, technology, engineering and math (STEM) education programs showcased in this compendium share three key strengths. First, they inspire all students and grow the innate interest all kids have for these subjects, particularly girls and underrepresented minorities. Next, they provide positive, real-life individuals in STEM careers for students to get to know, and make the fields more accessible. Finally, they introduce students to the myriad career opportunities available for them in today’s STEM fields.

Equally important, these best practice STEM education programs demonstrate the power and effectiveness of public-private partnerships to improve education and bolster student achievement. We hope that by using this compendium as a guide, similar types of partnerships involving K-12 education, higher education, industry and government will be further explored, encouraged and expanded.”

With An Eye to the Future

A handwritten signature in black ink, which appears to read 'Mae Jemison'. The signature is fluid and stylized, with a long, sweeping line extending from the end.

Mae C. Jemison, MD
President, BioSentient Corporation
Founder, The Earth We Share

Introduction



Despite the global recession, the United States continues to face a workforce shortage in science, technology, engineering and math (STEM) fields. We must do a better job of tapping the talent of citizens who are underrepresented in STEM fields: women, African-Americans, Hispanics and American Indians. Our global competitiveness depends on our ability to attract and retain future generations in areas such as chemistry, engineering, the physical sciences, mathematics and the computer sciences.

There are some encouraging signs that show progress in this area. Science-based companies like Bayer are responding. They're building business-education partnerships to develop the scientists and researchers we need to compete internationally and grow our economy. This updated booklet provides examples of effective K-12 STEM education programs and resources. They work. And they can be copied or tailored to meet specific needs.

Here, at Bayer, we demonstrate our commitment to improving STEM education through our company-wide *Making Science Make Sense*® (MSMS) program. This Presidential award-winning initiative advances science literacy across the U.S. through the support of hands-on, inquiry-based science learning, a corps of 1,000 employee-volunteers and a public education campaign led by astronaut Dr. Mae C. Jemison.

In addition, each year as part of the MSMS public education activities, Bayer surveys opinion leaders about STEM education. There's good news and bad news. Our latest survey clearly shows that those of us in STEM fields need to do a better job attracting and retaining women and underrepresented minorities, many of whom report experiencing bias and discouragement in the country's STEM education system.

On the other hand, I'm happy to report that our surveys of Fortune 1000 and emerging high-technology company CEOs show they "get it." They know that science literacy and diversity are essential to their own companies and to America's position in the world. What's more, many are taking action through partnerships with educators and government leaders to get the job done. The time for such partnerships has never been better.

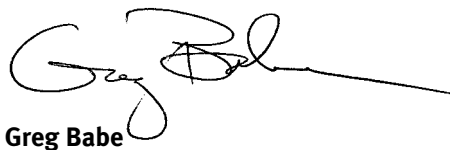
The STEM programs and resources detailed in this booklet provide valuable guidance. I hope they spark new partnerships and better ideas. Bayer will update these programs as they come to our attention. Please share your ideas and programs with us.

Many organizations made this guide possible. They include the National Science Teachers Association; the American Association for the Advancement of Science; the National Science Foundation; the National Science Resources Center; the National Research Council and its National Science Education Standards; and the National Action Council for Minorities in Engineering and its Building Engineering and Science Talent program.

Our country needs more scientists, engineers and innovators, to be sure. And the more diverse talent pool we can draw from, the better. But, it goes beyond these working directly in the STEM fields. We also need government and business decision-makers who understand science and all its implications. We need citizens who similarly understand science.

We need more journalists to accurately report on scientific developments. And we need more gifted teachers to advance science literacy and curiosity.

There is much to be done. Working together, we can change the future in bright, imaginative ways.



Greg Babe
President and CEO, Bayer Corporation

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About Bayer Corporation's *Making Science Make Sense*®

As a science and research-based company with major businesses in health care, nutrition and high-tech materials, Bayer Corporation has a strong stake in helping to improve science education and to insure that all individuals are scientifically literate. Bayer demonstrates this commitment with its national award-winning *Making Science Make Sense*® (MSMS) program, a companywide initiative which advances science literacy across the United States through hands-on, inquiry-based science learning, employee volunteerism and public education.

MSMS is one of 300 corporate social responsibility programs Bayer supports globally. For more than a century, Bayer has been acting in the public interest, demonstrating a distinct kind of corporate citizenship that benefits humankind and society at large. MSMS has been honored with numerous awards, including two presidential accolades – The Ron Brown Award for Corporate Leadership and The President's Service Award – and the National Science Board's Public Service Award.

More than 40 years ago, MSMS was born when Bayer volunteers began helping teachers teach and students learn science the way scientists do – by doing it. Today, in Bayer site communities across the country, more than 1,000 volunteers work to foster science literacy and ignite student interest in science.

MSMS relies on a number of important national and local partnerships. Nationally, Bayer has forged relationships with the U.S. Department of Education, National Science Foundation, National Science Teachers Association, American Association for the Advancement of Science and National Science Resources Center to change the way science is taught and learned in the classroom.

Locally, Bayer is spearheading education reform with school districts, other businesses, government and education organizations. Together, these groups work to implement Standards-based inquiry-centered curricula and provide teachers with ongoing professional development in science content and pedagogy.

Thus, MSMS not only helps educate the next generation of scientists, technologists, engineers and mathematicians, it equips all students with the skills acquired from a high quality, hands-on science education like critical thinking, creativity and adapting to change. Skills that in today's scientific and technological world are essential to any career one chooses.

Bayer's national science literacy campaign, led by astronaut Dr. Mae C. Jemison, features the *MSMS Experiment Guides* for parents and children; the *MSMS Audio Series*, featuring two-minute sound byte science classes about everyday science topics; the *C.A.U.S.E. Challenge™ High School Film Festival*, an environmental film competition for Pittsburgh-area high school students with its partners the Carnegie Science Center's Regional SciTech Initiative and Pittsburgh Filmmakers; the *International Children's Painting Competition*, an environmental art competition for students ages six-to-14 with its partner the United Nations Environment Programme; and, the annual *Bayer Facts of Science Education* surveys, which gauge public opinion on the state of science education in the United States, as well as support for reform and public recognition of the roles that science and science literacy play in everyday life.

Also, in order to further galvanize STEM (science, technology, engineering and math) industry involvement in education, Bayer has published and made widely available two resource guides — *Bridging the Diversity Gap in Science and Engineering: Introducing STEM Industries to K-12 Best Practice Programs - Highlights Report* and *Planting the Seeds for a Diverse U.S. STEM Pipeline: A Compendium of Best Practice K-12 STEM Education Programs*. These companion reports provide business leaders and others with information about best practice K-12 STEM education programs and practical advice for how they can support and/or replicate such programs in their local communities.

For more information about *Making Science Make Sense* or to subscribe to the *Making Science Make Sense* E-News Update, please visit www.BayerUS.com/MSMS.

Key Criteria

In order for all students – regardless of age, gender, cultural or ethnic background, disability, aspiration, inspiration or motivation – to achieve in science, they must have access to highly-skilled professional teachers, adequate classroom time dedicated to science learning and quality science learning materials.

Given that, to be considered for inclusion in Bayer Corporation's **Planting the Seeds for a Diverse U.S. STEM Pipeline: A Compendium of Best Practice K-12 STEM Education Programs**, a program had to meet the following four criteria:

1. Challenging Content/Curriculum

- An inquiry-based, experiential curriculum that is clearly defined and understood
 - related to real-world applications
 - encourages critical thinking, problem solving and team working
 - goes beyond minimum competencies
 - reflects local, state and/or national standards

2. An Inquiry Learning Environment

- An environment where teachers and their students work together as active learners
 - teachers have access to and time allotted for professional development that hones their science knowledge and experiential teaching approach
 - necessary curriculum materials are supplied in full
 - students' diversity, individuality and uniqueness are recognized and respected


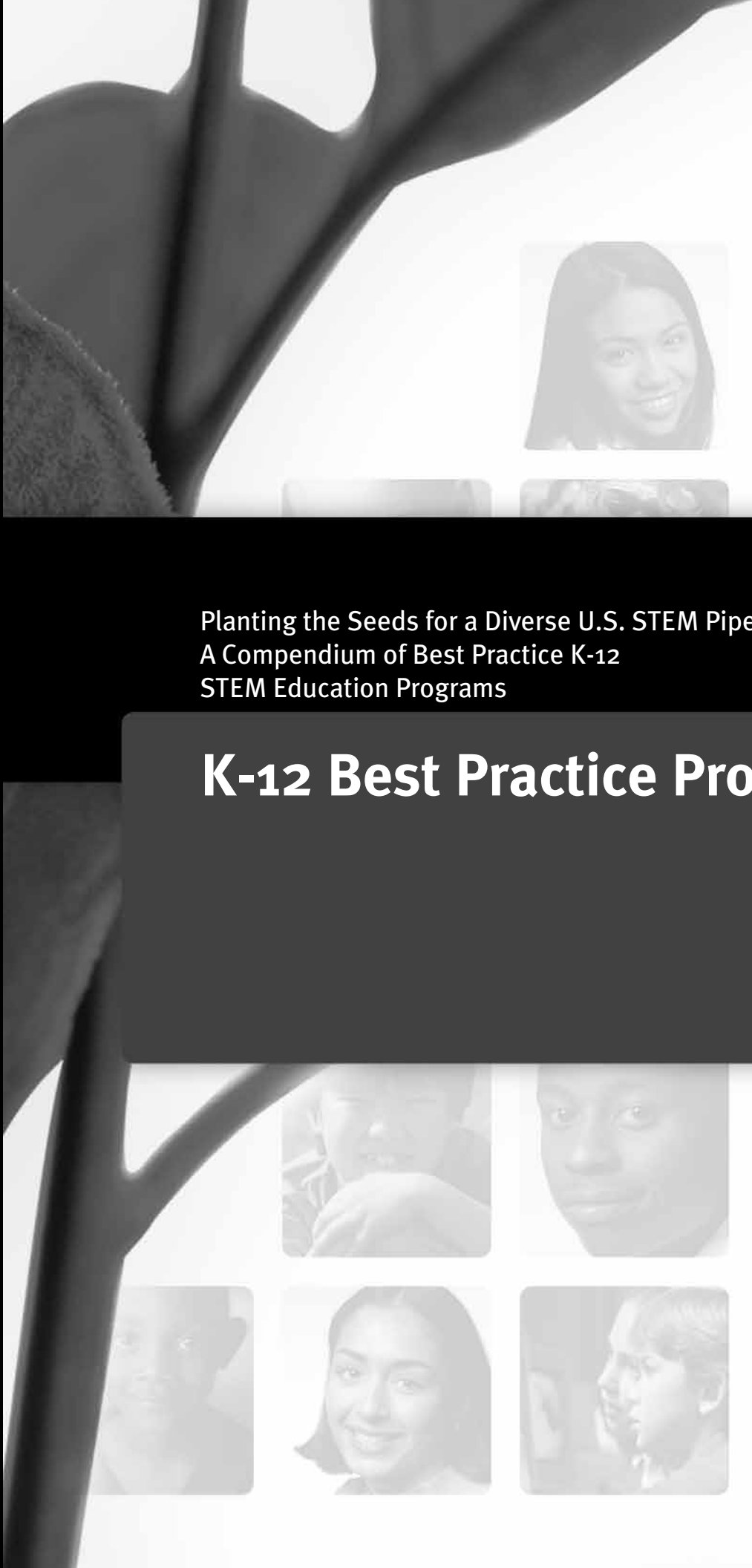
3. Defined Outcomes/Assessment

- Goals are clearly identified and success is measured against them
 - assessment tools are designed to measure outcomes
 - assessment provides:
 - *both quantitative and qualitative information
 - *basis for research and continuous improvement of program

4. Sustained Commitment/Community Support

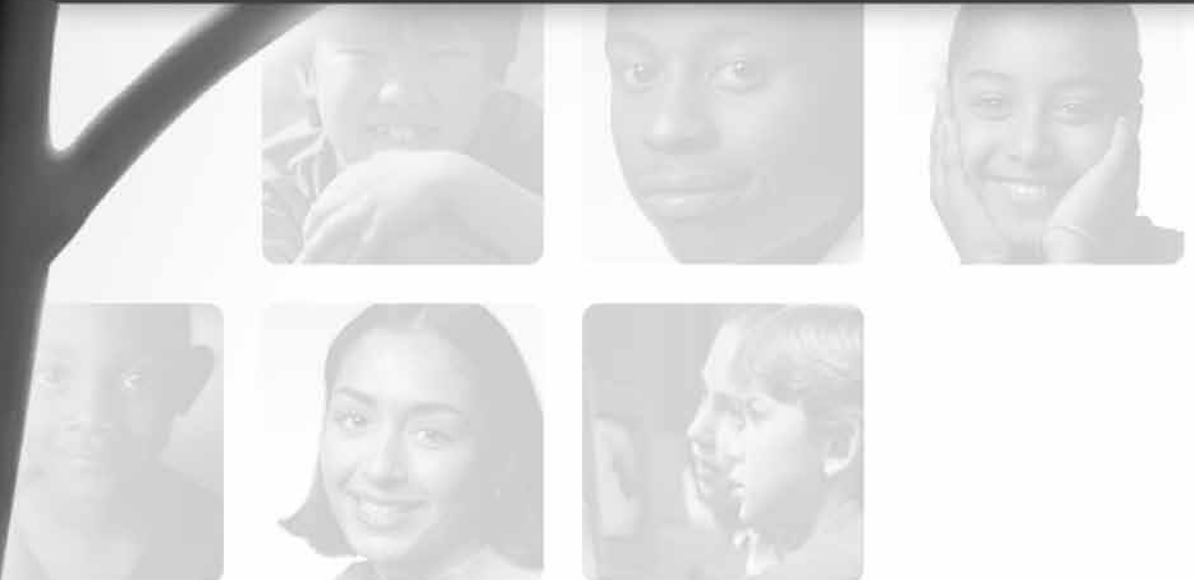
- Program has strong leadership and sufficient resources
 - continuity of program funding
 - school and/or school district support
 - community support, including parents and private industry

NOTE: Criteria based on guidelines provided by Building Engineering and Science Talent (BEST) Commission, *National Science Education Standards* and National Science Resources Center.



Planting the Seeds for a Diverse U.S. STEM Pipeline:
A Compendium of Best Practice K-12
STEM Education Programs

K-12 Best Practice Programs



American Chemical Society's Project SEED



Program Overview:

Established in 1968, Project SEED is an American Chemical Society (ACS) program for high school students from economically disadvantaged backgrounds who have an interest in pursuing science as a career. The program provides an opportunity for students to participate in scientific research and learn what it is like to work in science-related fields through on-the-job experience. Project SEED places students in academic, industrial and governmental research laboratories for eight-to-10 weeks during the summer months to perform hands-on scientific research under the supervision of a volunteer scientist-mentor. Project SEED offers a stipend and three opportunities to students: 1) Summer I is the first summer experience, open to students who have completed the 10th grade and at least one year of high school chemistry; 2) Summer II allows students to return for a second summer of more intensive research; and 3) a freshman college scholarship, for Project SEED graduates, offers up to \$5,000 for students planning to major in the chemical sciences or chemical engineering.

Reach/Target Student Population:

Every year, nearly 400 students participate in Project SEED at more than 100 institutions. In addition, some 300 volunteer scientist-mentors participate in the program (no mentor has more than two students). Since 1968, nearly 9,000 high school students have participated in Project SEED. Approximately 70 percent of the students are from underrepresented groups in the sciences, primarily African-American, Hispanic and American Indian. In addition, 62 percent are female.

Community Partners:

Financially, Project SEED receives support from ACS members through annual dues and other voluntary contributions. However, at the heart of Project SEED are the many scientist-mentors who contribute their time and effort to providing a meaningful experience for the students.

Learning Environment:

Students work in academic, industrial or governmental laboratories for eight-to-10 weeks and are provided with projects that give them the opportunity to do meaningful research. The projects are suggested by scientist-mentors and reviewed by an ACS committee. Many of the projects involve learning about making new compounds, testing and usage of lab instruments and analyzing data.

During the summer experience, students:

- develop lab skills, as well as written and oral communication skills;
- learn to work in teams;
- have the chance to develop and demonstrate their creativity; and,
- discover that they can do scientific research.

Program Results Highlights:

A comprehensive project evaluation confirms that Project SEED is a pivotal experience for students in shaping their career goals and aspirations. Of the students surveyed:

- more than 50 percent decided to attend college only after their Project SEED experience;
- some 70 percent reported that they have obtained a degree in a science field (and an additional 10 percent earned degrees in non-science fields) and credited their experience in Project SEED as a factor in their career planning; and,
- 63 percent obtained B.S. degrees, 13 percent M.S. degrees, 7 percent Ph.D.s and 9 percent other degrees.

Opportunities for Support/Replication:

Project SEED welcomes financial contributions and student-internship opportunities from corporations and other organizations, as well as scientist-mentor volunteers who can work with its students.



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Program Overview:

ASSET Inc. (Achieving Student Success through Excellence in Teaching) is an education improvement nonprofit that provides teacher professional development and hands-on curriculum materials for grades K-8. Since its inception in 1994 by a group of corporate, foundation and community partners, ASSET has quietly, but effectively, established itself as a major driver of systemic education improvement in Pennsylvania. Initiated as a pilot program in two school districts, ASSET received a five-year grant from the National Science Foundation to serve additional districts before successfully transitioning to a self-sustainable, fee-for-service model. ASSET's approach is modeled on the National Science Resources Center's (NSRC) five essential components of science education reform:

- standards-based curriculum materials;
- ongoing teacher professional development;
- refurbishment of hands-on curriculum materials;
- assessment and program evaluation; and,
- community and administrative involvement.

In 2006, Pennsylvania Governor Edward G. Rendell launched a statewide initiative to improve elementary science education called *Science: It's Elementary* and selected ASSET to manage and design the program in partnership with the Pennsylvania Department of Education. To date, the Pennsylvania Legislature has invested more than \$50 million in this landmark initiative.

President Barack Obama cited *Science: It's Elementary* as an example of a state taking steps to encourage inquiry-based science statewide. ASSET also has received national acclaim for its science education improvement model, which was cited by the NSRC as a "model for the nation."

Reach/Target Student Population:

Currently, ASSET and *Science: It's Elementary* collectively serve 180 school districts, charter and private schools, directly impacting 5,000 teachers and 142,000 students across Pennsylvania.

Community Partners:

ASSET has more than 100 community partners – corporations, foundations, universities and school districts – who provide an array of support and services, such as grants, in-kind support, fundraising assistance and volunteers. Among ASSET's most loyal partners are: Bayer Corporation, Buhl Foundation, Dollar Bank, Duquesne Light Company, DSF Charitable Foundation, EQT Corporation, The Grable Foundation, The Heinz Endowments, The Pittsburgh Foundation, PPG Industries, Inc., The Richard King Mellon Foundation, The Bank of New York Mellon, Universal Stainless and Alloy Products, Inc., and Westinghouse Electric Company.

Learning Environment:

ASSET patiently and persistently pushes the boundaries to motivate teachers to learn so they can deepen student understanding. ASSET has created a community that approaches learning as a lifelong, open-ended inquiry; embraces learning by doing; and uses a team approach to decision making. ASSET's core beliefs drive its organizational approach, including:

- all students can learn and should be provided equal opportunities to learn;
- science is an ideal entry point for students to explore their surroundings, ask questions, collect and analyze data, think critically and apply their learning to new situations and academic areas;
- teachers are both the targets and agents of change;
- ongoing professional development is vital to continuously improving teaching and learning;
- when teachers learn, students learn; and,
- research and development is integral to providing teachers with new opportunities to continuously improve their craft.

Program Results Highlights:

Since its inception, ASSET has conducted analyses to evaluate the effectiveness of the program on teacher and student learning. An early study by University of Pittsburgh researchers used fourth- and seventh-grade science questions from the 1995 Trends in International Math and Science Study (TIMSS) test to assess 1,500 ASSET fifth-grade students. They found that, compared with the official TIMSS scores from the United States and high-performing countries, ASSET fifth-grade students' mean scores were:

- significantly higher than United States students' scores; and,
- competitive with seventh-grade student scores from high-performing countries, such as Japan, Singapore, Korea, England, Hungary and the Czech Republic.

More recently, as part of the evaluation of *Science: It's Elementary*, Horizon Research, Inc. has provided observations regarding the initiative's impact across Pennsylvania. Results for 2008-2009 include:

- student post-test scores were significantly higher than pre-test scores in grades 3-6;
- student learning gains are greater in classes where the teachers base more of their instruction on the *Science: It's Elementary* hands-on science modules;
- greater teacher participation in *Science: It's Elementary* professional development is positively associated with greater student learning gains;
- teachers' perceptions of their science content knowledge were significantly greater after participating in the *Science: It's Elementary* professional development; and,
- schools indicated that science has become a higher priority and the amount of instructional time devoted to science has increased as a result of participating in *Science: It's Elementary*.

Opportunities for Support/Replication:

ASSET welcomes public- and private-sector support and accepts contributions through the Educational Improvement Tax Credit program. In addition, ASSET seeks mentors who can work with its teachers, as well as volunteers who can help to refurbish science kits in its Materials Support Center. ASSET also seeks teachers to serve as educational consultants to help the organization continue to scale-up statewide and provide ASSET professional development to teachers across Pennsylvania.



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Bioscience Explorations



Program Overview:

Established in 2001, Bioscience Explorations consists of two main components: the CURE BioBus and BioConnection. The CURE BioBus is a 40-foot-long, custom-designed mobile bioscience laboratory fully equipped to allow students and teachers to conduct advanced biotechnology experiments.

BioConnection lends the same research grade equipment, samples and reagents available on the CURE BioBus to teachers for use in the classroom for two-week periods. Teachers are provided comprehensive training for participation in the programs, as well as inquiry-based, hands-on activities to undertake in the classroom. All programs are provided free of charge to schools thanks to the support of its sponsors.

Reach/Target Student Population:

Since inception, Bioscience Explorations has visited more than 515 schools, training 960 teachers and working with more than 64,000 students. On average, 70 schools, 8,000 students and 175 teachers per year benefit from the two programs. Bioscience Explorations targets elementary, middle and high school students in both inner-city and rural schools in Connecticut. Bioscience Explorations also partners with local agencies to provide training and experiment opportunities to minorities, at-risk girls and various community outreach initiatives. In addition, each year, the Connecticut State Department of Education recognizes specific school districts with the greatest needs as Priority School Districts. During the 2007-2008 school year, the BioBus program reached 81 percent of those schools (an increase of more than 20 percent from the previous year).

Community Partners:

BioBus Educational Programs currently has 19 sponsoring organizations, including pharmaceutical and biotechnology companies, bioscience suppliers, federal and state government, and academic institutions.

Learning Environment:

When students enter the CURE BioBus or BioConnection classroom, they realize quickly that they are in a real science laboratory, conducting real experiments. They are introduced to modern research grade equipment including the vortex, micropipette, digital scale and electrophoresis instruments that they will use alone or with a partner. During their time on the CURE BioBus or in the BioConnection classroom, students engage in hands-on activities directly connected to human health issues, genetics or forensics. While the CURE BioBus rolls onto a school campus, the BioConnection program rolls directly into schools' classrooms. The impact of Bioscience Explorations is far-reaching, extending well beyond the initial visit. Since Bioscience Explorations' programs enable teachers to learn new techniques and concepts in bioscience, receive research updates from real scientists and practice relevant hands-on activities, the teachers learn new skills that they then bring to their classrooms all year, every year.

Program Results Highlights:

Recent assessments of Bioscience Explorations' program offerings have found an increase in student science content knowledge and interest in science overall. Teachers report increased confidence in teaching bioscience and in their knowledge of the subject. Additionally, previous independent evaluations of the programs found that teachers are better able to identify students who wish to pursue advanced study of bioscience, who show increased interest in career fields focused on bioscience and who wish to use bioscience as a subject for classroom projects, activities and competitions. The same study found that exposure to the BioConnection program helps students to better understand "real science" and how it fits into their everyday life. They also have a better understanding of the scientific process and become proficient with scientific techniques, processes and content. This enables them to solve problems and gain confidence in their own ability to complete a lab experiment. In addition, the study found that based on the students' experience, some have indicated they will consider pursuing this field as a career.

Opportunities for Support/Replication:

Bioscience Explorations currently receives requests for school visits during the year that continues to exceed current program capacity, resulting in a four-year waiting list. The program welcomes public- and private-sector support to increase capacity, donations of equipment and supplies, as well as scientist-volunteers who can visit classrooms and help shape future activities.



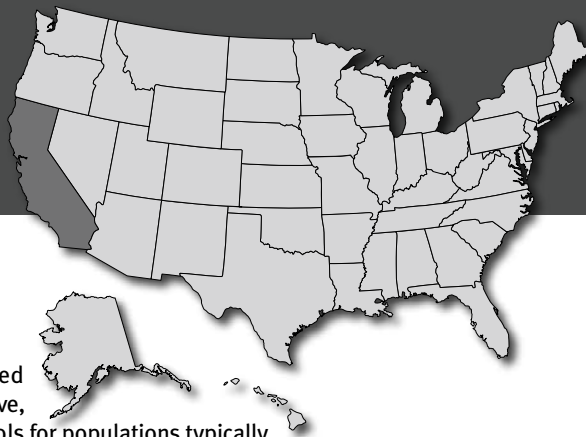
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Biotech Partners



Program Overview:

Founded in 1993 as part of a 30-year Development Agreement between Bayer HealthCare and the City of Berkeley, Biotech Partners is a nationally recognized model for school-to-career partnerships. The organization provides a comprehensive, hands-on academic and job-training program in Berkeley and Oakland public schools for populations typically underrepresented in the sciences – especially students of color, young women and those from low-income households. Biotech Partners' unique multi-year program consists of a career-focused, hands-on science and technology curriculum from 11th grade through community college; paid-summer internships for high school students; yearlong co-op jobs for community college participants; and, support services to help each student achieve success. The program prepares young people for skilled technical positions in the ever-expanding bioscience and health care industries. Biotech Partners promotes self-motivation and economic self-sufficiency. This program is designed to build students' confidence in their ability to succeed in the world both academically and professionally.

Reach/Target Student Population:

Each year, Biotech Partners works with approximately 150 young people at Berkeley High School, Oakland Technical High School and the Peralta Community College District. Nearly all (97 percent) are students of color, 53 percent are young women and many are from low-income households.

Community Partners:

Today, Biotech Partners' work is supported by the generous participation of and funding from more than 40 corporate, government, foundation, education and health care partners. Approximately 20 Bay Area biotech companies and organizations provide paid-summer internships for high school participants and yearlong co-op jobs for the community college participants. These include Bayer, Novartis AG, Joint Genome Institute/U.S. Dept. of Energy, Lawrence Berkeley National Laboratory, U.S. Dept. of Agriculture, Kaiser Permanente Medical Center and the Berkeley Dog and Cat Hospital, among others. Biotech Partners also partners with three local school districts to provide the educational component of the program: Berkeley Unified School District in Berkeley, CA; Oakland Unified School District; and, Peralta Community College District.

Learning Environment:

Two core principles underpin Biotech Partners' programmatic structure. 1) Young people are more than just students, and to help them succeed in school often means addressing issues that are not necessarily academic in nature. BBEI staff works with the students individually to help identify and resolve many of the barriers preventing their success. These can include lack of self-motivation, child-care issues, housing instability and family problems. 2) In order for academics to matter to Biotech Partners' target population, the curriculum must be engaging, hands-on and, most important, relevant. To achieve this, Biotech Partners has structured a program where the demands of paid employment and those of the classroom are inextricably linked. Recruited in 10th grade, students participate in the program in 11th and 12th grades, taking four specialized bioscience classes and an additional chemistry class, along with their regular course load. Biotech Partners emphasizes interactive laboratory experiences, a skills-based and industry-informed curriculum and industry/research-oriented speakers who come into the classroom to show students the real-world significance of what they are learning. Through this approach, students grasp the relevance of their coursework and are motivated to stay engaged. Full-time paid internships in biotech and health care settings are arranged for every qualified student during the summer between 11th and 12th grades.

Program Results Highlights:

Since 1993, Biotech Partners has placed nearly 900 youth in internships and co-op work positions. Recent evaluation results show Biotech Partners' program works. In the last four years, 100 percent of the students who completed the program graduated high school. This is in marked contrast to the other students in the school districts that Biotech Partners serves and significantly higher than the overall state graduation rate of 68 percent. Furthermore, the study found that Biotech Partners' students who enroll in the community college program have a 59 percent completion rate, which is nearly double the national completion average for students attending non-four-year, post-secondary institutions. Usually within 30 days of graduation, Biotech Partners students are employed in industry. Employers report Biotech Partners' graduates "outperform their peers at work" and are "significantly better than their coworkers on the vast majority of technical skills, including familiarity with laboratory equipment, and processes... computer applications and instrumentation, ability to learn how to use new equipment and to learn new processes."

In addition, Biotech Partners sees success from those students who choose not to participate in the community college program. They report these students taking Advanced Placement classes in preparation for college and, upon high school graduation, enrolling in four-year colleges and universities.

Opportunities for Support/Replication:

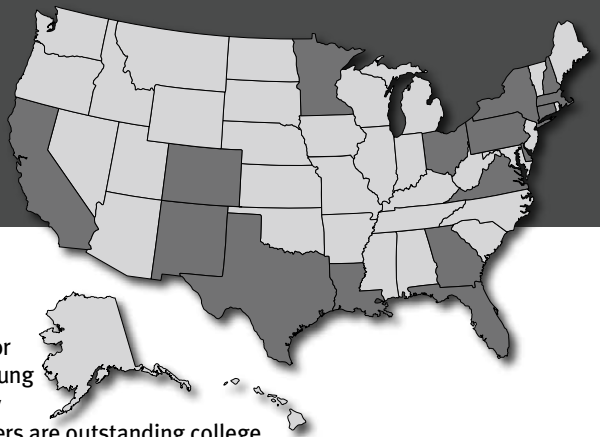
Biotech Partners welcomes financial contributions and student-internship opportunities from corporations and other organizations, as well as scientist-mentor volunteers who can work with its students. Lauded by the U.S. Department of Labor and others as an exemplary school-to-career program, Biotech Partners could be replicated in other communities with the strong support of partners.



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Breakthrough Collaborative



Program Overview:

Founded in San Francisco in 1991, Breakthrough Collaborative prepares students for challenging, college-preparatory science and math courses and recruits diverse young people to teach these subjects. Breakthrough middle school students are primarily low-income students of color who dream of college diplomas. Breakthrough teachers are outstanding college and high school students who dream of careers as CEOs, doctors and lawyers. Through an innovative Students Teaching Students model, Breakthrough teachers are trained to teach middle school students in six-week summer sessions, after-school tutorials and weekend events. The results are transformative. Some 80 percent of Breakthrough middle school students enter college-preparatory high schools; 84 percent of Breakthrough teachers express interest in pursuing careers as teachers. Breakthrough currently has 34 sites in 28 cities across the United States.

Reach/Target Student Population:

Breakthrough recruits high-potential students, most of whom are low-income and of color. All Breakthrough students demonstrate academic motivation and potential, and all face significant obstacles to realizing their aspirations. Specifically:

- 91 percent are students of color;
- 68 percent qualify for free or reduced-price lunch;
- 39 percent speak English as a second language;
- 61 percent will be the first in their families to attend college; and,
- 39 percent live in single-parent households.

In 2009, Breakthrough served 2,440 middle school students, 2,998 high school students and 723 college students.

Community Partners:

Nationally, Breakthrough partners with dozens of organizations ranging from the Morehead Scholars at University of North Carolina, Chapel Hill, which provides stipends and housing expenses for Breakthrough teachers, to the Princeton Review, which provides SAT preparation to Breakthrough students. Locally, all Breakthrough programs are hosted by independent schools, universities or prestigious public schools. Hosts provide in-kind use of office space, classrooms and office equipment. Many serve as the fiscal agents and provide management and leadership through their own boards and administrations. Additionally, all Breakthrough programs are partnered with local public and charter schools from which they recruit students for services.

Learning Environment:

Breakthrough classes have a maximum of 10 students and one teacher, but class sizes can be as low as four to six students. In the small classes, there is no “back of the room,” and all students are engaged every day in every class. All classes are held in outstanding, state-of-the-art labs and classrooms. Typical Breakthrough classes include building toothpick bridges to learn physics; dissecting cow eyes to study anatomy; building models of cells to learn biology; burning marshmallows to study chemistry; and, making life-size replicas of each student to examine body systems.

Program Results Highlights:

Annually, Breakthrough completes multiple assessments of the program’s effectiveness, examining qualitatively and quantitatively the impact of student and teacher services, measuring entrance into college-preparatory high schools, successful completion of college-preparatory curricula, college matriculation, and for teachers, entrance into the field of education.

From 1999 – 2003, Breakthrough Collaborative worked with Stanford University and the American Institutes of Research to conduct a third-party, five-year evaluation of the Breakthrough model for students and teachers. The study confirmed that Breakthrough prepares disadvantaged students for high school and college success. Key findings include:

- 79 percent of Breakthrough alumni were attending rigorous, college-preparatory high schools;
- 57 percent of Breakthrough students were taking algebra or geometry in the eighth grade versus the national average of 25 percent;

- More than 90 percent of Breakthrough ninth graders and more than 80 percent of 10th graders were enrolled in a rigorous mathematics course that put them on track for college;
- 74 percent of ninth graders and 92 percent of 10th graders were taking either biology or another advanced science course;
- Breakthrough students were more likely to come to class prepared, spend more time on homework and be more assertive in the classroom than students in the control group; and,
- Breakthrough students believe that the program prepared them for high school, taught them what it takes to get into college, and showed them that learning is fun.

The retrospective study of Breakthrough teachers was equally encouraging. It found:

- 72 percent went on to work in other educationally related careers or internships after teaching at a Breakthrough site;
- 72 percent indicated their experience strengthened their commitment to enter education; and,
- 50 percent volunteered their time in other educational or youth advocacy programs.

Opportunities for Support/Replication:

Nationally, Breakthrough Collaborative is looking for support from public- and private-sector organizations which will help extend their offerings to students and teachers. Locally, the program is looking for schools and universities to host programming and recruit students. As the program has grown to include 34 sites in 28 cities, Breakthrough Collaborative lends itself easily to replication.



Breakthrough
COLLABORATIVE

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Community Resources for Science



Program Overview:

Founded in 1997, Community Resources for Science (CRS) is building a community of educators working together to get young students excited about learning through science. CRS serves as a hub for teachers, science and environmental education programs, and scientists, providing information and support to improve elementary science learning. In addition to an in-class volunteer scientist role model program called Community in the Classroom (CIC), CRS programs encompass teacher professional development workshops and pre-service teaching courses, a teacher membership program for year-round assistance with science content questions, and various research and development projects with program providers, agencies and school districts.

Reach/Target Student Population:

CRS's service area is public elementary schools in the East Bay Area, Calif., primarily in the diverse, urban districts of Oakland and Berkeley. In these districts, 37 percent of students are African-American, 22 percent are Hispanic and 10 percent are Asian. More than half receive free and reduced price lunches.

CRS serves almost 500 teacher members and work with roughly 150 teachers (in-service and pre-service) in its professional development workshops and classes. In 2009, CRS placed more than 190 scientist role model volunteers in more than 200 classrooms, directly engaging and inspiring more than 5,400 students in exploration through science.

Community Partners:

CRS partners include funders, who provide the necessary resources to sustain our programs, as well as specific organizations and school districts, including the University of California, Berkeley's Department of Chemistry, Berkeley Unified School District, Oakland Unified School District and the Berkeley Public Education Fund. CRS enjoys strong corporate and foundation support, and works with these funding partners to consistently evaluate our programs and address areas of need in science education, fostering lasting connections among the science and education communities.

Learning Environment:

CRS programs equip teachers with the knowledge, skills and confidence required for successful science teaching, and provides them with ongoing access to professional scientists and engineers. In doing so, CRS has helped teachers create classroom environments that are hands-on and inquiry-based, with students engaging in the scientific process and being exposed to real-world science and science professionals.

Program Results Highlights:

Teacher evaluations point to the overall high quality of volunteer classroom interactions for the teachers, themselves and their students. For instance:

- 76 percent said they got help teaching science content;
- 76 percent said they would be able to use some part of the presentation in their own teaching;
- 86 percent felt that their students learned new science content;
- 86 percent found the presentation relevant to students' lives and learning interests;
- 96 percent cited "observation" as a specific skill students learned;
- 79 percent cited "predictions" and "drawing conclusions" as specific skills students learned;
- 98 percent measured student engagement by relevant questions asked; and,
- 96 percent measured student engagement by students' full participation.

Opportunities for Support/Replication:

Community Resources for Science is looking for public- and private-sector support to help further develop and implement its programs in the community. In addition, CRS is exploring ways to modify the successful CIC program model to provide working professional scientists with opportunities to volunteer to bring their knowledge and enthusiasm about science to classrooms to inspire the next generation of scientists.



CRS

COMMUNITY RESOURCES FOR SCIENCE
practical support for great science teaching

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Detroit Area Pre-College Engineering Program (DAPCEP)



Program Overview:

Since 1976, the Detroit Area Pre-College Engineering Program (DAPCEP) has been preparing and motivating students to pursue higher education and careers in engineering and technology fields. DAPCEP touches the lives of more than 5,000 K-12 students annually, exposing them to challenging activities that enrich traditional academic programs. By participating, students develop networks of peers investigating similar careers, make important contacts with educators and professionals, and receive early acclimation to college life.

Reach/Target Student Population:

DAPCEP's K-12 student population encompasses individuals and families from various cultural and socio-economic backgrounds. Since its inception in 1976, DAPCEP has impacted the lives of more than 150,000 youth. Specifically, the student population has the following demographic profile:

- Primarily African-American and Hispanic;
- 70 percent residents of the City of Detroit;
- 50 percent female; and,
- 30 percent median household income at or below poverty.

Community Partners:

DAPCEP provides educational programming for more than 5,000 students annually in partnership with:

- 40 Detroit Public Schools;
- Eight universities in the State of Michigan
University of Detroit-Mercy, Wayne State University, the University of Michigan and Michigan Technological University;
- Technology-based corporations located in Michigan
Nissan USA, Ford Motor Company, Dow Corning Corporation, Blue Cross Blue Shield of Michigan and EDS; and,
- Community-based Foundations
The Kresge Foundation, The Skillman Foundation, John S. & James L. Knight Foundation and Herbert H. & Grace A. Dow Foundation.

Learning Environment:

Designed to provide students with advanced exposure to science, technology, engineering and math, and improve their scientific and technical literacy, DAPCEP's classroom programs are creative, hands-on and real world. For example, fifth graders build helicopters, parachutes and airplanes as they study the principals of air resistance, pressure and flight. Seventh and eighth graders are introduced to automotive engineering, by designing their own cars to bring to market. And, high school students work to develop viable alternative energy solutions for the cars of tomorrow. Supplementing these experiences are field trips and other projects that bring students into various work environments to witness the STEM fields they are learning about in school.

Program Results Highlights:

Recently, DAPCEP targeted former K-3 students who entered the program in 2000 who are now entering high school. It found that many are excelling in STEM and have identified a STEM career as a viable option. In addition, recently enrolled middle and high school students who had, upon entering the program, not thought about STEM career opportunities, now indicate serious consideration of the fields after a three-month exposure to DAPCEP.

Opportunities for Support/Replication:

A highly replicable program, DAPCEP is currently looking for funding to develop and implement new curricula that address bioengineering, biochemistry, alternative energy and fuel cell technology.



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Developmental Approaches in Science, Health and Technology (DASH) is a comprehensive K–6 program comprised of hundreds of interconnected, developmentally appropriate, hands-on activities that are aligned with national standards. The goal of DASH is to engage students in the excitement of questioning and making sense of things unknown, inventing and building to solve problems, and caring for themselves through their experiences in science, health and technology learning. Program content is sequential and spiraled to promote reinforcing multi-year development of concepts and skills. Students work inside and out of the classroom as a research community, modeling the real-world roles of scientists and technologists with teachers as research-team leaders. Established in 1986, DASH is designed for heterogeneous classrooms and is effective with both genders and diverse ethnic, socio-economic and ability student populations. DASH aligns with National Research Council Standards and American Association for the Advancement of Science Benchmarks and is adaptable to state standards. DASH recognizes teachers' needs for content, skills and pedagogy instruction and requires teacher training.

Over the last 20 years, DASH has trained more than 11,000 teachers, using a cadre of 175 certified trainers in 26 states. The number of students receiving a DASH experience is in the millions. The materials have been designed for all K–6 students in U.S. public/private schools. Student populations have included:

- those in predominantly urban and rural settings;
- high-ability and special-education students;
- high and low socio-economic groups;
- African-American, Hispanic, American Indian, Asiatic and Pacific Islander groups; and,
- males and females.

DASH was originally developed with a consortium of 14 universities. Today, several centers continue to support the program including Carnegie Mellon University, Archdiocese of St. Louis, Shippensburg University and the Curriculum Research & Development Group (CRDG) of the University of Hawai'i.

While some schools use special science classroom environments, typical classrooms are where teachers teach on a daily basis. The classroom transformation occurs in the placement of science-related materials used by the class. For example, the classroom is arranged so that a Learning Calendar (the ongoing continuous log of activities recorded on roll paper), a Responsibility Chart, a Wonder and Discovery Book (record of things yet to be investigated) and Working Dictionary (the dictionary of terms in construction) are posted. Space is provided for ongoing activities, pets and out-of-class growing areas for gardens. There is no materials kit for DASH. Instead, equipment found in most elementary settings is used, including hammers, pliers, screwdrivers, saws, shovels, rakes, hoes, hoses, animal cages, scissors, etc. Other equipment is constructed by the students out of standard classroom supplies—rulers, file cards, paper clips, brads, string, color pens, etc., and collectable materials such as paper plates, coffee cups, wood, plastic bottles, wire coat hangers, jars and the like.

Most recently, the program has been assessed by the Expert Panel on Mathematics and Science Education Promising Practices and identified as one of seven promising programs. Reviewers found that DASH provided evidence from 14 case studies conducted in five states that:

- K-5 students demonstrated an understanding of foundational science concepts and use of essential skills of inquiry, data collection and concept application;
- teachers also showed significant increases in their sense of personal efficacy and their demonstrated capacity to interact with students;

- despite a wide spectrum of socio-economic, ethnic and ability representation, these factors did not detectably differentiate student performance; and,
- there were no differences in performance between males and females.

Opportunities for Support/Replication:

DASH welcomes support from the public and private sectors. Given the program's long history and widespread use, it is highly replicable.



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Engineering Is Elementary



Program Overview:

Founded in August 2003, the Engineering is Elementary (EiE) project aims to foster engineering and technological literacy among children. EiE is creating a research-driven, standards-based and classroom-tested curriculum that integrates engineering and technology concepts and skills with elementary school science topics. EiE lessons not only promote STEM learning, but also connect with literacy and social studies. Storybooks featuring children from a variety of cultures and backgrounds introduce students to an engineering problem. Students are then challenged to solve a similar hands-on engineering design challenge in the classroom. The EiE project also helps elementary school educators enhance their understanding of engineering concepts and pedagogy through professional development workshops and resources.

Reach/Target Student Population:

As of December 2009, the EiE program has reached more than 15,500 elementary school teachers and 1,000,000 students in first through fifth grades and more than 1,300 schools in all 50 states. A core commitment of EiE is ensuring that all students can envision themselves as engineers, with a particular interest paid to reaching those who are “at-risk” and underrepresented in STEM fields.

Community Partners:

EiE uses a model of working with regional partners to deliver the program to local schools and support implementation. These partners include:

- professional development and regional advocacy partners
 - Science Museum of Minnesota, Stevens Institute of Technology, North Carolina State University, University of Cincinnati, Towson University, Purdue University, University of Alabama-Huntsville, Worcester Polytechnic Institute, Sally Ride Academy, Texas Education Service Center-Region XIII, Falcon District 49 in Colorado Springs, and Long Beach Public Schools provide professional development to teachers in their local schools and districts, collect assessment data and serve as local advocates for the EiE program;
 - EiE is in various stages of developing 15-20 new partnerships in states across the nation;
- pre-service teacher education partners
 - more than 10 universities, colleges and community colleges across the United States have incorporated EiE into their pre-service teacher education programs;
- corporate and foundation partners
 - National Science Foundation, Cargill Foundation, Liberty Mutual Foundation, Intel Foundation, Cisco Systems Foundation, the S. D. Bechtel, Jr. Foundation and several others have provided generous financial support; and,
- school district partners
 - scores of school districts, both within Massachusetts and in other states, have adopted Engineering is Elementary in all first through fifth grade classrooms.

Learning Environment:

The EiE curriculum fosters a classroom environment where:

- teamwork is strongly valued;
- students learn that there is no single “correct” solution to an engineering problem;
- failure is part of the process and expected;
- everyone can engineer;
- the sharing of ideas and learning from others is valued; and,
- engineering is both collaborative and sometimes competitive.

Program Results Highlights:

Pre- and post-tests of 7,000 students show that after completing an EiE unit, students demonstrate, a better understanding of:

- the specific kind of tasks that engineers working in a specific field (e.g., environmental engineers) might do for their job;
- engineering involving design and teamwork;
- relevant engineering and technology vocabulary;
- the engineering design process;
- materials, their properties and their uses in engineering design scenarios;
- science content related to the unit;
- how to improve technologies;
- what a process is and how it is a type of technology; and,
- the criteria for judging the effectiveness of a technology.

Teachers overwhelmingly report that the EiE project is particularly engaging and effective with students who are currently underrepresented in STEM. Work is currently underway to analyze students' quantitative assessment by demographic variables.

Opportunities for Support/Replication:

As a program that has been implemented in school districts and communities around the country, EiE is highly replicable. As such, EiE is always looking for new partners (both funding and programming alike) to bring EiE to more elementary school classrooms in the United States.



Engineering is Elementary

Museum of Science

National Center For
Technological Literacy

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Environment as a Context for Opportunities in School (ECOS)



Program Overview:

Established in 2002 in Houston at Baylor College of Medicine, the Environment as a Context for Opportunities in School (ECOS) project responds to the need to improve K-5 science education in schools with high enrollments of minority and economically disadvantaged students. ECOS aims to develop and evaluate a scalable model for integrating science content across the elementary school curriculum using environmental themes that are relevant to students. Specific project objectives are to: (1) collaboratively design, implement and evaluate an instructional program in elementary schools that integrates science, health, reading/language arts and mathematics; (2) improve teacher practice through summer and school-year professional development over multiple years; and, (3) support school-wide reform of teaching and learning. ECOS is funded by the National Institute of Environmental Health Sciences (NIEHS), a component of the National Institutes of Health (NIH). The project builds on previous National Science Foundation-funded teacher professional development programs and curriculum development programs funded by NIEHS and the National Center for Research Resources of the NIH, conducted by the same team at Baylor College of Medicine.

Reach/Target Student Population:

Through 2007, 11 elementary schools, approximately 140 teachers and 3,500 students from the Houston Independent School District participated each school year. The ECOS program is being implemented across all grades K-5 in the participating schools.

The project is aimed at schools with high enrollments of underrepresented minority (African-American and Hispanic) and economically disadvantaged students (based on statistics for free/reduced lunch). For comparison purposes, two schools within the same geographic area with small enrollments of students in these groups also are participating in the program.

Community Partners:

- Houston Independent School District
 - active co-planning with district administrators and assistance in the recruitment of schools;
 - co-planning of project implementation with school principals;
 - direct support by principals from individual school budgets for teacher stipends and classroom materials;
- Harris County Department of Education
 - space for professional development activities and communications with schools; and,
- Texas Education Agency
 - participation of the Assistant Director for Science on project advisory board.

Learning Environment:

Using the ECOS curriculum, students conduct guided-inquiry science activities, work in collaborative groups, read related science content and fiction, use science vocabulary for language arts activities, solve mathematics examples that are related to the science question at hand, and learn to apply science information to personal decision-making and health practices. Each unit is aligned with the state education standards, known as Texas Essential Knowledge and Skills, for science, reading/language arts, mathematics and health. The approach is being implemented in a variety of ways, depending on whether schools consist of self-contained classrooms, have a central shared laboratory and/or have a dedicated science lead teacher. Regardless of whether there is a science lead teacher in the school, individual classroom teachers are involved in teaching each inquiry unit and related activities.

Program Results Highlights:

Student assessments indicate that the project's integrated instructional approach is contributing to the closure of the science achievement gap between underrepresented students and other groups at a rate that exceeds progress in the district or state of Texas. Professional development courses for teachers on each of the ECOS units now are being developed and made available on the Web sites, BioEd Online (www.bioedonline.org) and K8 Science (www.k8science.org).

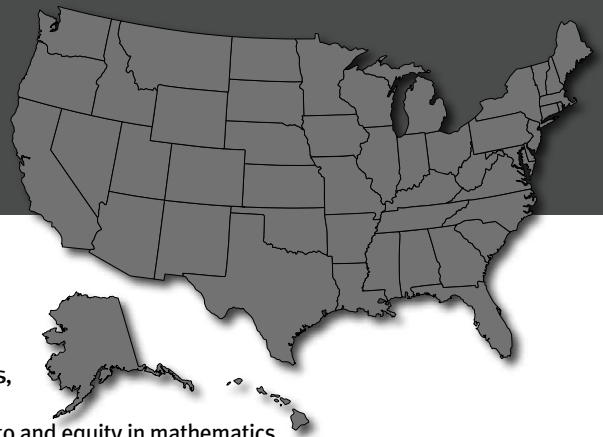
Opportunities for Support/Replication:

Currently, ECOS partners include members of the public-education sector. Support from the private sector is welcomed. ECOS believes its integrated education program provides a model for other schools and school districts. Inquiry lessons used in the ECOS project now can be downloaded free-of-charge from the Web sites, BioEd Online (www.bioedonline.org) and K8 Science (www.k8science.org).



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Program Overview:

Developed by the University of California, Berkeley's Lawrence Hall of Science, EQUALS mission is to improve math education for all students, particularly females, students of color and children from bilingual and low-income families. It offers programs for teachers, counselors, administrators and parents that increase access to and equity in mathematics. EQUALS' innovative Investigation curriculum units and *Get It Together* math puzzles increase students' and teachers' awareness of the role mathematics plays in everyday life. In addition, they build self-confidence in mathematical abilities, improve problem-solving skills and encourage perseverance. Since 1977, hundreds of thousands of educators have participated in EQUALS workshops nationwide helping millions of students achieve success in math.

Reach/Target Student Population:

EQUALS helps all children everywhere experience success in mathematics with a special focus on making math accessible to females, students of color and children from bilingual and low-income families. The program has significant impact nationwide and internationally with teacher training sites in 65 school districts in 34 states and at nine international locations on five continents. In addition to professional development programs, a network comprised of thousands of teachers use EQUALS' curriculum materials in their classrooms, reaching tens of thousands of pre-K-12 students each year.

Community Partners:

The development, testing and evaluation of the EQUALS program have been made possible through the support of private foundations and individuals, as well as educators, school districts and educational researchers.

Learning Environment:

EQUALS programs emphasize cooperative group interaction reflecting a dynamic and active approach to learning and discovery through hands-on activities. The environment is filled with energy and excitement and ongoing interaction between teachers and students. This results in students developing skills ranging from high-level thinking and creative problem solving to project planning and solution communicating.

Program Results Highlights:

EQUALS received a grant from the California Postsecondary Education Commission in 2003 for program assessment by the Researching Equity and Achievement Project. This assessment recently concluded four years of mathematics and equity professional development for teachers of students in kindergarten through eighth grade algebra in the San Leandro Unified School District. Project assessment data show steady growth in teachers' mathematics content knowledge. The district also experienced an increase in their mathematics scores during the length of the project. In particular, Latino students' mathematics scores surpassed both county and state percentages in second, third, fourth, fifth and eighth grade, for students scoring at the proficient and above levels during the project period. African-American student scores in fifth, sixth and eighth grade increased similarly.

Opportunities for Support/Replication:

Given the numerous school districts throughout the U.S. and the world utilizing the EQUALS program, it is highly replicable for other communities.



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Family Math



Program Overview:

Founded in 1981, Family Math and Matematica para la Familia is a series of books and workshops that provides parents, teachers and other adults with the tools to become more effective partners in helping children succeed in mathematics. Developed by the Lawrence Hall of Science at the University of California, Berkeley, Family Math shows all participants that math is understandable and relevant to their lives. It achieves this through hands-on, problem-solving activities that emphasize math concepts. Every activity is designed so that an adult and child can work together on it. The program provides professional development workshops and curriculum materials to parents, teachers and other community members enabling them to establish Family Math programs in their schools and communities.

Reach/Target Student Population:

Family Math is a worldwide phenomenon. From South Africa to New Zealand to Central and South America to the United States, more than five million families are learning and enjoying math together. The program is designed for K-8 students and their families with special emphasis on addressing the needs of traditionally underserved groups. The international scope of the program makes it suitable for families in diverse cultures and socio-economic levels.

Community Partners:

The Family Math program receives support from the U.S. Department of Education, the National Science Foundation and various corporate partners to develop and test the program with families from inner cities, suburbs and rural areas. It also partners with universities, museums, schools and community organizations that provide programming and workshops for families. Recently, Family Math has developed new partnerships that focus on Spanish-speaking communities and other traditionally underserved populations.

Learning Environment:

While Family Math programs take place in varying learning environments (in school, at home or in community gathering places), the approach is the same – energetic, engaging, exciting and hands-on.

Program Results Highlights:

When implemented according to plan (a series of six, one-and-a-half hour classes), Family Math has resulted in:

- increased confidence in math competency for both parents and children, across various ethnic groups and socio-economic backgrounds;
- increased parental involvement in children's schools in Hispanic communities;
- increased awareness and understanding of the role of mathematics in students' education and career choices;
- changes in how teachers perceive poor communities and families served; and,
- improved teacher practice in mathematics teaching (Pedagogical Strategies, Devany, 1988).

Opportunities for Support/Replication:

Given its extensive usage, Family Math has been demonstrated to be a program that is highly replicable for communities large and small.



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Full Option Science System (FOSS)



Program Overview:

Founded in 1986, the Full Option Science System (FOSS) was created to address the concern that young students were not being provided with an adequate science education. FOSS is a K-8 program developed by the Lawrence Hall of Science at the University of California, Berkeley, under three separate National Science Foundation grants. Originally developed and trial-tested in urban and suburban San Francisco Bay area school districts, today FOSS is used in every state in the country. FOSS materials are designed to provide meaningful science education for students in diverse American classrooms, preparing them for life in the 21st century. There are 26 K-6 modules and nine for middle school grades. Each module includes student materials, a teacher guide, a module-specific teacher preparation video, a student reading book and a web site. Delta Education is the publishing partner and works with the Lawrence Hall of Science to provide professional development for teachers.

Reach/Target Student Population:

FOSS is used in every state in the country with more than 100,000 teachers and two million students participating and is in approximately 16 percent of the nation's school districts. The target population is all K-8 students and teachers, particularly those who do not have a strong science background.

Community Partners:

FOSS was developed through a rich collaboration of scientists, educational researchers, curriculum developers, assessment specialists, teachers, administrators, community members and parents. Partners include SRI International, WestEd, National Science Teachers Association, National Science Resources Center, Center for Applied Special Technology, TERC, the Boulder Language Technologies and many universities, colleges and school districts.

Learning Environment:

Typical of an activity-based, hands-on approach to science, the FOSS classroom environment is collaborative, energetic and filled with the excitement of learning and discovery. FOSS investigations are guided by questions. In pursuing answers, students usually start with free exploration of materials, followed by a discussion of their discoveries. The students work in teams to investigate, experiment, gather data, organize results and develop conclusions.

Program Results Highlights:

FOSS is on 20 states' curriculum adoption lists, and is used in 50 of the 100 largest U.S. school districts. WestEd is currently conducting a four-year efficacy study using FOSS modules with fourth-grade students under a Department of Education grant. Those results will be available in 2011. However, there have been many state and city assessments that underscore the impact of FOSS on underrepresented students. For example:

- in Fresno, Calif.
 - students who participated in FOSS outperformed students receiving traditional science education in the same district;
 - an increase in the number of years in the FOSS program correlated with an increase in standardized test scores in both science and reading;
- in Philadelphia, Pa.
 - students from three middle schools using FOSS were followed from fourth to seventh grade and compared to students in matched control schools;
 - standardized test scores were higher for FOSS students with the size of the gain correlating with the number of years in the program; and,
- in Rhode Island
 - a study of 399 fifth graders indicated that students receiving FOSS instruction scored significantly higher than students receiving traditional forms of instruction, even though there were more minutes of science instruction in the traditional classroom.

Opportunities for Support/Replication:

FOSS welcomes support from the public and private sector as it continues its work. Given the program's long and successful history, FOSS is a curriculum that easily can be adopted at the state, city or district level.



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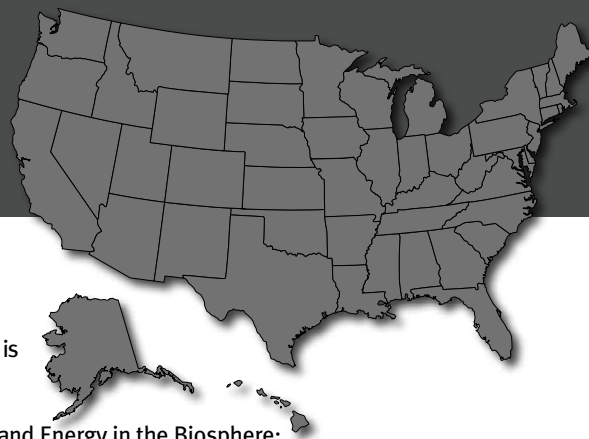
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Foundational Approaches in Science Teaching (FAST)



Program Overview:

Founded in September 1966, Foundational Approaches in Science Teaching (FAST) is a three-year inquiry program providing hands-on activities for intermediate and middle school students in sixth through eighth grade. It is comprised of three one-year sequential courses, including: FAST 1, The Local Environment; FAST 2, Matter and Energy in the Biosphere; and, FAST 3, Change Over Time. The goal is to develop a scientifically literate student who has the background necessary for understanding concerns arising in our technological society and the foundational tools for further study in science. FAST is designed for the heterogeneous classroom and has been found to be effective with both genders and diverse ethnic, socio-economic and ability student populations. FAST is aligned with National Research Council Standards and American Association for the Advancement of Science Benchmarks and adjustable to state standards. FAST recognizes teachers' needs for content, skills, and pedagogy instruction and requires teacher training.

Reach/Target Student Population:

In nearly 40 years, the FAST program has trained more than 5,000 teachers, using a cadre of 75 certified instructors in 36 states and 10 foreign countries. The number of students receiving a FAST experience is in the millions. The materials have been designed for all students in U.S. middle and intermediate schools. Student populations have included:

- those in predominantly urban and rural settings;
- high-ability and special-education students;
- high and low socio-economic groups;
- African-American, Hispanic, American Indian, Asiatic and Pacific Islander groups; and,
- males and females.

Community Partners:

FAST, with the help of the National Diffusion Network, developed a collaborative group of 14 universities. Today, three centers continue to support the program: Carnegie Mellon University, Archdiocese of St. Louis and the Curriculum Research & Development Group (CRDG) of the University of Hawaii.

Learning Environment:

The classroom environment usually is a standard middle or intermediate school laboratory with access to a field study area. The FAST program supplies the following materials, including:

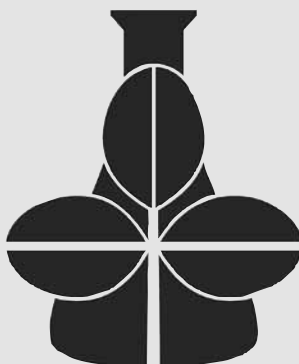
- three student books of sequenced inquiries, one for each grade level;
- three companion reference libraries of monographs detailing laboratory and field techniques;
- printed student data sheets to standardize data collection;
- an instructional guide explaining the program's pedagogy;
- a teacher guide detailing the approach to each inquiry, the vocabulary introduced, materials needed, procedures to be used, debriefing questions and special instructions for equipment building;
- an evaluation guide with performance and multiple-choice tests, as well as a student self-assessment Concept-and-Skill Inventory. The latter instrument is jointly used by the teacher and students to assess the students' perceptions of their degree of mastery of the major concepts and skills of the program; and,
- visual aid masters to be used with in-class discussions.

Program Results Highlights:

Recently the FAST program was assessed by the Expert Panel on Mathematics and Science Education Promising Practices and identified as one of two exemplary programs (2002). Reviewers found convincing evidence across numerous implementation sites to conclude that FAST has a positive impact on student learning.

Opportunities for Support/Replication:

FAST welcomes support from the public and private sectors. Given the program's long history and widespread use both nationally and internationally, it is highly replicable.



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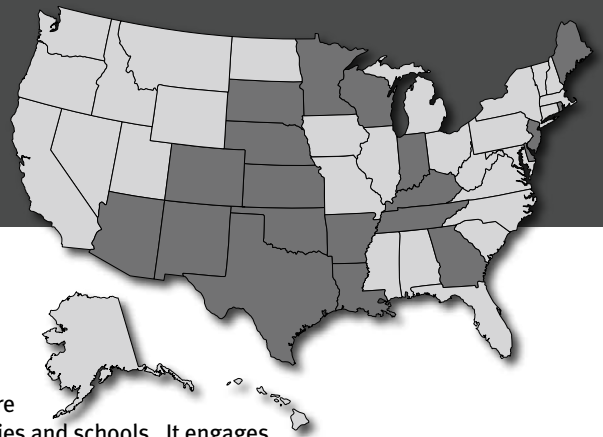
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Future Scientists: Sowing the Seeds for Success



Program Overview:

Founded in 2004, the Future Scientists: Sowing the Seeds for Success program is designed to inspire students to continue their studies in science. It develops a collaborative research community between United States Department of Agriculture (USDA)/Agricultural Research Service (ARS) laboratories and their local communities and schools. It engages fourth through 12th grade teachers and students in hands-on, inquiry-based activities that are linked to current USDA/ARS research and adhere to the *National Science Education Standards*. The activities allow teachers, students and their parents to participate directly in cutting-edge research on an insect called the corn earworm. This pest, found all over the country, causes more than one billion dollars worth of damage and control expenses annually.

Reach/Target Student Population:

In the last three years, nearly 800 teachers and 66,620 students have participated in various Future Scientists programs at USDA/ARS laboratories in 20 states, including Arizona, New Mexico, Oklahoma, Texas, Arkansas, Colorado, Georgia, Indiana, Kansas, Kentucky, Louisiana, Maine, Minnesota, Missouri, Nebraska, New Jersey, Rhode Island, South Dakota, Tennessee and Wisconsin. The ethnic make-up of participating students is largely determined by the geographic location of the participating USDA/ARS labs. Over the last three years, the make-up has been 42 percent Hispanic, 12 percent African-American and 46 percent Caucasian.

Community Partners:

Future Scientists have partners at the national, state and local levels. For example:

- USDA/Hispanic Serving Institutions National Program funds salaried staff in the program out of Washington, D.C. but seeks grant funding for operating costs;
- USDA/ARS/Southern Plains Area-wide Pest Management Research Unit in College Station, TX, bears all costs and employs a technician to take care of shipping worm orders to schools and maintaining the reproductive colony of the insects;
- USDA/ARS labs in Arkansas, Arizona, California, New Mexico, Oklahoma and Texas have scientists who participate and have opened their facilities to teachers;
- over the next five years, the program plans to expand to Arizona and California (2009); Florida and Puerto Rico (2010); New York State (2011); Illinois (2012); and, Colorado (2013);
- Texas A&M College of Science's Center for Mathematics and Science Education provides logistical and office support and houses the co-principal investigators; and,
- School districts, science supervisors and science teachers annually commit to the yearlong projects, allowing program staff to work in the school and supporting release time for teachers to take 4-5 students to the Student Research Presentation Day at the end of the school year.

Learning Environment:

The learning environment is an exciting one. Students make daily observations of the insect's life cycle. Then, they design an experiment to help find new ways to control the insect's damage to crops. The classroom extends to the outdoors with students growing their own corn crop to study and experiment and into the scientific community with connections to the local USDA/ARS lab and its scientists and other resources. Finally, a bilingual book "Frankie the Free-Tailed Bat," is given free to students. The book integrates the subjects of science, language arts and social studies, while introducing students to the concepts of food chains and environmental issues as bats are voracious predators of the corn earworm moths and other insects.

Program Results Highlights:

Qualitatively, Future Scientists has received countless letters from teachers and students. Invariably, teachers comment on increased student interest in science, improved observation and research skills; and are grateful for the yearlong support and access to the scientists. Students overwhelmingly mention that they are actually "doing" science. Quantitatively, a recent assessment of Beaumont, Texas, fifth graders found students' average Texas Assessment of Knowledge and Skills (TAKS) science test scores increased from 74 percent to 80 percent in one year. These new scores put them nearly 10 percent above the state average on this test.

Opportunities for Support/Replication:

The Future Scientists program is looking for public- and private-sector support to help offset operating costs and develop other research activities that complement the corn earworm studies and align with USDA/ARS laboratory locations.



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Gateway Institute for Pre-College Education



Program Overview:

The Gateway Institute for Pre-College Education was established in New York City in 1986 to address the underrepresentation of minority students in medical schools and science- and mathematics-based careers. Gateway has established learning communities with 14 New York City public-high schools and also has partnered to create three of its own high schools. The interdisciplinary enriched curriculum prepares students for college with experiences and internships in medicine, engineering and other science-related fields. Gateway provides thousands of low-income and minority students the opportunity to prepare for college and careers. Based at the City University of New York, the Gateway program maximizes student achievement by:

- organizing student cohorts and teacher teams that work together in a planned four-year high school experience that features reduced class size and an extended instructional day and year to facilitate a rigorous interdisciplinary curriculum;
- designing and implementing support services that are managed by the teacher team to maximize student achievement and success;
- providing appropriate professional development for teachers;
- exposing students to many educational and cultural opportunities, both inside and outside the classroom, through enrichment programs offered by teachers and partners including universities, museums, hospitals, research laboratories, corporations and other institutions; and,
- offering early college and career planning to help students identify summer placement and internship opportunities.

Reach/Target Student Population:

Currently, 14 New York City public high schools have Gateway programs and there are three Gateway small schools (Queens Gateway to Health Sciences Secondary School, S.T.A.R. High School at Erasmus in partnership with Brooklyn College and Gateway High School for Environmental Research and Technology). Two years ago, Gateway launched a program at the John D. O'Bryant School in Boston in partnership with more than twenty research centers, hospitals and colleges. In total, Gateway works with more than 3,000 sixth-through 12th-grade students and 200 teachers. Gateway students are Hispanic (23 percent), African-American (60 percent), Asian (12 percent) and other (5 percent).

Community Partners:

Partners include:

- New York City Department of Education that provides access to schools, funding at the school sites;
- City University of New York which provides resources in implementing programs;
- Science Entry and Technology Program (STEP) funded by New York State Legislature which provides funding for school services and supplies not provided by New York City Department of Education;
- Medical schools which provide placements for students, visits to facilities and support for teachers;
- Public hospital system which provides placements for students;
- Private industry/corporations which provide funding and placements for students;
- Colleges and research institutions which provide placements for students;
- More than 3,000 alumni who provide resources for current students and serve as mentors; and,
- American Medical Association and the American Hospital Association which recently have added their support to help establish Gateway programs across the country.

Learning Environment:

Gateway creates programs with reduced class sizes (25 students versus 32) in science, mathematics and communication skills. In addition, it works with schools to add enrichment program opportunities through partner organizations and to increase the number of laboratory sessions. For example, Gateway was the first organization to introduce molecular biology in the form of installation of DNA laboratories, including PCR machines, at all its participating high schools.

Program Results Highlights:

The success of Gateway is measurable, with more than 90 percent of ninth-graders continuing through graduation; more than half of Gateway's graduates are female. In addition, Gateway has followed 80 percent of its high school graduates and 75 percent of those graduates have completed college in four or five years. Out of the nine 2009 graduating classes in Gateway schools and programs, Gateway students were valedictorians and salutatorians in eight. Gateway students have a strong legacy of attracting scholarship funding and recognition, including four who received full four-year tuition scholarships from the Posse Foundation and Questbridge. Recently, Gateway selected 100 alumni who are 10-years post-high school for a survey and found that 97 percent had completed college and more than two-thirds had entered graduate school and are working in a variety of STEM or teaching professions.

Opportunities for Replication:

Having begun in one New York City high school in 1986 and expanded to 17 city schools today, the Gateway program is highly replicable. Gateway welcomes public and private support, and student internship opportunities from corporations and other organizations, as well as scientist-mentor volunteers who can work with its students. In addition, Gateway continues to develop new initiatives to further enhance opportunities for students. Two of the most significant are:

- An extended-pipeline program, with planning support from the New York State Department of Health, which will provide students with five years of activities that prepare them for medical school – two years during high school and three years during college and the medical school application process. Initially, three medical schools are participating and each will accept 20 students per year.
- Gateway is in discussions with four other cities about starting their own programs.



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Great Explorations in Math and Science (GEMS)



Program Overview:

Established in 1984, Great Explorations in Math and Science (GEMS) is a leading resource for innovative science and math education. Developed at the Lawrence Hall of Science, the public science center at the University of California, Berkeley, today there are more than 70 GEMS Teachers Guides and Handbooks offering a wide range of supplemental-learning experiences for pre-school through the eighth grade. GEMS activities engage students in direct experience and experimentation, introducing essential, standards-based principles and concepts. Clear step-by-step instructions enable all teachers to successfully present the activities. GEMS units offer effective, practical, economical and schedule-friendly ways to provide high-quality science and math learning to all students in thousands of classrooms nationwide.

Reach/Target Student Population:

GEMS is designed to improve learning for *all* students – to reach the widest and most diverse section of students (and teachers) possible. It is estimated that over the past 25 years, more than 800,000 teachers and at least 12 million students have experienced GEMS activities. Many GEMS units reflect contributions of diverse cultures – content, language and graphics are considered with attention to multicultural and gender equity issues. In addition, the guides include photographs depicting a high proportion of girls and young women taking active roles, as well as a high representation of African-American, Hispanics, American Indians and other non-white students. Currently, there are 65 GEMS sites and centers in 33 states, most affiliated with state and local school districts, colleges and universities, and public science centers. In addition to the program's nationwide presence, there are now eight international GEMS centers.

Community Partners:

Initial support for the origination and publication of the GEMS series was provided by the A.W. Mellon Foundation and the Carnegie Corporation of New York. Under a grant from the National Science Foundation, GEMS Leaders workshops have been held across the United States. GEMS also has received support from the Employees Community Fund of Boeing California and the Boeing Corporation; Chevron USA; the Crail-Johnson Foundation; the Hewlett-Packard Company; the William K. Holt Foundation; Join Hands, the Health and Safety Educational Alliance; the McConnell Foundation; the McDonnell-Douglas Foundation and the McDonnell-Douglas Employee's Community Fund; the Microscopy Society of America; the NASA Office of Space Science's Sun-Earth Connection Education Forum; the NASA Swift Mission; the Shell Oil Company Foundation; and, the University of California Office of the President. GEMS also received an early contribution of computers from Apple Computer, Inc.

Learning Environment:

A GEMS learning environment is a dynamic one, characterized by interactivity, discussion, experimentation and team-based problem solving. GEMS activities lend themselves to a variety of formats – the curriculum can be presented in full during a concentrated period of time or can be integrated into other subject areas over a period of time. Teachers appreciate knowing that they can adapt materials to fit within their broader curriculum mandate and the time constraints they face. Additionally, GEMS encourages team teaching, the exploration of multidisciplinary links and the inclusion of parents as active participants in the learning process.

Program Results Highlights:

From its inception, GEMS has been involved in a number of collaborative projects that require formal program evaluations. Many of these evaluations have found that the GEMS program:

- makes a significant and measurable difference in and impact on students' learning;
- has the demonstrated capability of reaching all students, including historically underrepresented groups, and special-education and gifted students, in a wide variety of settings and regions; and,
- fosters positive attitudes and motivation of students and teachers in science and mathematics.

In addition, GEMS was evaluated by the United States Department of Education's Mathematics and Science Education Expert Panel and found to be a "Promising Program."

Opportunities for Support/Replication:

Given GEMS long history and vast reach, it is a highly replicable program.



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Girl Game Company



Program Overview:

Founded in 2003, the Girl Game Company (GGC) aims to increase the interest, capacity and motivation of girls to pursue courses and careers in information technology (IT). Its middle school-aged participants design and program computer games with a partner; publish and receive feedback on the games in a virtual community; and, engage in field trips to technology companies and e-mentoring programs to learn about college and career opportunities. Students meet twice a week after school, and for two to three weeks during the summer. The long-term goal is to increase diversity in the STEM workforce, with a focus on girls and Latinas. Short-term goals include increasing IT fluency, increasing the appeal of educational pathways to IT careers and building a network of support to pursue computing. To date, more than 200 games have been produced, and the best ones have been posted in the virtual GGC clubhouse on www.whyville.net.

As of September 2009, Girl Game Company is part of a broader community capacity building initiative focused on college and career pathways of rural, Latino youth. This initiative, Watsonville Tecnología-Educación-Comunidad (WatsonvilleTEC), is a collaborative of organizations and programs providing informal learning opportunities designed to build an IT career pathway from fifth grade through 12th grade. This initiative includes a parent leadership and capacity building effort.

Reach/Target Student Population:

GGC currently serves students and families in the county of Santa Cruz, Calif. The students are drawn primarily from three middle schools. To date, 276 girls and their families (80 percent Latina) have been involved.

Community Partners:

GGC partners with schools, school districts and industry partners to deliver its program. For example:

- school partners, coordinated through the Pájaro Valley Unified School District's (PVUSD) Extended Learning Program (ELP), recruit participants and provide access to computer labs, educators for the program and the use of school facilities for program events;
- district partners provide technical support, a family liaison and input on program development and sustainability; and,
- technology companies, including Google Inc., Cisco Systems Inc., Apple Inc., Electronic Arts and Three Rings provide in-kind support by hosting field trips, providing virtual mentors for the girls and consulting on resource development.

Learning Environment:

GGC creates an environment where girls work in teams, share and present their work for feedback and where independent problem solving and intrepid exploration are part of the culture. The strategies for developing students' IT fluency, while increasing girls' tech savvy identity, include:

- leveraging existing interests in IT;
- teaching computer game programming;
- supporting independent problem solving;
- promoting effective pair programming;
- building cultural connections; and,
- challenging negative stereotypes about IT jobs.

Program Results Highlights:

Data is collected from participants throughout the program, and suggest that the program can increase the extent to which girls value computing, as well as their expectations for success with computing. An independent evaluation using surveys of 59 participants to date found significant increases in frequency of computer use, computer skills, confidence with computers, attitude toward computers and

computing careers, and perceived parental support after a minimum of 50 hours of participation. Qualitative data collected over time suggest an increase in the number of computing-related career goals, and fewer negative stereotypes about computer scientists. And an analysis of 96 games shows that computer game programming is a promising approach to engage girls in the concepts and capabilities that will prepare them for computer science courses and careers, although what they learn varies greatly depending on the game genre. In addition, surveys of 126 girls who completed a semester-long version of the GGC program suggest that compared to a control group, participants increased their computer skills, knowledge about computers, and perceived social support, and they decreased their negative stereotypes about girls and IT workers.

Opportunities for Support/Replication:

The WatsonvilleTEC initiative needs financial, volunteer and in-kind support to maintain its programs within the Pájaro Valley Unified School District (PVUSD) and to replicate the program model in additional communities. Funding could be used to sustain or expand:

- the GGC middle school program;
- the Tech Teach program in which high school students build the IT literacy of fifth graders;
- Tech support at participating computer labs;
- staffing for the parent leadership effort;
- staffing to further develop “Puente” – WatsonvilleTEC’s online learning community that runs on Moodle learning management system software; and,
- the GGC virtual reality site in Whyville.net, an online resource center for students and teachers.

Support in the form of volunteers, technical assistance, in-kind donations and funding could provide:

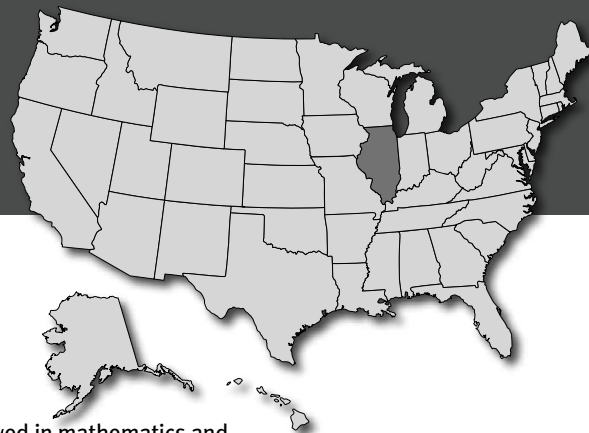
- adult IT industry professionals to serve as e-mentors for youth;
- a mobile technology lab;
- new applications and online learning activities to enhance the Puente online learning community; and,
- the resources to turn the prototype GGC Game Design Studio in Whyville into a fully-functioning online, collaborative digital game-building laboratory.



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Illinois Math and Science Academy (IMSA) Excellence 2000+ (E2K+)



Program Overview:

The Illinois Math and Science Academy (IMSA) Excellence 2000+ (E2K+) outreach program offers after-school enrichment for late elementary and middle school students who are talented, interested and motivated in mathematics and science, placing special emphasis on students historically underrepresented and underserved in mathematics and science. By design, the E2K+ curriculum exemplifies IMSA's core expertise which centers upon competency-driven learning experiences that are inquiry-based, problem-centered and integrative. The program serves primarily as a professional-development program for the mathematics and science teachers who deliver program curriculum to students in the after-school program. Participating schools are provided not only with curricular materials, but also with a kit of lab materials for hands-on, minds-on activities for two units per school year. E2K+ teachers acquire knowledge and skills that transfer into their regular classrooms and benefit all students. Ongoing site visits and support, and sessions for principals and parents are also provided to ensure success.

Reach/Target Student Population:

E2K+ has served more than 6,700 students since piloting the program in 2000. For the 2009-2010 school year, E2K+ is working with 176 teachers and 1,710 students with 74 programs in 61 Illinois schools. In helping to increase access to programming for students who are historically underrepresented in mathematics and science and for all areas of the state, when reviewing applications, preference is given to schools that serve African-American and Hispanic populations, as well as schools in rural areas.

Community Partners:

The IMSA E2K+ program has enjoyed the support of a number of community partners. In addition, participating schools and administrators are given materials and training to assist them in building program sustainability by promoting and encouraging community support. Funding partners have included: the Harris Family Foundation, the Pritzker Foundation, the Chicago Community Trust, the Lloyd A. Fry Foundation, Underwriters Laboratories, Ameren and ComEd, an Exelon Company. A partnership was created with Lincoln Land Community College and Springfield District 186 to serve as teacher training sites for central Illinois participants. Finally, individual sites have received support from a variety of community partners, including state senators, county health departments and local businesses, as well as school boards and parent organizations.

Learning Environment:

The learning experiences in the IMSA E2K+ program focus on helping students “learn how to learn” and emphasize logic, mathematical thinking and experimental-scientific thinking. Topics relate to the students’ lives, arousing their curiosity and increasing their motivation to study different phenomena and problems and their causes and solutions. Instructional approaches emphasize student-driven, engaged learning that integrates mathematics, science and technology.

Program Results Highlights:

The most recent annual E2K+ evaluation surveyed participating students, parents, teachers and administrators from schools, and focused on the program’s integrity and impact in relation to its stated goals. It found that the program is effectively implemented across sites, exceeding administrator’s vision for their schools, as well as parents’ and students’ expectations. Participants consistently praise both the support offered to teachers and sites by IMSA staff, and the quality and effectiveness of the professional development. In addition, teachers, coordinators and administrators note changes in students’ skills related to making connections, questioning, collaborating and problem solving. Students request even more hands-on activities and more field trips, as well as the opportunity to suggest future activities and lessons. Finally, a longitudinal study of high school students who had participated in the E2K+ program shows that a significant majority of them retained an interest in both mathematics and science that was higher than the national average. This high school transcript study also shows that most of our former students have enrolled in at least one advanced course in their freshman and sophomore years in high school, (60 percent in advanced math courses; 83 percent in advanced science courses) with strong performance in those courses (average grade 85 percent in math; 89 percent in science).

Opportunities for Support/Replication:

IMSA and its E2K+ program welcomes and needs outside support, including new opportunities for hands-on student experiences. As the program has grown to include more and more schools and school districts throughout Illinois, the program is one that lends itself easily to replication.



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JETS (Junior Engineering Technical Society)



Program Overview:

Established in 1950, JETS (Junior Engineering Technical Society) is the leading nonprofit educational organization dedicated to promoting engineering and technology careers to America's youth. From creating the only student assessment tool strictly for engineering to developing top competitions that paint a real-world picture of the profession, JETS' successful ventures have provided multiple pathways for students to discover their potential for engineering. Specifically, JETS' major program components include:

EXPLORE

- The Pre-Engineering Times, a free monthly e-newsletter highlighting exciting, real-world experiences and people in engineering;
- Explore magazine, JETS' newest publication that helps students discover engineering;
- Jets.org/explore, the ultimate online resource covering more than 20 careers in engineering;

ASSESS

- PathAssess™: an online tool showing students how their unique interests and skills can align with certain majors and careers in engineering;

EXPERIENCE

- TEAMS, a written competition for students highlighting the “Grand Challenges” identified by the National Academy of Engineering;
- National Engineering Design Challenge (NEDC), a hands-on design challenge in which students make a direct impact in their community by improving the lives of people with disabilities; and,
- UNITE, a summer program designed to prepare and motivate minority students for success in engineering through advanced academic classes.

Reach/Target Student Population:

JETS' programs directly impact a national audience of more than 40,000 students and 10,000 educators in 6,000 high schools each year. JETS' reach is extended to more than 200,000 students through the distribution of its career exploration materials and free electronic newsletter. JETS' participants are a diverse group – more than 50 percent are from groups that are traditionally underrepresented in the engineering and technology fields, including one-third who are female.

Community Partners:

JETS' partners play a valuable role in leading to the success of its programs. Partners include:

- teachers who volunteer as coaches for TEAMS and NEDC;
- school counselors who use and distribute “Explore” materials;
- universities and colleges which host the TEAMS competition, purchase career resources, utilize the assessment tool and support pre-college engineering education by becoming JETS' affiliates;
- professional societies which provide discipline-specific content for career information and JETS' e-newsletter, work collaboratively on outreach projects, coordinate TEAMS competitions, serve as engineering advisors and become JETS' affiliates; and,
- corporations which provide support for area TEAMS competitions, offer employee-volunteers as engineering mentors before and during competitions, distribute JETS' materials at local school career fairs and support JETS as a national program.

Learning Environment:

The study of science is a form of discovery, trial and error, and evaluation. With JETS' programs, students and teachers are encouraged to examine creative approaches for problem solving. For instance, to advance in the NEDC, the team must follow and apply the Engineering

Design Process. Students must discover and identify a problem, research it, identify possible solutions, evaluate and assess their solutions, and defend the final prototype to a panel of experts. This entire process gives students a chance to participate in a tangible, cross-curricular learning experience. JETS' hands-on activities provided in each issue of Pre-Engineering Times also give teachers the chance to conduct quick classroom, science-based activities, such as Make a Thermometer, Land and Sea Breezes, Seltzer Tablet Rocket, Make Your Own Soda Pop and Build a Bacterial Terrarium. The TEAMS competition most often places students on college and university campuses presenting them with a firsthand view of the campus, and engineering and technology programs. Students and teachers are frequently given tours of the campus, a chance to speak with university faculty and department professors and are provided with academic program information.

Program Results Highlights:

JETS is an essential factor in cultivating the future scientific and engineering community. No other educational program has a history dedicated to and focused on increasing awareness of and interest in engineering majors and careers. Program impact and success is seen in student confidence to pursue engineering and their understanding of the profession. In addition, JETS coordinates programs designed to remove social barriers and negative attitudes about engineering. In recent evaluations of students and teachers, JETS uncovered that:

- 88 percent of students report an increase in their ability to participate in engineering projects and activities;
- 81 percent of students report an increase in their ability to succeed in engineering;
- 81 percent of students agree that engineers work with other people to solve problems;
- 92 percent of students agree that engineers work on things that can make a change in the real world;
- 81 percent of teachers report JETS competitions are a good way to get students interested in engineering;
- 88 percent of teachers report an increase in student knowledge about engineering; and,
- 89 percent of teachers report an increased student interest in pursuing an engineering career.

Opportunities for Support/Replication:

JETS welcomes financial contributions at the national and local level for its programs. In addition, its programs need scientist-mentor volunteers who can work with students as advisors, serve as judges for competitions and participate in career days/fairs.

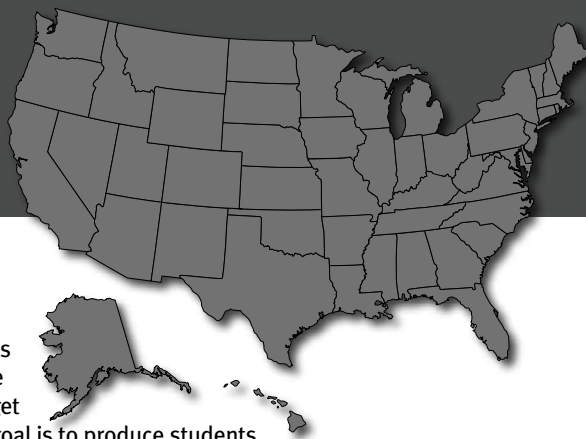
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Kinetic City



Program Overview:

Kinetic City is an innovative, award-winning series of after-school learning programs produced by the American Association for the Advancement of Science (AAAS). The mission of Kinetic City is to reach students who may have little interest in science, get them excited about it and engage them in standards-based learning activities. The goal is to produce students who are science literate and “ready to learn” in school. Programs include:

- *Kinetic City: Mission to Vearth* - In this program, children race to save the virtual Earth, or Vearth, from science-destroying computer viruses. It combines online computer-based games and simulations with hands-on science activities, physical education challenges, art projects and creative-writing activities. As they complete their missions, students keep research journals, score points in their online account and receive collectible trading cards. *Kinetic City: Mission to Vearth* won the Codie Award for Best Elementary Education program.
- *Kinetic City Science Gym* - This eight-week program combines standards-based science, health and physical education content, teaching children about the human body, nutrition and exercise. Science Gym consists of a large duffle bag with all the materials needed to guide a group of 24 children in a series of eight activities, including: *Feel The Burn*, in which children learn the caloric content of 50 food items and the exercise required to burn off each one; *Respiration Relay*, in which children become red blood cells, racing to supply oxygen to active muscle cells; *Germ Tag*, in which children become immune cells, protecting the body from infection; and, *Fitness Factor*, where students pair up to complete an eight-week exercise program and chart the results in their journals.
- *Kinetic City Super Crew* - Featuring a 13-volume book series and a 95-episode radio show, *Kinetic City Super Crew* is a science drama based on the adventures of a team of teenagers and their chatty supercomputer, Alec, who travel the world about a high-tech super train, thwarting villains, helping their friends and solving science mysteries.
- *Kinetic City Spark Club* (Spring 2010) - This new, eight-week after-school program teaches students about energy sources and culminates in a team project in which children work with engineering college students to complete a community energy-demonstration project.

Reach/Target Student Population:

Kinetic City’s target population is upper elementary and middle school students, ages nine-to-12 years old, participating outside of regular school hours at community learning centers, school-based programs, Boys and Girls Clubs, YMCAs and other out-of-school venues. More than 31,000 students currently participate in Kinetic City as registered users. Approximately 1,500 of those are participating through official Kinetic City After School Clubs at 50 sites around the country. Hispanic and African-American students comprise a large portion (more than half) of Kinetic City’s members.

Community Partners:

Kinetic City is currently working primarily with partners in Washington, D.C., including:

- a consortium of 11 public charter schools and other D.C. schools, who participate in the *Kinetic City Spark Club* program through a grant from the National Science Foundation; and,
- 16 sites at D.C. schools that participate in *Kinetic City Science Gym* through a grant from the Washington, D.C. Office of the State Superintendent of Education.

Learning Environment:

Different Kinetic City programs offer different learning environments. In *Kinetic City: Mission to Vearth*, children divide into five teams and rotate through five different stations, each employing a different educational style. These include *MindGames*, which are computer games and simulations, *Move Crews*, which are physical games, *Fab Labs*, which are hands-on activities, *Write Aways*, which are creative-writing challenges and *Smart Art*, which are arts-based science activities. This environment lets students participate in different ways, and gives them all opportunities to shine. *Science Gym* is primarily a physical education program and takes place in a gym or on a playground. *Spark Club* is a combination of indoor, tabletop explorations and actual work outdoors in a community park or other location.

Program Results Highlights:

Edumetrics evaluated *Kinetic City: Mission to Vearth* in 2005 during implementation among students in the poorest sections of Washington, D.C. Most of the students participating were African-American or Hispanic. It found that:

- students showed substantial gains in knowledge of standards-based science content;
- girls and members of minority groups improved in all categories just the same as boys and students who were not members of minority groups; and,
- students made substantial improvements in language arts skills.

Spark Club is now part of an evaluation, which will be complete in late 2010.

Opportunities for Support/Replication:

The Kinetic City programs were developed with grant support from the National Science Foundation and the AAAS. We are now looking for support to offer the programs regionally or nationally.



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Marine Activities, Resources and Education (MARE)



Program Overview:

Founded in 1991, Marine Activities, Resources and Education (MARE) is a dynamic, K–8, inquiry-based science program that transforms entire elementary and middle schools into laboratories for ocean exploration. This whole school Ocean Immersion approach explores different marine environments through the disciplines of earth, life and physical science, as well as language arts, music, mathematics and visual arts. MARE teacher professional development and curriculum focus on the integration of literacy with science. MARE is a program of the Lawrence Hall of Science at the University of California, Berkeley.

Reach/Target Student Population:

MARE curriculum focuses on K-8 students. It is designed specifically to address the needs of English language learners and other under-represented students. MARE has been used in more than 600 schools by more than 15,000 teachers and more than 300,000 students throughout the United States and Mexico.

Community Partners:

The MARE program is administered throughout the United States and Japan by the Lawrence Hall of Science at the University of California, Berkeley, as well as through five regional MARE Centers, including:

- Institute of Marine and Coastal Sciences, Rutgers University, NJ;
- Marine Science Institute, University of Texas;
- Oregon Institute of Marine Biology, Oregon;
- Marine Learning Center, Okinawa, Japan; and,
- Scripps Institution of Oceanography, California.

Funding partners include the National Science Foundation and the National Oceanic and Atmospheric Administration.

Learning Environment:

The K-8 MARE curriculum focuses each grade on a different aquatic habitat. Primary grades focus on nearshore, more familiar habitats (pond, rocky seashore, sandy beach and wetlands). As students progress to their upper elementary years, they explore offshore marine habitats that are more conceptually abstract (kelp forest, open ocean and islands). Finally, middle school students explore coral reefs and the polar seas. The curriculum addresses standards in earth, physical and life science, as well as inquiry (“investigation and experimentation” in California), language arts, environmental issues, art and music.

Program Results Highlights:

MARE evaluation reports over the last 15 years document that the program is effective in:

- promoting science learning and second language acquisition among English language learners;
- improving school climate and culture;
- increasing teacher collaboration and collegiality; and,
- increasing parent involvement in the academic life of their children and their children’s school.

In 1995, MARE was selected as one of the 50 most promising science and mathematics education programs in the country by the Eisenhower Regional Consortia, U.S. Department of Education and the Office of Educational Research and Improvement. In 1999, MARE was selected as one of 38 “Ideas That Work in Science Professional Development” by the Eisenhower National Clearinghouse.

Opportunities for Support/Replication:

Trying new approaches and program elements helps keep MARE ever responsive to the needs of schools. MARE is looking for new collaborations, partnerships and grants that will help expand the reach of this highly successful and replicable program. For example, MARE is the lead institution for the Center for Ocean Sciences Excellence Education (COSEE) in California that is leading the international Ocean Literacy Campaign; developing and disseminating college courses that help undergraduate and graduate students to communicate with the public about their passion for ocean sciences; and, developing new technology-based tools for teaching ocean sciences in the 21st century.



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Math Out of the Box®



Program Overview:

Established in December 2001 by the College of Engineering and Science at Clemson University, Math Out of the Box is a K-5 research and development project that includes a mathematics curriculum and a companion professional development program for teachers. The curriculum is designed in four vertical strands, including Developing Algebraic Thinking, Developing Geometric Logic, Developing Measurement Benchmarks and Developing Number Concepts. Together the four strands provide a comprehensive, connected mathematics curriculum program that is designed to support the mathematical development of all students, the professional development of teachers and the development of the larger school community.

Reach/Target Student Population:

Math Out of the Box is designed for all K-5 elementary school students and teachers. Currently the program is being implemented in school districts across the country impacting 60,000 students, the majority of whom attend high-poverty schools.

Community Partners:

Partners include:

- Clemson University, College of Engineering and Science which provides financial support, administrative support, release time for mathematics professors, graduate students and in-kind support;
- Educational Testing Service which creates assessment items, tests evaluation instruments, collects and analyzes qualitative and quantitative data, evaluates the Lawrence Township, N.J. project;
- Carolina Biological Supply Company which publishes the curriculum, provides financial support to Clemson University, develops the hands-on materials in partnership with Clemson University, and provides in-kind support for field tests and pilots;
- corporations and foundations, including DuPont Office of Education, Michelin North America, Fluor Daniel, American Honda Foundation, John Deere Foundation, Self Family Foundation, Ford Foundation and General Electric Fund which fund pilot programs and research projects and provide networking opportunities; and,
- other partnerships – SECME (Southeastern Consortium of Minority Engineering), Call Me MISTER, ASSET, Comanche Nation College and others which mentor the development team, provide networking opportunities and collaborate in research.

Learning Environment:

Math Out of the Box uses a learning cycle to foster inquiry-based learning. The learning cycle:

- provides teachers with a template that promotes the development of active inquiry and critical thinking;
- allows students to make connections between past and present learning experiences; and,
- provides the opportunity for students to share ideas with others and to more formally connect what they have learned with what they already know.

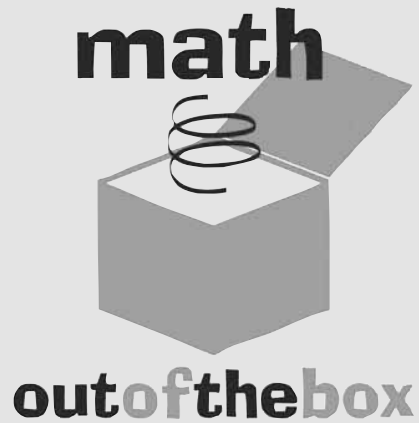
Program Results Highlights:

Research shows the following trends, including:

- when teachers implement the curriculum with fidelity, they change their teaching strategies to successfully teach all of their students;
- Math Out of the Box professional development is an ongoing learning process, which creates a culture of learning among elementary teachers of mathematics;
- formative (MAPS) and summative test scores (State Tests) improve for students being taught the Math Out of the Box curriculum;
- data on the potential of Math Out of the Box improving students' math skills to the proficient level have been promising;
- indications that Math Out of the Box is a powerful tool for significantly closing achievement gaps; and,
- students' writing skills in Math Out of the Box classrooms show improvement from pre-assessments to post-assessments.

Opportunities for Support/Replication:

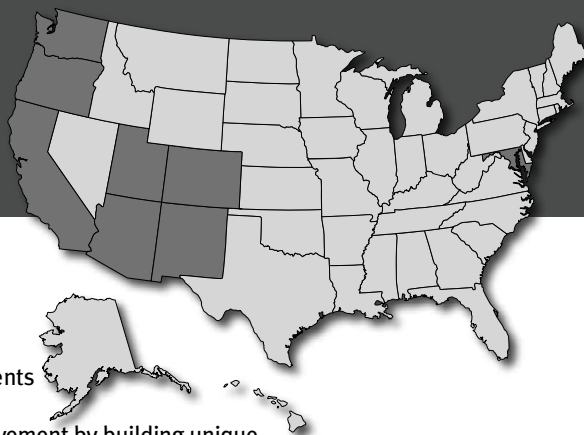
Math Out of the Box is appropriate for school districts across the country to use as a primary curriculum, an intervention or an informal mathematics program. Companies, organizations and individuals can work with their local school districts to bring the Math Out of the Box curriculum to their elementary school students.



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Mathematics, Engineering, Science Achievement (MESA)



Program Overview:

Since 1970, the California Mathematics, Engineering, Science Achievement (MESA) academic development program has supported educationally disadvantaged students so they can excel in math and science studies and graduate with degrees in engineering, science or technology. California MESA builds a culture of academic achievement by building unique, diverse partnerships and providing consistent academic assistance throughout the educational pipeline. MESA reinforces the message that academic achievement is attainable. This message is consistently delivered at all educational levels – elementary, middle and senior high schools, community colleges, and four-year colleges and universities – by educators, industry representatives, community leaders, parents and other family members. California MESA is the model for similar academic preparation programs in seven other states, which together are known as MESA USA.

Reach/Target Student Population:

MESA serves educationally disadvantaged students and, to the extent possible by law, emphasizes participation by students from groups with low rates of eligibility for four-year colleges. Two-thirds of schools participating in MESA area among the most underperforming in the state. Within the remaining third, MESA directs its services to the most educationally disadvantaged students. MESA's three programs serve 19,721 students at 54 locations in California. It serves 12 universities, 33 community colleges, 99 school districts, 154 senior high schools, 174 middle and junior high schools, and 38 elementary schools. The MESA Schools Program serves 14,659 students at 21 centers. The MESA Community College Program serves 2,837 students at 33 centers. The MESA Engineering Program serves 2,225 students at 12 centers at four-year institutions. MESA centers are located at University of California, California State University, California Community College and independent college and university campuses. MESA works with 650 math and science public school teachers throughout the state who serve as MESA advisors in the classroom.

Community Partners:

Partners include:

- higher education and local school districts which provide local funds and in-kind support;
- local schools which provide release time for teachers who become MESA advisors;
- state legislature in partnership with the University of California which provides infrastructure and funding; and,
- more than 250 corporations which offer resources and financial support and sit on local and state advisory boards.

Learning Environment:

MESA delivers its curriculum to student groups in various environments, including MESA classes during the school day, after-school and on weekends. The critical success factor is MESA's utilization of a hands-on approach to the "real-world learning" of science and mathematics. For example, MESA works to develop real engineering concepts by using a competitive model where students demonstrate their understanding by building bridges, mousetrap cars and other fun, but challenging, projects. Also, the students are encouraged to learn the value of working in teams.

Program Results Highlights:

Of California MESA high school graduates who are African-American, Hispanic and American Indian, 41 percent are eligible for admission to a University of California campus. This eligibility rate is much higher than the statewide rate of 6.2 percent for African-American and 6.5 percent for Hispanic students. Of California MESA high school graduates overall, 54 percent go on to postsecondary education as math, science or engineering majors.

MESA has been named one of the most innovative public programs in the country by Innovations in American Government, a project of the Kennedy School of Government at Harvard University and the Ford Foundation. MESA also is a winner of the Presidential Award for Excellence in Science, Mathematics and Engineering Mentoring.

Opportunities for Support/Replication:

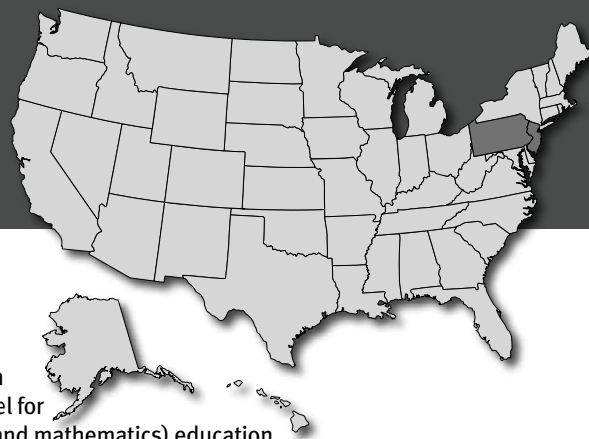
California MESA is the model for similar academic preparation programs in seven other states, which together are known as MESA USA. These states include: Arizona, Colorado, Maryland, New Mexico, Oregon, Utah and Washington.



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Merck Institute For Science Education



Program Overview:

The Merck Institute for Science Education (MISE) was founded in 1993 by Merck & Co., Inc. as a nonprofit organization dedicated to improving science education from kindergarten through 12th grade. During the past 17 years, MISE has become a model for how corporations can support the nation's STEM (science, technology, engineering and mathematics) education objectives and make a lasting difference in education reform by committing to long-term partnerships focused on the specific goals of:

- developing and delivering research-based professional development opportunities to enhance teacher knowledge and skills;
- providing access to high-quality curriculum materials and resources;
- building communities within a school that are committed to strengthening science teaching and learning within and across schools and school districts; and,
- promoting local, state and national policies that support effective science education.

In addition to funding provided by The Merck Company Foundation, MISE has received funding from the National Science Foundation (NSF), most recently through a \$7.1 million six-year award in 2003 to MISE and a regional partnership of schools and education organizations to strengthen science and mathematics education.

In 2005, the MISE portfolio expanded to include undergraduate- and graduate-level science education programs that work to build capacity in the biomedical sciences through partnerships with educational institutions and scientific organizations. This portfolio includes the UNCF/Merck Science Initiative and the Alliance/Merck Ciencia Scholars Program.

Reach/Target Student Population:

All K-8 students in five New Jersey public school districts – Elizabeth, Hillside, Linden, Rahway and Readington Township – and in one Pennsylvania public school district – North Penn.

Community Partners:

MISE works with teachers, administrators and parents in six school districts in New Jersey and one in Pennsylvania. MISE also partners with:

- informal science centers;
- professional teacher and educator organizations;
- institutes of higher education and community colleges;
- Merck employees;
- The International Telementor Program; and,
- The New Jersey Department of Education.

Learning Environment:

The Academy for Leadership in Science Instruction is a three-year professional development program for teachers, principals and district administrators who work together to deepen their understanding of the fundamentals of leadership and strong classroom science instruction. Through the work of the Academy, school districts develop their capacity to support instructional improvement in science, resulting in increased student participation and performance in science. School-based teams that participate in the Academy have access to a professional development curriculum designed by a team of educators, scientists, staff developers and education researchers, many of whom are also Academy instructors. Academy participants examine research around effective science instruction and engage in scientific investigations in order to analyze student and teacher learning. To support their work, teams study and practice methods of effective collaboration, and using these behaviors, create a shared vision of leadership in science.

In addition, Peer Teacher Workshops are weeklong professional development sessions designed to deepen teachers' content knowledge and understanding of key concepts in their science curriculum, preparing them to successfully engage in inquiry-based science instruction.

Finally, MISE Professional Development Design Workshops help prepare teacher leaders to plan and facilitate the Peer Teacher workshops.

Program Results Highlights:

MISE has made a significant impact on the character of teaching and learning science in its partner school districts, according to research performed over a 17-year period first by the Consortium for Policy Research in Education (CPRE) and subsequently by Horizon Research, Incorporated (HRI).

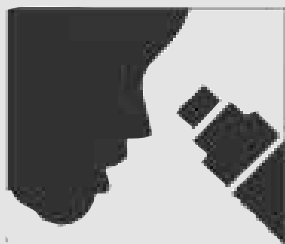
The external analyses also show that MISE is helping to:

- elevate science as a priority;
- support rigorous, inquiry-based teaching;
- support research-based adoption of instructional materials;
- improve hiring and recruitment practices to emphasize teachers' knowledge about content and instructional strategies;
- build the capacity of administrators to identify and support high-quality science instruction; and,
- develop new district-wide science assessments.

Most importantly, MISE has achieved results in the classroom. Analysis of student performance on standardized tests by CPRE found that students receiving science instruction from teachers who participated in MISE professional development activities over several years outperformed students whose teachers had only one or no years of MISE training. The differences were statistically significant when comparing the students of teachers with multiple years of MISE professional development to students of teachers with few years of MISE professional development.

Opportunities for Support/Replication:

This program is an example for other corporations, as well as technical assistance organizations, whether they be sponsored by states, universities, nonprofit organizations or professional organizations.



**Merck
Institute for
Science
Education**

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Program Overview:

Founded in 1998 and born out of neuroscience research at the University of California, the MIND Research Institute is a national nonprofit organization dedicated to research on learning and the brain, and the application of this research to the development of K-12 math education programs. MIND has developed a visually-based math education process that taps into the way we are “wired” to learn. MIND’s approach consists of language-independent, animated representations of math concepts presented via its Spatial Temporal (ST) Math® computer software games. MIND’s education programs teach all children, regardless of socio-economic or cultural background, how to think, reason and create mathematically. They are designed to meet major challenges facing public education (language barriers and diversity) and to help improve teacher efficacy and efficiency in the classroom.

Reach/Target Student Population:

In 2009, MIND reached more than 700 schools in 22 states, with nearly 150,000 students and more than 6,000 teachers participating. MIND targets all K-12 students. Approximately 84 percent of MIND schools serve low-income, low-performing students and more than half of the students are enrolled in the federal free- and reduced-lunch program. Sixty percent of MIND students are Hispanic and 10 percent are African-American. At several schools, English-language learners make up the majority of the student population. The breakdown by gender is 50 percent male and 50 percent female.

Community Partners:

The MIND Research Institute has received support for its work and programs from more than 38 private and family foundations, and more than 62 corporations and/or corporate foundations, including:

- foundation support
 - The Annenberg Foundation, Bannerman Foundation, Arnold and Mabel Beckman Foundation, California Community Foundation, Carol and James Collins Foundation, Croul Family Foundation, Dancing Tides Foundation, The Draper Family Foundation, Dwight Stuart Youth Foundation, The Eisner Foundation, The Fieldstone Foundation, The Ella Fitzgerald Foundation, S.L. Gimbel Foundation, The Grammy Foundation, The Guenther Foundation, The Green Foundation, Helping Us Help Ourselves Foundation, George Hoag Family Foundation, KDK-Harman Foundation, Leonetti/O’Connell Family Foundation, Long Beach Community Foundation, The Lookout Foundation, New Visions Foundation, Norris Foundation, The Pacific Endowment, The Rose Hills Foundation, Roth Family Foundation, Sacchi Foundation, Samueli Foundation, The Seaver Institute, Segerstrom Foundation, Donald and Constance Sperling Foundation, Steinmetz Foundation, Technology for Kids Foundation, Tiger Woods Foundation, TriumphEnt Foundation, Ueberroth Family Foundation and Waltmar Foundation; and,
- corporate support
 - Abbott Medical Optics, Adams Legacy Foundation, Allergan Foundation, American Honda Foundation, ASUSComputer International, AT&T Foundation, Bank of America, The Boeing Company, The Capital Group, Capital Pacific Holdings, Chevron Texaco Foundation, Chicago Mercantile Exchange, Citigroup, Cisco Foundation, Commercial Bank of California, Conexant, Cox Charities for Orange County, Edwards Lifesciences, Emulex Corporation, Experian, First American Corporation, Flour Corporation, Ford Motor Company, The Gas Company, Haskell & White, Hitachi, Hot Topic Foundation, IBM, Ingram Micro, KPMG, JP Morgan Chase Foundation, Knobbe Martens Olson & Bear LLP, Latham & Watkins, PacifiCare (United Health Foundation), Pacific Life Foundation, Microsemi, National Association of Music Merchants, National Cooperative Bank, NEC Foundation of America, New Century Financial Services, Northrop Grumman, Ralphs Food For Less Foundation, Rockwell Collins, SchoolsFirst Credit Union, Segerstrom Companies, SMART Technologies, Southern California Edison, State Farm Insurance Companies, Symantec Foundation, Taco Bell Corporation, Toshiba America Electronics, Toshiba America Foundation, Toyota USA Foundation, Trader Joe’s, Union Bank of California, US Bancorp, Verizon, Washington Mutual, Wells Fargo, Western Digital, Yamaha International and Yum Brands Foundation.

Learning Environment:

MIND’s unique approach accesses the brain’s spatial temporal reasoning ability. This ability allows the brain to think multiple steps ahead, by holding visual and mental representations in short-term memory and evolving them both in space and time. MIND’s language-independent, animated illustrations of math concepts allow students to develop this ability. Self-paced and self-motivating, MIND’s ST Math software provides students with immediate, instructive feedback, and deepens problem-solving and reasoning skills.

Program Results Highlights:

To assess success, MIND collects student test score data each year from standardized state tests and conducts annual teacher and principal surveys to monitor overall program effectiveness. MIND's most recent data analysis of California students showed a 15-point gain in student math proficiency after two years in the ST Math elementary program, and a 20-point gain after three years. This is compared with an average three to five point growth for California students not using the ST Math program.

Opportunities for Support/Replication:

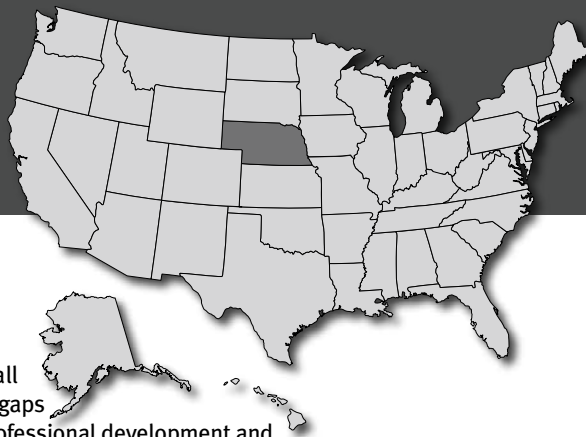
The MIND Research Institute welcomes foundation and corporate support to help it continue to refine its educational programs and implement them in more schools and learning centers around the United States.



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Omaha Public Schools/Banneker 2000



Program Overview:

Established in 2000, Omaha Public School's Banneker 2000 is a National Science Foundation (NSF)-funded Urban Systemic Program. It is designed to increase overall achievement for students in mathematics and science, while closing achievement gaps among underrepresented groups. Banneker 2000 focuses on providing teacher professional development and inquiry-based curriculum materials in order to improve student achievement.

Reach/Target Student Population:

While Banneker 2000 is a K-12 initiative, it focuses on fourth- through eighth-grade participation. All 83 schools in the Omaha Public School District participate at varying levels. All are required to submit and implement school improvement plans that include a focus on mathematics and science. Today, 58 schools are considered "Developing Schools," meaning they are involved more intensely in professional development. Of those 58, 17 schools have been designated "Exemplary," having met the 70 percent participation requirement and consistently impacted student achievement.

Community Partners:

Banneker 2000 works with a number of partners, including:

- University of Nebraska at Omaha which designs and provides course modules that help teachers learn science and math content directly related to standards they teach; helps evaluate teacher portfolios; and, provides additional workshop support for grade-level teams addressing science and math content gaps;
- Henry Doorly Zoo which offers multiple professional development experiences in content and inquiry;
- Community agencies and churches which provide enrichment and support for students;
- Mid-continent Research for Education and Learning which helps design the instrument used by teachers to profile their learning needs and to provide content learning workshops for some of the discipline-based teams; and,
- National Science Teachers Association which provides support for online learning environment.

Learning Environment:

The Banneker 2000 classroom environment:

- is one that is respectful and knowledgeable of students and their learning needs;
- provides standards-based curriculum materials;
- requires teachers have solid subject and pedagogical content knowledge in mathematics or science; and,
- focuses on teacher and student inquiry to promote learning.

Program Results Highlights:

Banneker 2000 has made significant impacts on mathematics and science achievement. Consistent increases in achievement were seen on "Criterion Referenced Tests" across grades in science and mathematics. Some reduction in achievement gaps for underrepresented student groups was seen at all grade levels. The greatest gap reductions were seen in fourth-grade science, algebra and geometry. Pipeline data show significant increases in students completing rigorous mathematics and science courses that prepare them for post-secondary success.

Opportunities for Support/Replication:

Banneker 2000 welcomes support from the public and private sectors. Part of the NSF's Urban Systemic Initiative, Banneker 2000 is a program suitable for replication with the support of community partners.

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Project Lead The Way



Program Overview:

Established in 1996, Project Lead The Way (PLTW) is the nation's leading provider of rigorous STEM education programs. PLTW, a nonprofit organization, partners with middle schools and high schools to prepare students to become the most innovative and productive in the world. PLTW's engineering and biomedical-sciences programs are currently found in more than 3,400 schools in all 50 states and reach more than 300,000 students. The hands-on, project-based program engages students by showing them how what they are learning in mathematics and science applies to the real world. Students are introduced to the scope, rigor and discipline of engineering, technology and biomedical sciences and provided with a foundation and proven path to college and career success in STEM-related fields. PLTW teachers play a critical role in the success of students. More than 13,000 teachers have been trained to teach PLTW classes and PLTW provides teachers with ongoing professional development, including the use of a web-based Virtual Academy.

Reach/Target Student Population:

PLTW is available to all sixth- through- 12th grade students nationwide. One of PLTW's strategic goals is to recruit and retain more female and underrepresented minorities to the program. Currently, more than 3,400 schools in all 50 states have more than 300,000 students enrolled in PLTW classes. The students will be taught by more than 10,500 individual teachers, all of whom have been trained by PLTW. They will be counseled by more than 5,000 school counselors, all oriented by PLTW.

Community Partners:

PLTW has numerous partners throughout the country that support the initiative nationally and locally, including:

- 30 colleges and universities which support teacher professional development in their states;
- 40 state departments of education which collaborate with universities and schools which oversee program implementation in their states;
- corporations like National Instruments, Lockheed Martin, Northrup Grumman, Intel and Rolls Royce that underwrite national and state initiatives for teacher training;
- agencies like NASA which collaborate on curriculum development;
- associations like the National Fluid Power Association and the Society of Manufacturing Engineers which collaborate on curriculum development and extra-curricular initiatives;
- organizations like the National Action Council for Minorities in Engineering and the National Association for Partnerships in Equity which collaborate on the minority and female participation issues;
- philanthropic organizations like the Kern Family Foundation, The Kauffman Foundation and the Knight Foundation; and,
- institutions like the National Academy of Engineering's Center for the Advancement of Scholarship in Engineering Education, which recognizes PLTW as the top pre-college engineering education program.

Learning Environment:

The problem/project-based nature of the curriculum necessitates a classroom environment which emphasizes group collaboration and inquiry. In a PLTW classroom, the teacher is a facilitator and not a conveyor of information. Students must create their own understanding by using a variety of sources to obtain information, discussing that information with classmates and the teacher, synthesizing their understanding and then applying it to the project at hand.

Program Results Highlights:

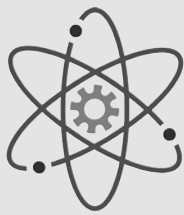
A 2008 study by True Outcomes of York, Pa. reports that:

- 95 percent of all seniors surveyed say they are preparing for jobs that emphasize engineering, technology and computer science;

- 97 percent of all seniors say they intend to pursue a four-year degree and 57 percent indicate they are planning on graduate school in a related field (the National Center for Education Services report that only 67 percent of graduating high school seniors intend to pursue a bachelor's degree, by comparison);
- representation of Hispanics and Native Americans in PLTW courses is proportional to their representation in post-secondary engineering programs nationwide;
- while African-American students currently are not proportionally represented, PLTW has created a partnership with the National Action Council for Minorities in Engineering and the National Academy Foundation to create 110 urban Academies of Engineering to increase the recruitment and retention of underrepresented minority students; and,
- female student participation in PLTW remained at 17 percent, which is the same percentage of female students enrolled in college and/or university engineering programs.

Opportunities for Support/Replication:

Support is welcomed by corporations, organizations and/or individuals. With 3,000 participating middle and high schools, PLTW offers a curriculum that can be adapted by school districts across the country.



PROJECT LEAD THE WAY

PLTW

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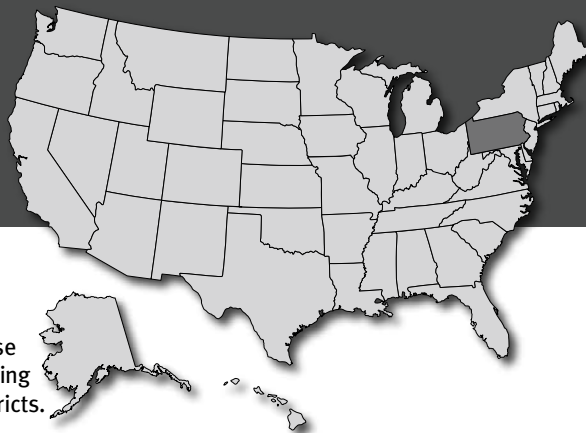
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Science In Motion



Program Overview:

Science In Motion is a comprehensive outreach program that addresses the expense and difficulties of teaching good science in the secondary classroom by using existing higher education infrastructure and sharing expensive resources among many districts. The program facilitates systemic change by providing:

- a mobile educator who provides expert support to secondary teachers in the classroom;
- materials and equipment delivered via a well equipped van to the classroom for hands-on use by students;
- regularly scheduled, subject-specific teacher professional development workshops; and,
- opportunities for teachers to work collegially with other teachers and with college faculty to implement exemplary curriculum.

The program began at Juniata College as Chemistry In Motion in 1987 and was designed specifically for students in rural areas. With its second grant from the National Science Foundation in 1993, it became known as Science In Motion. Statewide expansion to include 10 other higher-education partners and more than 200 school districts occurred in 1997 after funding by the Commonwealth of Pennsylvania began.

Reach/Target Student Population:

Science In Motion's target population is all Pennsylvania secondary-science students. During the 2005-2006 reporting period, the Pennsylvania Science In Motion Consortium provided outreach support to 698 teachers in 307 public, private and parochial schools. Mobile educators from these sites supported a total of 5,165 classes. Equipment loans and prepared experiments were delivered to an additional 6,447 classrooms. Altogether, 217,366 student experiences were provided through Science in Motion.

Community Partners:

Eleven institutions of higher education serve as Science In Motion hubs: Cedar Crest College, Clarion University of Pennsylvania, Drexel University, Gannon University, Gettysburg College, Juniata College, Susquehanna University, University of Pittsburgh at Bradford, Ursinus College, Westminster College and Wilkes University.

Science In Motion's major corporate sponsor is GlaxoSmithKline, which has provided \$80,000 per year for the past three years to support the program in schools served by Juniata College and those served by Drexel University in the City of Philadelphia School District. In addition, Juniata College also has support from local businesses (DC Goodman, Kish Bank and PNC Bank) through donations made with the Pennsylvania Earned Income Tax Credit Program. Other members of the Science In Motion Consortium have support from foundations such as the Merck, Whitaker Chiron and Tyco Electronics Foundations.

Learning Environment:

Students are attracted to and become actively engaged in science activities because they are given access to the types of real science equipment that they see in popular television shows such as *CSI* and in science documentaries. However, these are not just motivational experiences; these are experiences that provide students with the science and technology skills needed for work in modern industrial settings and for entry into higher education. Students feel empowered by knowing that they are using equipment that can solve real-world problems and by knowing that they are acquiring real skills that will be marketable in the workforce. By working in small groups, students also learn the teamwork skills that they will need in the workplace.

Program Results Highlights:

In 2003, pre- and post-tests were administered to both Science In Motion participating schools and control schools by eight consortium sites for chemistry and five sites for biology. Science In Motion schools demonstrated significantly improved science content scores (16.8 percent improvement) across the board among all students compared to scores of students in control sites. Science In Motion also is just concluding a consortium-wide assessment that tests student knowledge of biology and chemistry. The assessment approach uses a pre- and post-test strategy to compare scores between 37 participating and 18 control schools. A report on this assessment will be complete by September 2006. The demographics of the involved school districts will enable these results to be compared in terms of districts with high and low minority enrollments.

Opportunities for Support/Replication:

Science In Motion welcomes support from the public and private sector. During the past 10 years, the states of Alabama and Delaware implemented their own version of Science In Motion, using the Pennsylvania program as a model. The Alabama program reaches across the entire pre-college educational spectrum.

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Summer Science Academy



Program Overview:

Founded in 1988 at Xavier University in New Orleans, the Summer Science Academy was created to address the critical shortage of African-Americans and other people of color in science and health-related careers. Targeting secondary school students, it consists of three “Star” programs designed to introduce high-ability students to certain math and science content areas before enrolling in the course for the upcoming school year. Specifically, the three programs include: MathStar, which introduces algebra; BioStar, which introduces biology; and, ChemStar, which introduces chemistry. A fourth program, Stress On Analytical Reasoning (SOAR₁), has a residential component, and provides assistance with ACT/SAT test-taking skills, along with drills in quantitative and verbal reasoning. Students (grades eight to 12) are selected based upon grades earned in English, mathematics and science, and must have an expressed interest in a science/health-related field. The programs are taught by local high school teachers with the assistance of Xavier University science majors.

Reach/Target Student Population:

The program has a national reputation with average summer attendance reaching the 300 level mark and representing more than 75 different schools. Almost all students are African-American and the large majority are female.

Community Partners:

The Summer Science Academy has the support of the local school districts in the New Orleans Metropolitan area, which freely disseminates information to a captive audience. In addition, Summer Science Academy representatives take part in high school career days. Parents are one of its biggest supporters.

Learning Environment:

The Summer Science Academy is staffed by local high school science teachers and Xavier science majors; the presence of the Xavier student permits regular interactions with someone who is actively pursuing a career in science. Classes are held in the science complex on the University’s campus, which provides the science backdrop and also allows for interactions with college science majors.

The curriculum is standardized. The lessons are strategically designed in a series of modules, each with clear learning goals, a copious amount of practice problems and relevant homework. Additionally, the presence of local high school teachers as directors/lecturers lends a hand in forming the collaborative bond between secondary schools and college campuses.

Program Results Highlights:

Data from student evaluations found that after participating in one of the Summer Science Academy programs, nearly all students indicated an intention to attend college and many plan for a career in a scientific area, such as, pharmacy, engineering, medicine and mathematics.

Opportunities for Support/Replication:

Summer Science Academy welcomes support from corporations, foundations and organizations, as well as scientists who can serve as mentors or special guests during the summer experience.



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Science Education for Public Understanding Program (SEPUP)



Program Overview:

Founded in 1983, Science Education for Public Understanding Program (SEPUP) is a program of the Lawrence Hall of Science at the University of California, Berkeley. It designs instructional materials for elementary and secondary schools and the community that focus on science and technology and their interaction with people and the environment. These learner-centered materials promote the use of scientific principles, processes and evidence in public decision making. The SEPUP approach enhances the role of teachers as facilitators of student learning and as educational leaders within their communities by having them share in the development, implementation and assessment of issue-oriented science materials and programs.

Reach/Target Student Population:

Conservative estimates indicate that since 1990, more than 10 million students have used a least one of the SEPUP modules or year-long courses. SEPUP materials are designed for fourth through 12th grade and are appropriate for students of all ethnic, cultural and socio-economic backgrounds. They are field tested and used in a wide variety of school districts, from rural to inner-city schools, with student populations that include English language learners, student groups that are underrepresented in the sciences, special needs students and gifted students. Examples of school districts with significant implementations of SEPUP materials are New York City, N.Y.; Baltimore, Md.; Charleston, S.C.; Chicago, Ill.; Clark County, Nev.; Denver, Colo.; and, Grand Rapids, Mich.

Community Partners:

Since its establishment, SEPUP has been supported by grants from public agencies and by contributions from private foundations and industry. To deliver its program, SEPUP partners with scores of school districts, universities and colleges. In addition, Lab Aids, Inc. produces the materials and kits that accompany all SEPUP courses and modules.

Learning Environment:

SEPUP strives to support a classroom learning environment in which the connections of science to students' lives and other school subjects are established through discussion of real-world issues. These issues might be related to personal and community health or to environmental or other community issues. SEPUP curriculum materials foster group interaction and discussion and debate about scientific phenomena and the impact of science on their lives. Students work individually and in groups to explore scientific phenomena and relate them to larger concepts. The teacher facilitates learning, helping students when necessary, while encouraging them to become more independent as they take the next step in learning.

Program Results Highlights:

SEPUP's impact on science education is evident from professional reviews of the curriculum, the adoptions and implementation of SEPUP materials in school districts nationwide, and the evaluation of student progress. The National Science Foundation has identified SEPUP as "providing a good model for . . . engaging students in learning and applying important science concepts" (NSF, 1997).

Opportunities for Support/Replication:

Given its broad reach, SEPUP is a highly replicable program suitable for various school district environments. Private- and public-sector support is welcome as the program continues to refine its offerings and develop new ones.



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Seeds of Science/Roots of Reading™



Program Overview:

Founded in 2003, Seeds of Science/Roots of Reading™ (Seeds/Roots) is a combined research and development program dedicated to investigating ways of integrating science and literacy instruction. A collaboration of the Lawrence Hall of Science and University of California, Berkeley's Graduate School of Education, Seeds/Roots addresses the urgent need for materials that help elementary students make sense of the physical world and foundational dimensions of literacy. The hands-on model of typical inquiry science is extended to include reading and writing, as well as frequent opportunities for student discussion and reflection, resulting in a multimodal instruction model called "Do-it, Talk-it, Read-it, Write-it."

Reach/Target Student Population:

The target population for the initial program is all students in second through fifth grade, with a special emphasis on English language learners. During its field test phase, still continuing for some units, the Seeds/Roots program involves hundreds of teachers and tens of thousands of students nationwide. Specifically, the first three second- and third-grade units reach 87 teachers and 2,000 students in 21 states. By the time field tests for second through fifth grade are completed, along with other studies, it is estimated that 500 teachers and 7,500 students will have experienced a Seeds/Roots unit.

Community Partners:

Seeds/Roots is a partnership between science educators at the Lawrence Hall of Science and literacy educators from the Graduate School of Education – both at the University of California, Berkeley. Scientists, educational researchers, curriculum and professional developers, and science and literacy educators nationwide have also made key contributions, as have field test teachers from diverse school districts and communities across the nation. The launch of the program was made possible by grants from the National Science Foundation. Additional support has been provided by the Noyce Foundation for work focusing on ensuring the materials are accessible to English language learners.

Learning Environment:

Seeds/Roots creates an interactive and engaging environment that provides opportunities for students to find, evaluate and interpret evidence both in firsthand situations and from secondhand sources, especially from the age-appropriate student science books that are part of the program. Negotiating this interplay between firsthand and secondhand sources of information is something students will do all of their lives—even if they don't choose a career in science. Making sense of the world and navigating daily life require a lot of skill in reconciling different sources of evidence—some of it gathered through experience and investigation (firsthand) and some from books, media and conversations (secondhand). In the Seeds/Roots curriculum, students have the opportunity to develop all of these skills as they "Do, Talk, Read, and Write" about science.

Program Results Highlights:

An independent and respected research organization, the National Center for Research on Evaluation, Standards, and Student Testing (CRESST) at the University of California, Los Angeles, conducted an extensive evaluation study, analyzing results and contacting field test teachers on their own in 2004-5 on the second- and third-grade units. It involved 87 classrooms across 21 states, one-third of which had 30 percent or more English language learners. The results from this first phase of work are exceptionally promising, suggesting that students using the Seeds/Roots units showed significantly greater gains in nearly all science and literacy outcomes as compared to students in the comparison conditions (content-comparable inquiry-only or reading-only treatments).

Opportunities for Support/Replication:

As a program that has been successfully introduced and implemented in 21 states, Seeds/Roots is highly replicable.



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Stanford Medical Youth Science Program



Program Overview:

The Stanford Medical Youth Science Program (SMYSP) addresses the critical need for low-income and minority students in the health sciences. The program began in 1988 as a student-directed program with strong faculty/Stanford support, and has grown into a complementary set of university and school-based programs that offer academic enrichment in the biomedical sciences, college guidance, and long-term mentoring to low-income and underrepresented minority high school students. SMYSP creates inquiry-based science education learning environments whereby students collectively observe, problem solve, and practice their skills in environments that foster cooperative learning and a sense of ownership. It accomplishes this through in-school programs and summer residential opportunities that teach students about hands-on science relevant to their families and community. Its overarching goal is to be a national model for increasing diversity in the scientific and health professions.

Reach/Target Student Population:

The SMYSP school-based program has impacted more than 400 10th grade students through a five-year partnership with four Northern California high schools (William C. Overfelt High School, Edison High School, Oakland Technical High School and Round Valley High School).

The SMYSP Summer Residential Program has impacted the lives of more than 600 10th and 11th grade high school students from more than 300 Northern and Central California high schools and communities.

All student participants are from low-income and underrepresented minority backgrounds (African- American, Native American, Hispanic and Asian-American), are interested in the sciences and health, and are most often the first in their families to attend college. In addition, many students have faced significant personal hardships, such as placement in foster care, being homeless, living in agricultural labor camps and/or losing a parent.

Community Partners:

SMYSP has developed lasting partnerships with a number of community organizations and health institutions. These partners provide college admissions workshops and tours, individual and group genetic demonstrations, technology workshops and information sessions, hospital shadowing experiences and tours, and anatomy, pathology and forensic laboratory workshops. Partners include:

- universities/colleges
 - Foothill College, California State University East Bay, California State University Monterey, Humboldt State University, Diablo Valley Community College, San Francisco State University, College of the Alameda, San Jose City College, University of California Santa Cruz and University of California Davis;
- community organizations
 - Oakland Police Department Forensics Laboratory, the Tech Museum of Innovation, R.T. Fisher Educational Enterprises, Inc. and the Santa Clara County Biotechnology Education Partnership; and,
- medical centers/hospitals
 - Ukiah Valley Medical Center, Mendocino County Medical Center, Santa Clara Valley Medical Center, Kaiser Hospital Oakland, Stanford Hospital & Clinics, and the Veterans Affairs Palo Alto Health Care System.

In addition, Stanford University, Stanford University School of Medicine, Stanford Hospitals & Clinics and the Veterans Affairs Palo Alto Health Care Systems hospitals provide enormous in-kind support. Many Stanford faculty and staff, and community members volunteer annually by presenting lectures, serving as mentors and providing academic or professional guidance.

Learning Environment:

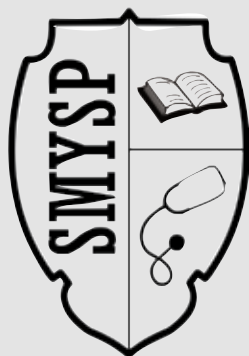
Both the Summer Residential and School-Based Programs support teaching and learning models of instruction where students directly observe and participate in hands-on activities, and where “thinking is visible.”

Program Results Highlights:

Since 1988, SMYSP has tracked the course of its students who have completed the program. Of those students who completed the Summer Residential Program, 99 percent have been admitted to college. Among these, 78 percent of African-Americans, 81 percent of Hispanics, 82 percent of Native Americans and 96 percent of Asian-Americans have earned a four-year college degree (excluding those currently attending college). Among SMYSP's four-year college graduates, 47 percent are attending or have completed medical or graduate school, and 43 percent are working as or training to become health professionals. The School-Based Program has similarly good results, with 56 percent of its high school graduates attending a four-year college and 30 percent attending a two-year college.

Opportunities for Support/Replication:

Stanford Medical Youth Science Program welcomes public- and private-sector support, as well as science, medical and education professionals who can serve as guest lecturers and mentors.



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Program Overview:

Founded in 2000 by Chabot Space and Science Center, Techbridge offers free after-school and summer programs, including hands-on projects, career exploration opportunities, and academic and career guidance to expand girls' interests and options. The mission of Techbridge is to encourage more girls to pursue careers in technology, engineering or science, ultimately increasing the number of girls electing to major in these fields and diversifying the workforce pipeline. Techbridge also places a focus on building a strong network of support for girls, and has reached more than 7,000 educators, role models, families and partners through professional development, trainings, publications and other dissemination activities across the country.

Reach/Target Student Population:

Since its founding, Techbridge has worked with nearly 2,500 girls in fifth through 12th grade. Techbridge serves a highly diverse population, including girls from schools with high proportions of students receiving free- or reduced-price meals, girls for whom English is a second language, and girls from schools where educational performance is considerably below state standards. Nearly 38 percent of girls self-identify as Hispanic/Latina; 35 percent as Asian/Pacific Islander; 25 percent as White/Caucasian; 16 percent as Black/African-American; and, 5 percent as American Indian. A number of girls (20 percent) self-identify with more than one ethnicity.

Community Partners:

Techbridge is fortunate to have a strong network of support from partners who provide funding, real world STEM experience opportunities, mentors and role models, and academic and career guidance for its students. Partners include:

- higher education
 - University of California, Berkeley, Mills College, Smith College and University of California, San Francisco;
- corporate
 - Chevron, Google, Intel, Yahoo!, Apple, LeapFrog, eBay, Cisco, Bechtel, Clorox and Pixar Animation Studios;
- government
 - National Science Foundation; and,
- community organizations
 - CollegeWorks and the Berkeley Foundation for Opportunities in Information Technology.

Learning Environment:

Techbridge aims to engage girls in science and technology, while allowing them to have fun, tinker, and be interactive and challenged. Girls build engines and learn about automotive design; explore renewable energy by designing and creating “green” dollhouses; and, solder their own robots to understand electronics. The informal after-school setting allows instructors to create a fun, yet safe and inviting atmosphere that helps build teamwork, friendship and a support network for youth.

Program Results Highlights:

In post-surveys, students attribute the following gains to their experience in Techbridge, including:

- 96 percent know more about how things work, like circuits and simple machines;
- 94 percent feel more confident trying new things;
- 88 percent plan to study harder so they can go to college;
- 84 percent try harder to overcome a challenge and not get frustrated;
- 80 percent are better at problem solving;
- 94 percent believe engineering is a good career for women; and,
- 81 percent can see themselves working in STEM.

Recently, based on the success of its program, both the National Science Foundation and Google have provided funding to Techbridge to develop a Role Model Guide which will expand Techbridge from California to states across the country.

Opportunities for Support/Replication:

A highly replicable program, Techbridge is looking for public- and private-sector support to continue the expansion of its program nationally. In addition, it is looking for STEM professionals to serve as mentors and role models to students.



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The Earth We Share™ International Science Camp



Program Overview:

Founded in 1994 by astronaut Dr. Mae C. Jemison, The Earth We Share (TEWS) International Science Camp is a four-week residential summer program for students ages 12-16 that asks students to solve global dilemmas. Held at different colleges and universities annually, TEWS Discovery Topics™ seek to increase students' science literacy and problem-solving skills, build knowledge of the impact of science and technology on society, and increase the understanding of societal and environmental impact on science. In addition, TEWS helps teachers develop their skills in experiential, open-ended teaching, science education and working with students in teams. TEWS also provides its participants the opportunity to encounter a variety of cultures and perspectives as students and teachers come from various communities throughout the United States and around the world.

Reach/Target Student Population:

TEWS seeks students, ages 12-16, from throughout the United States and around the world. Student selection is guided by the following principles and includes students who:

- have a grasp of the English language and a 2.5 or better grade point average;
- represent a cross-section of the United States and diversity of countries around the world;
- may or may not intend to pursue careers in science;
- demonstrate the potential to be influential and share the insights gained at TEWS with fellow students and their community when they return home; and,
- are well-rounded and able to effectively share their culture with others.

To date, more than 200 boys and girls have participated in program. Additionally, 35-40 teachers and 40 college interns have been trained; 22 guest teachers from various professions have attended the international science camp.

Community Partners:

TEWS is made possible by the support of partners who provide funding, in-kind support and services, research materials, field trip experiences, guest lecturers, administrative services, public relations, computer hardware and software, and other services and resources. These partners come from industry, education, civic and community groups, and national and international schools, colleges and universities.

Learning Environment:

The TEWS learning environment is hands-on and minds-on. It affords students the resources they need to solve global dilemmas outlined in their given Discovery Topic, such as “How many people can the Earth hold?,” “Pick the hot public stock of the year 2030” and “What do we do with all this garbage?” Students conduct research, take field trips to nearby laboratories and other relevant facilities, review existing literature, connect with experts by phone and in person when possible, conduct surveys and design and implement experiments. Supplementing their project work are cultural programs, sports activities, astronomy and star-gazing, and writing and reporting on Radio TEWS.

Program Results Highlights:

TEWS requires each student to complete a written test/assessment at the beginning and end of the four-week program. These assessments have found that students have enhanced their understanding of science literacy, and improved their problem solving, team building and presentation skills. Also, students' report increased respect and understanding of the importance of a culturally diverse society. Finally, many students report being more motivated and focused on planning for their college careers and majors.

Opportunities for Support/Replication:

TEWS seeks public- and private-sector support for its program to continue to expand and grow from the four-week residential program to one that can be integrated into middle and secondary schools' formal science curriculum or extracurricular activities.



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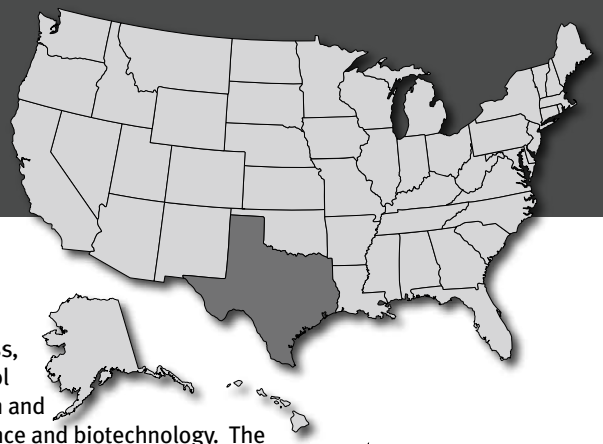
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Texas Bioscience Institute



Program Overview:

The Texas Bioscience Institute (TBI) is a program established to develop a seamless, comprehensive system for training biotechnology workers beginning in high school through college and culminating in employment in today's biotechnology, research and medical fields. The rigorous, yet innovative curriculum concentrates on math, science and biotechnology. The Texas Bioscience Institute-Middle College is a component part of this unique program in which students can receive as much as two years of college credit while completing the last two years of high school. The Texas Bioscience Institute includes high school students, community college students, industry-based clinical lab science students and university students.

Reach/Target Student Population:

The Texas Bioscience Institute-Middle College currently has served more than 283 students from the following independent school districts: Temple, Belton, Killeen, Academy, Troy, Bartlett, Chilton, Rosebud-Lott, Salado and Rogers Independent School Districts; the private schools of Holy Trinity Catholic High School and Central Texas Christian School; and, home school students. The approximate demographics of the student group are: 53 percent white and 47 percent minority (Asian/Indian-10 percent, Hispanic-16 percent, and African-American-21 percent). With regard to gender, approximately 66 percent are female; 34 percent male.

Community Partners:

Temple College is well-known for its ability to work effectively with many partners. And, TBI is no different. Specific partners include:

- Education Partners
 - Temple, Belton, Killeen, Academy, Troy, Bartlett, Chilton, Rosebud-Lott, Salado and Rogers Independent School Districts;
 - Private schools of Holy Trinity Catholic High School and Central Texas Christian School;
 - Home school students;
- University/College Partners
 - Central Texas Tech Prep Consortium, Texas A&M University (formerly Tarleton State University)-Central Texas, University of Mary-Hardin Baylor, Texas A&M University College of Medicine-Temple Campus and the Scott & White Clinical Laboratory Science Program;
- Workforce Partners
 - Central Texas Workforce Board and Central Texas Workforce Centers ; and,
- Industry Partners
 - Scott & White Hospital and Clinics, Central Texas Veterans Health Care System, Cancer Research Institute, Cardiovascular Research Institute, Institute of Regenerative Medicine, Temple Economic Development Corporation, Temple Health and Bioscience District, and the City of Temple.

Learning Environment:

Students attending TBI are introduced to the world of science by engaging in a real-world, project-based curriculum and attending seminars led by world-class scientists and physicians. Housed in a medical research facility, the program allows students to see how math, chemistry and biology are used in the workplace each day. The rigorous, yet innovative curriculum concentrates on science, math and biotechnology. In addition, research scientists work directly with students to prepare them for employment and/or further education.

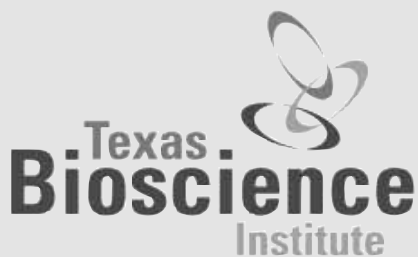
Program Results Highlights:

In its first year of operation, the TBI received a \$150,000 Texas Science, Technology, Engineering and Math (T-STEM) Academy Early Innovator grant from the Texas High School Project T-STEM Initiative. The T-STEM grant helped support the continuation of the Academy's work and led to the creation of a T-STEM network in 2007. Through the T-STEM network, schools across Texas have

access to relevant professional development, a rigorous math and science curriculum, lesson plans infused with real-world activities in math and science, and advice from peers and experts. The T-STEM network also sponsors annual regional and state meetings. TBI instructors also have access to professional scientific meetings/assemblies, and the annual meeting of the Texas Community College Teachers Association which includes sessions for teaching innovations and curriculum-specific topic coverage related to biotechnology and medicine. In fall 2009, the TBI started a new grant-funded “2-STEP” project that is supported by a \$1.2 million STEP grant (Science Talent Enhancement Program) from the National Science Foundation. The project incorporates multifaceted approaches whereby several different groups of students are targeted for involvement in a number of “best practices” that are recognized for attracting students into and retaining them in STEM fields. Students enrolled in Temple College’s Texas Bioscience Institute-Middle College, associate degree students continuing their education and transitioning military students who have an interest in a STEM field, greatly benefit from the “2-STEP” project activities.

Opportunities for Support/Replication:

Temple College’s TBI program welcomes public- and private-sector support, as well as scientists who can serve as guest lecturers and/or mentors.



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Texas Pre-Freshman Engineering Program (TexPREP)



Program Overview:

The Texas Pre-Freshman Engineering Program (TexPREP) is a college-based, academically intense, mathematics-related summer enrichment program, which stresses the development of abstract reasoning skills and their applications. TexPREP particularly encourages the participation of women and members of minority groups who traditionally have been underrepresented in STEM fields. The purpose of the six- to eight-week program is to identify middle school and early high school students with the interest and potential for careers in STEM areas and to reinforce them in the pursuit of these fields. In the end, the major goal of the program is to increase the number of well-trained Texas senior-college graduates and technological professionals by encouraging the participation of women and diverse ethnic and racial groups and increasing their retention rate in college.

Reach/Target Student Population:

In 2008, TexPREP served 2,993 students, of whom 2,543 completed the program. The majority of the students are Hispanic (60 percent), followed by African-American (12 percent) and Caucasian (18 percent). Half (50 percent) are female. The students are from middle and high schools in 100 Texas-based independent school districts, and numerous parochial, private, charter and home schools. The TexPREP program is conducted on 28 community and senior-college campuses throughout Texas. The instructional staff includes approximately 143 teachers and 124 program assistants who are current college students majoring in STEM fields.

Community Partners:

The program receives in-kind and financial support from approximately 135 local, state and national public- and private-sector organizations, including:

- the state of Texas;
- participating college and university PREP sites;
- local school districts;
- Texas Department of Agriculture Summer Food Service Program;
- private industry; and,
- other public and private agencies.

Learning Environment:

A typical day (Monday through Thursday) for a TexPREP I student runs from 9 a.m. – 3 p.m. Each day, students hear from an invited speaker from a STEM industry who discusses professional opportunities; attend classes on logic and its applications to mathematics; take an introduction course to engineering where they learn about topics ranging from engineering design to digital signal processing; participate in a problem-solving seminar; and, work with their group on their assigned project for the summer. Projects include bridge-building and rocket construction, among others. Friday is reserved for project exhibits, seminar group competitions, games such as PREPardy (TexPREP version of Jeopardy!) and field trips to science or engineering related facilities. In a typical summer, TexPREP students learn that through hard work and persistence they can be successful in a college environment. Moreover, they acquire the preparation and motivation to successfully pursue a college preparatory program when they return to their schools in the fall. In subsequent summers (TexPREP II, III and IV) student classes include physics, algebraic structures, geometry, trigonometry, probability and statistics, technical writing, dynamic modeling and water science. While students can attend PREP IV after PREP III, they are also given the option to attend University PREP (UPREP) which provides them the option of taking courses for college credit during the summer.

Program Results Highlights:

Since 1979, more than 28,361 middle and high school students have successfully completed at least one summer component of TexPREP. Of these students, 81 percent are members of minority groups who are underrepresented in science and engineering, 53 percent are women and 38 percent represent economically disadvantaged families (students who are financially eligible for the school lunch program). Of the 13,066 who are of college age, 5,854 responded to the 2008 annual survey, reporting:

- 99.9 percent are high school graduates;
- 99 percent attend college;
- 82 percent of the college attendees graduate from college;
- 74 percent of the senior-college graduates are members of underrepresented minority groups;
- 45 percent of the senior-college graduates are STEM majors; and,
- 69 percent of the STEM graduates are members of underrepresented minority groups.

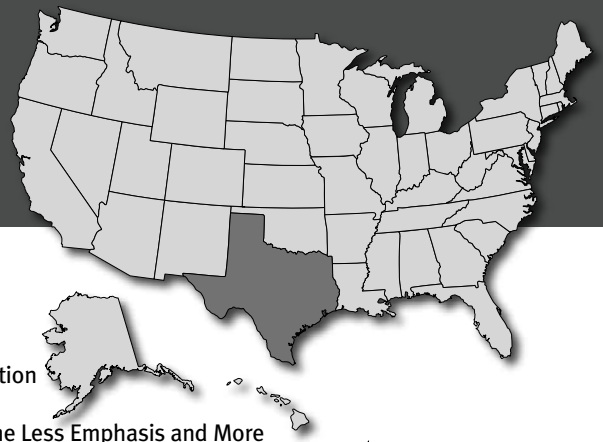
Opportunities for Support/Replication:

TexPREP is a proven response towards increasing the number of engineers and scientists within the US and it needs support from outside organizations to maintain and increase the number of students it serves. In addition, public and private sector organizations can provide career awareness speakers. Since its establishment in 1979 as San Antonio PREP, TexPREP has expanded significantly with its statewide rollout beginning in 1986. Additionally, PREP-USA continues to look for financial support to replicate TexPREP outside of Texas.



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Program Overview:

Founded in 1999, Visualrealization.com (VR program) is a teacher professional development program that is recognized by the National Science Teachers Association (NSTA) as an Exemplary Science Program to effectively produce superior student learning and teacher professional development. This recognition corresponds to the Less Emphasis and More Emphasis conditions that conclude each section of the Standards, characterizing what most teachers and programs should do less of as well as describing the changes needed if real reform is to occur.

The VR program centers on a learning technology model called Digital Imagery as an Instructional Mode for Student Achievement (DIIMSA®). The DIIMSA Model incorporates digital imagery technologies (digital cameras and associated toolsets), collaborative groups and science concepts during learning. The DIIMSA Model, created by VR program educational leaders, stimulates a better learning environment by activating more senses – sight, sound, touch – during learning, which increases retention and provides teachers with an effective way to increase student achievement at a high level. Students are then able to move to the next level of learning in a leveled playing field regardless of ethnicity, socio-economic status or background. The VR program's core resource is called DIIMSA EXPERT (Experience-Based Digital Imagery Content Repository and Forum). This resource contains authentic digital imagery scenes from DIIMSA real project experiences that are integrated with applied concept-based questions, vocabulary, content modules, activities, content collections and strategies. DIIMSA-EXPERT is designed for curriculum integration and classroom transfer leading to instruction and assessment successes.

Reach/Target Student Population:

In Texas, the VR program reaches 4,500 teachers, representing 152 schools with more than 220,000 students across 12 school districts. Additional program participants include university professors and students in STEM disciplines and pre-service teachers. The target population includes: elementary and secondary school teachers and students spanning African-American, Hispanic, Asian, American Indian and Anglo groups from rural, urban and suburban school districts.

Community Partners:

The VR program partners with:

- Texas Parks and Wildlife – Sheldon Lake Environmental Learning Center which serves as a project site for students and teachers; and,
- A.C. Green Youth Foundation on the Project STEM-LEADRS program.

In addition, the VR program collaborates with higher-education institutions, large corporations and nonprofit organizations that would like to do more with less, while gaining a significant impact across school boundaries.

Learning Environment:

“The sky is the limit” is a phrase that captures the essence of the VR program. Students and their teachers are revitalized and reenergized. The study of science becomes alive and the boundaries of the science classroom disappear. Teachers and students work side-by-side, questioning, discovering, sharing and learning. Teachers can effectively and successfully lead a science research project by involving students in all aspects of inquiry. Through its teacher professional development, the VR program prepares teachers to provide the foundational knowledge, skills and experiences students need for future educational achievement, while allowing them to become more involved in the processes of science. It levels the learning field for students, not by lowering standards or resources, but by raising the bar and bringing all students and teachers up to it.

Program Results Highlights:

In addition to the less tangible, but critical outcomes of increasing student enthusiasm and involvement in science learning, all of the VR program's efforts continue to yield a surge in student achievement across the board.

Opportunities for Support/Replication:

The VR program encourages interested corporations, government agencies, higher-education institutions and nonprofit organizations to contact it about supporting the program, providing field excursion opportunities, allowing scientist-employees to participate, or incorporating the VR program into existing science education outreach programs.



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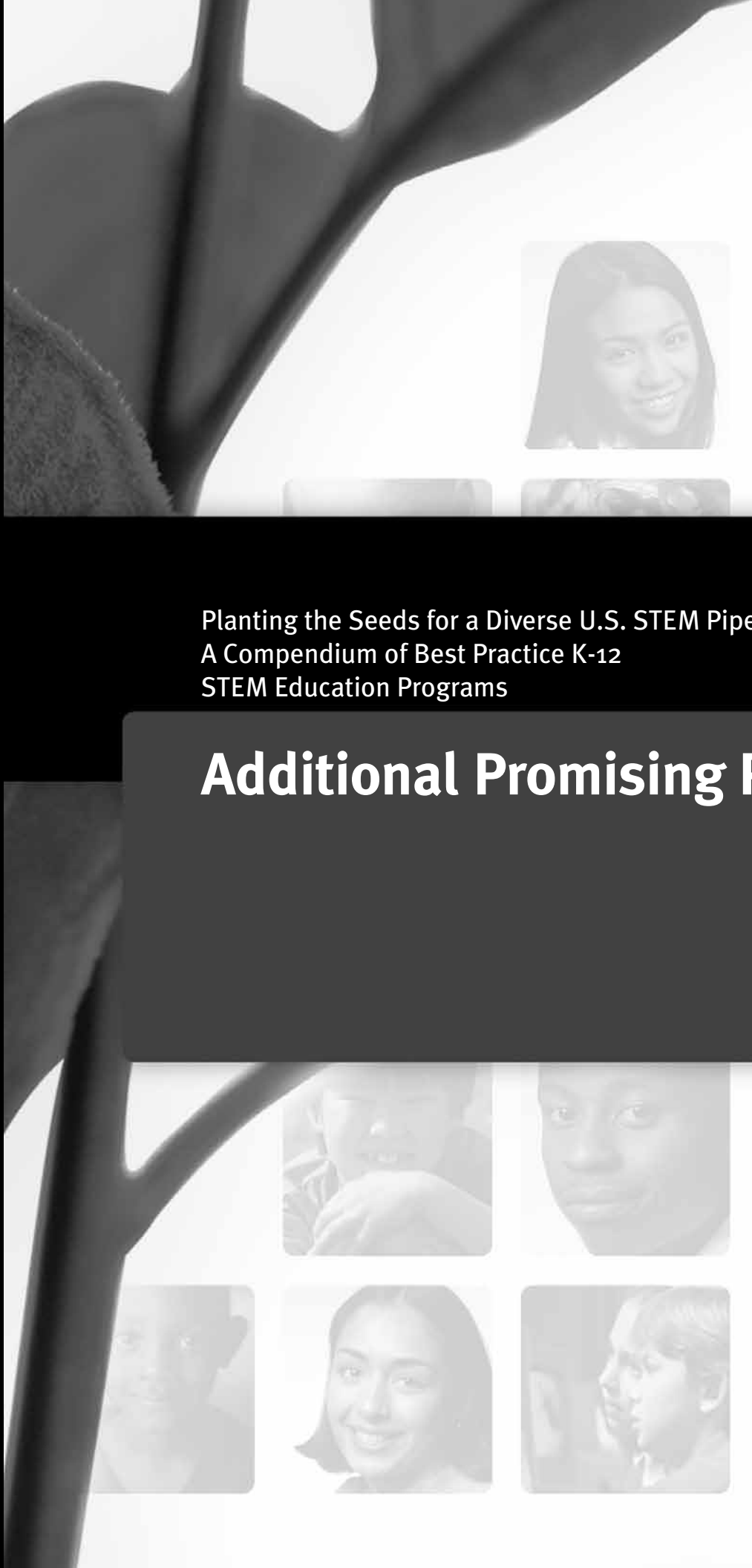
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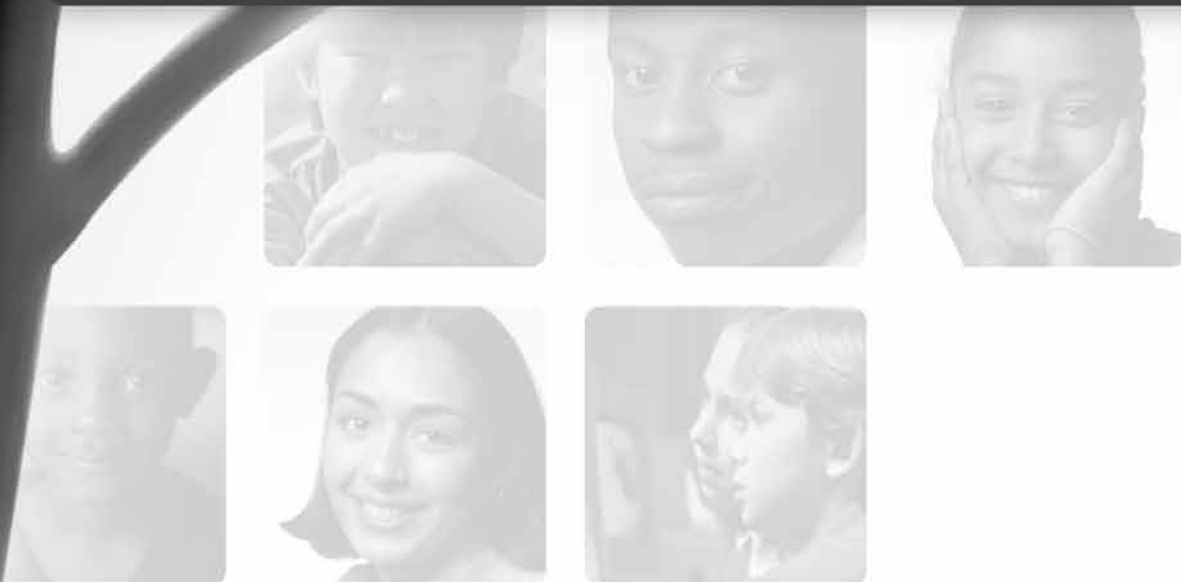
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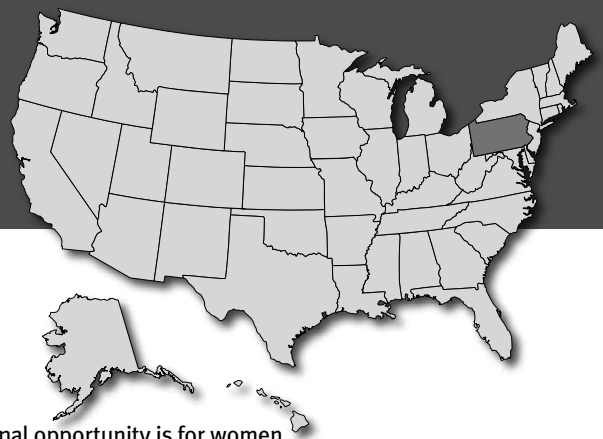


Planting the Seeds for a Diverse U.S. STEM Pipeline:
A Compendium of Best Practice K-12
STEM Education Programs

Additional Promising Programs



Allegheny Women's Biotechnology Workforce Collaborative



Program Overview:

Established in August 2007 by the Allegheny-Singer Research Institute and the Community College of Allegheny County, the Allegheny Women's Biotechnology Workforce Collaborative (AWBWC) is a research-based psychosocial educational program designed to provide young women access to STEM careers. This educational opportunity is for women who have had their high school education interrupted and now yearn for self-sufficiency and to continue in the field of biotechnology. The participants live 60 percent below the poverty level and 90 percent have been victimized. This community-based program provides a student-centric holistic model in concert with experiential learning at world-class research labs. Over the three-year experience, the young women gain lab skills, as well as necessary life skills. Participants complete a summer internship within the STEM industry prior to graduation with an Associate's Degree in Biotechnology.

Reach/Target Student Population:

Currently, AWBWC includes 16 young women participants, 20 educators and more than 50 world-renowned researchers and scientists for experiential learning opportunities. Economically disadvantaged and/or African-American women are the target population. Additionally, the program is being introduced to over 100 local high school students who have been identified for future participation.

Community Partners:

AWBWC benefits from a strong partnership among several key Pittsburgh-based organizations, including:

- Allegheny-Singer Research Institute (ASRI) which developed and directs the research based project. Additionally, ASRI provides world renown researchers and scientists to mentor participants in experiential learning opportunities;
- Community College of Allegheny County which provides the academic programming;
- Pittsburgh Tissue and Engineering Initiative which provides access to researchers and scientists to work with participants in experiential learning opportunities;
- The Northside Leadership Conference which helps with job placement; and,
- Allegheny General Hospital which provides in-kind contributions of space and resources.

Learning Environment:

Given that AWBWC participants may not have been academically successful in the past and, perhaps, been out of school for some time, the program works to create a learning environment which fosters and nurtures the minds of learners who are intrinsically motivated despite past performance. Specifically, AWBWC has developed an individualized intervention where students and facilitators learn together through hands-on, inquiry-based, real-world approach.

Program Results Highlights:

After completing their first full year of coursework, the AWBWC students exceeded national averages with a group GPA of 2.89 and 20 percent attrition compared with 60-80 percent of their peers due to insufficient math skills. Furthermore, the women indicated that they are eager to continue their studies. Finally, although not actually participants, AWBWC continues to observe social and academic benefits for the participants' 41 children.

Opportunities for Support/Replication:

AWBWC is looking for private- and public-sector support to continue to develop its program and expand its outreach in the region and beyond.

For More Information, Please Contact:

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Allegheny Women's Biotechnology Workforce Collaborative

Allegheny Singer Research Institute

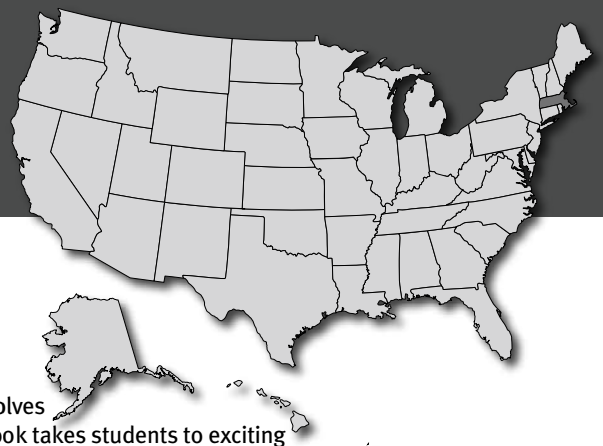
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Building Math



Program Overview:

Established in 2007 by the Boston Museum of Science's National Center for Technological Literacy, the "Building Math" program's mission is to introduce middle school students to engineering while improving their math skills. The program revolves around three books, entitled *Everest Trek*, *Stranded!* and *Amazon Mission*. Each book takes students to exciting places around the world where solutions to unique design challenges help them to hone their math and engineering skills. Each book has three challenges and each challenge takes approximately one week to complete in math class. In addition, the program provides teachers with professional development opportunities to best utilize the materials in the classroom.

Reach/Target Student Population:

The target population is all middle school students. Currently, more than 2,300 books have been purchased by teachers. With an estimate of 50 students per teacher (one book per teacher), the reach of the "Building Math" program is approximately 115,000 students to date.

Community Partners:

Partnering with the Boston Museum of Science to deliver the program's teacher professional development component are:

- Center for Innovation in Engineering and Science Education (<http://www.ciese.org/>);
- Transformation T-STEM 2013 (<http://www.transformation2013.org/>); and,
- Valley City State University (<http://www.vcsu.edu/>).

Learning Environment:

The math classroom comes alive with hands-on activities and team-based learning with open-ended solutions that all require math usage.

Program Results Highlights:

Initial research has been conducted showing the successful integration of the "Building Math" program in both inquiry-based and traditional math classrooms. Additional research is underway to help influence the next editions of the books.

Opportunities for Support/Replication:

While a very young program, "Building Math" is looking for corporate support to expand its reach and help fund its next phase of research.



For More Information, Please Contact:

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Web Site: <http://www.mos.org/nctl>

ENTRYPOINT! Internship Program for Students with Disabilities



Program Overview:

Founded in 1996, ENTRYPOINT! partners with government and private industry to provide 10-week paid-summer internships for undergraduate and graduate students with physical, learning, and other apparent and non-apparent disabilities who are majoring in STEM. Managed by the American Association for the Advancement of Science (AAAS), it is an initiative designed to meet the human resource needs of the private and public sectors by identifying, screening and placing students in productive and challenging positions.

Reach/Target Student Population:

Students are recruited from accredited institutions and must submit a letter of interest, resume, transcript, two letters of recommendation, validation of U.S. citizenship and list of required accommodations. Prospective interns must have a cumulative GPA of 3.0 and reflect gender, racial, geographic, discipline and disability diversity. Internship placements are based on a match between the student's skills and a company's needs.

Community Partners:

The AAAS ENTRYPOINT! partners are NASA, NOAA, IBM, Merck and Google. All of the partners agree to offer 10-week internships to students with disabilities whose skills and academic backgrounds match their company's need. Each company provides mentors and any assistive technology needed by the student to successfully manage the job. AAAS partners provide annual partnership fees or grants to AAAS for recruitment, screening, suggested placement and follow-up of students with disabilities in STEM fields.

Program Results Highlights:

Since 1996:

- 334 individuals have participated in ENTRYPOINT! internships;
- 52 additional students were placed in 2006;
- 74 are continuing on to graduate studies;
- 18 are pursuing or have received a Ph.D.;
- 50 have converted from internships to full-time employment;
- 17 are African-American;
- 12 are Hispanic; and,
- 245 are women.

Opportunities for Support/Replication:

ENTRYPOINT! welcomes public- and private-sector support, as well as internship opportunities for its students from corporations and other organizations.

For More Information, Please Contact:

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Web Site: www.entrypoint.org

Math and Science Programs for English Language Learners



Program Overview:

Since the early 1980s, the University of California, Berkeley's Lawrence Hall of Science has undertaken groundbreaking work to implement strategies for teaching math and science to English language learners, in an effort to narrow the gap that exists between English language learners and their native English-speaking counterparts. In the past five years, this work has coalesced into the Math and Science Program for English Language Learners (MSPELL), through which the Lawrence Hall of Science conducts teacher professional development to provide educators with tools and knowledge they need to understand the underpinnings of second language acquisition, as well as teaching strategies that help students understand science and math concepts, and address the role culture plays in learning.

Reach/Target Student Population:

The target population for the program is teachers of elementary and middle school students in New York City, San Francisco, Oakland and Tahoe/Truckee, Calif. The student population includes students for whom English is not their first language. These students face a triple challenge of learning English both socially and academically, navigating unfamiliar cultural and social norms and learning content.

More than 200 teachers have participated in these professional development efforts to date. In New York, the Lawrence Hall of Science works with three middle schools, two in Manhattan and one in the Bronx, providing training and resources to entire math departments. In 2009, due to the program's success, it will expand to 22 additional New York City public schools. In San Francisco, the Lawrence Hall of Science serves 50 math and science middle school teachers. In Tahoe/Truckee, MSPELL works with 130 elementary teachers.

Community Partners:

In each community, LHS partners with different groups to deliver the MSPELL program, including:

- New York City – school administrators and the Massachusetts-based Education Development Center;
- San Francisco - San Francisco Unified School District and the National Science Foundation;
- Tahoe/Truckee – Tahoe/Truckee Unified School District and the California Postsecondary Education Commission; and,
- Oakland - Aspire Charter Schools and the National Science Foundation.

Learning Environment:

The ultimate goal is for ELL students to grasp mathematics and science content in a manner comparable to their English-speaking counterparts. With this goal in mind, the successful learning environment is marked by an inquiry-based approach that is interactive, collaborative and high energy.

Program Results Highlights:

While the program is in its formative stages, LHS has already seen positive results in its work. For example, in New York City, proficiency rates on state tests for third through eighth grade show 59 percent of English language learners meeting mathematics content standards in 2008 compared to 36 percent in 2006. Feedback from participating teachers has been very encouraging as well, indicating clear improvements in their skills and understanding of working with English language learners. The project in Tahoe/Truckee was evaluated by the funder and was one of five projects awarded a fourth-year budget augmentation because of its impact and excellence. An evaluation study is currently being conducted in Oakland.

Opportunities for Support/Replication:

Since this program is still in the early stages, in order to expand its reach, the Lawrence Hall of Science needs supporters who can help underwrite program delivery and ongoing support for participating teachers who are becoming experts, not only with the use of these new instructional strategies but as providers of professional development for their peers working with English language learners.



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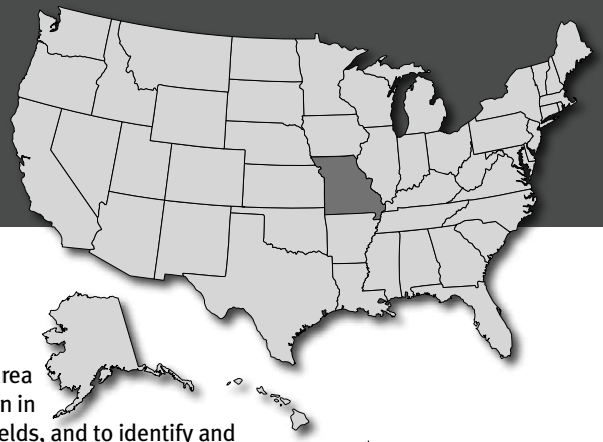
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Email: lhsdir@berkeley.edu

Web Site: www.lawrencehallofscience.org

St. Louis Regional Engineering Academy



Program Overview:

The St. Louis Regional Engineering Academy (SLREA) is a regional partnership of business and industry, area high schools, St. Louis Community College and other area colleges and universities. Its purpose is to enhance and expand technical education in high schools, to encourage students to explore engineering and technical career fields, and to identify and pursue the academic prerequisites for college engineering programs. To accomplish these goals, SLREA supports the Project Lead The Way (PLTW) curriculum in St. Louis-area high schools.

Reach/Target Student Population:

Implementation of the PLTW curriculum in the St. Louis-area schools began in 2002, with Riverview Gardens as the first school district to offer the program to 10 students. In the last six years, the program has grown to 22 high schools and more than 2,100 students.

Community Partners:

SLREA works closely with the St. Louis Industry Council, a group of STEM corporations and industry leaders, such as Boeing, GKN Aerospace, Tyco-Mallinckrodt and Ameren UE, who are interested in developing the trained workforce and engineering talent necessary to move their businesses forward. Specifically, through its partnership with SLREA, the St. Louis Industry Council provides:

- industry mentors to PLTW schools through a planned and coordinated program;
- assistance in review and delivery of curriculum;
- opportunities for field trips, internships and summer jobs;
- ongoing evaluation and future direction of the Academy;
- promotion of the program to school superintendents, teachers and counselors; and,
- third-party advocacy for the program in the community, particularly to parents and media.

Learning Environment:

SLREA, through PLTW, creates a classroom environment that results in high school graduates who are able to successfully enter the workforce and use technology in problem solving; understand and apply the scientific process; be prepared for challenging college engineering courses; understand technological systems; use mathematics in problem solving; communicate effectively; and, work in teams.

Program Results Highlights:

The success of SLREA lies in its ability to unite business and education under an economic development umbrella. It is:

- helping develop a technical workforce to keep St. Louis competitive; and,
- building a regional asset to recruit new and retain existing STEM industry companies to the area.

Opportunities for Support/Replication:

SLREA provides a model for how key community stakeholders – in industry and education – can work together to effectively improve science education and prepare a local workforce with strong science literacy skills.



For More Information, Please Contact:

Ashok Agrawal

Dean of Math, Science, Engineering, and Technology Division


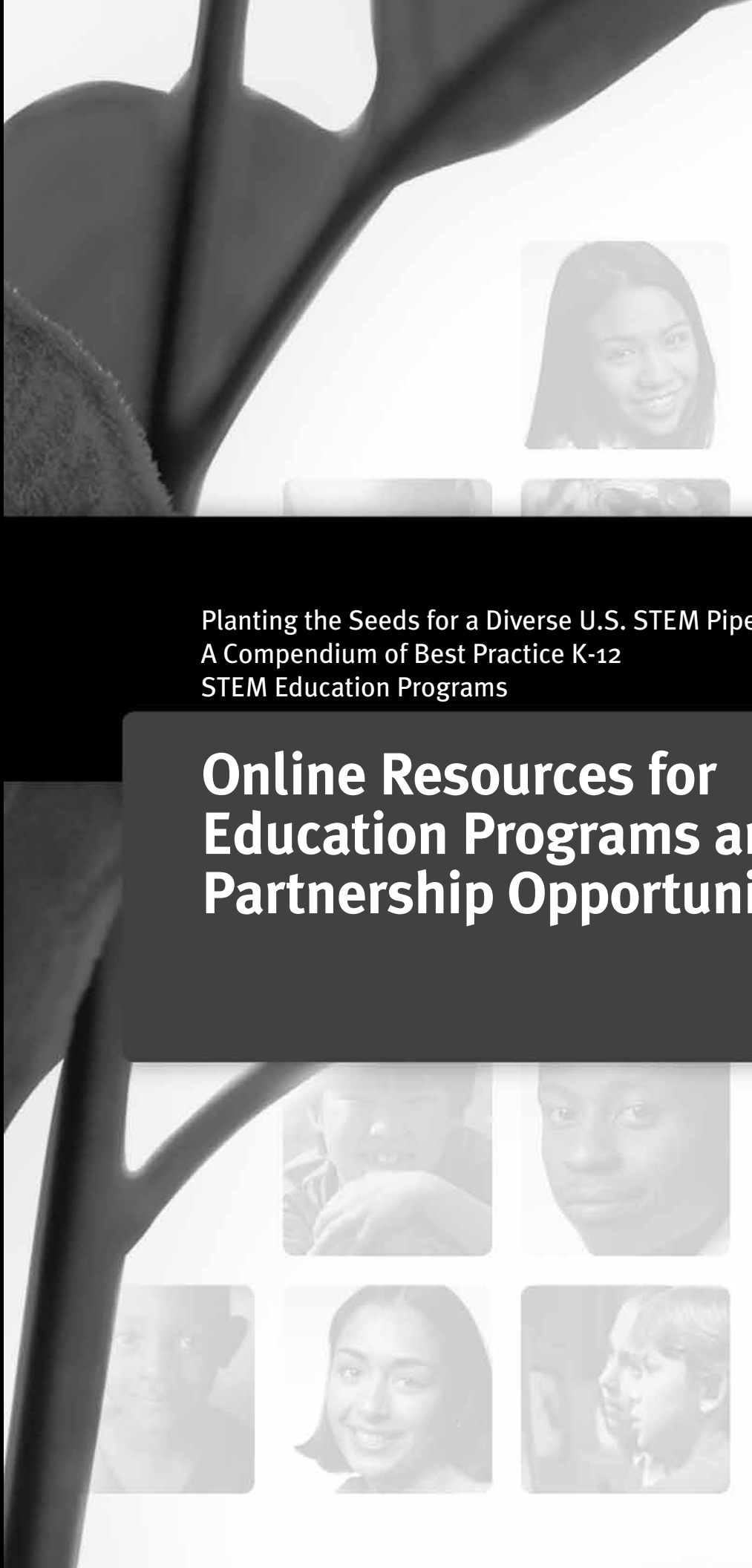
St. Louis Community College at Florissant Valley

3400 Pershall Road

St. Louis, MO 63135-1499

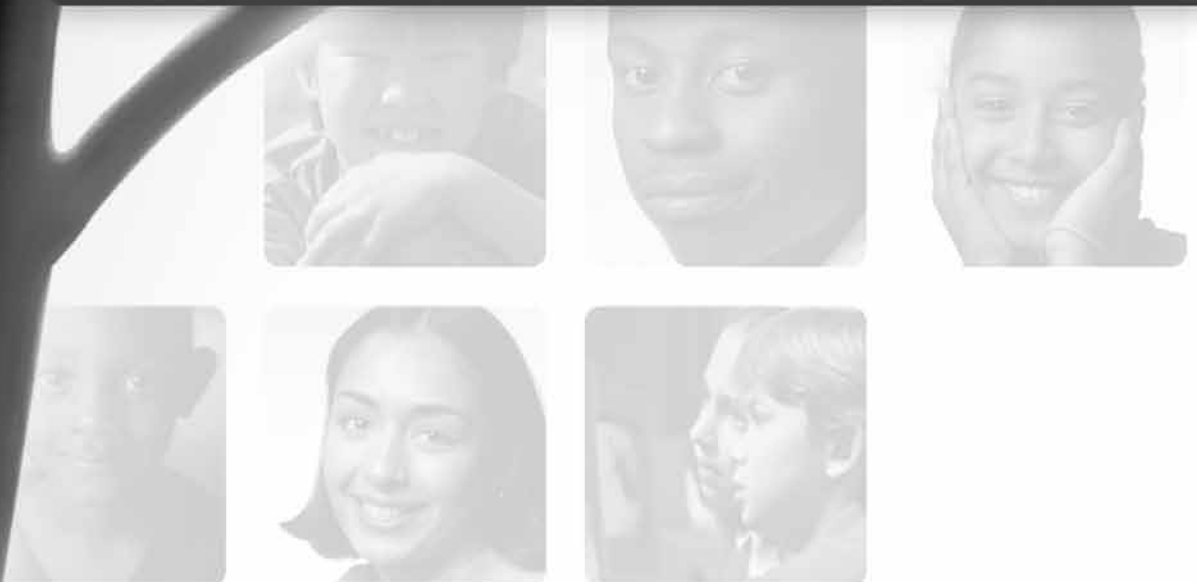
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Planting the Seeds for a Diverse U.S. STEM Pipeline:
A Compendium of Best Practice K-12
STEM Education Programs

Online Resources for Education Programs and Partnership Opportunities



STEM Organizations

American Association for the Advancement of Science
www.aaas.org

American Association of Engineering Societies
www.aaes.org

American Chemical Society
www.chemistry.org

American Chemistry Council
www.americanchemistry.com

American Indian Council of Architects and Engineers
www.aicae.org

American Indian Science and Engineering Society
www.aises.org

American Institute of Biological Sciences
www.aibs.org

American Institute of Chemical Engineers
www.aiche.org

American Mathematical Society
www.ams.org

American Society for Engineering Education
www.asee.org

American Society of Agricultural Engineers
www.asae.org

American Society of Civil Engineers
www.asce.org

Association for Women in Computing
www.awc-hq.org

Association for Women in Science
www.awis.org

Association of American Indian Physicians
www.aaip.org

Association of Women in Mathematics
www.awm-math.org

Council for Chemical Research
www.ccrhq.org

Extraordinary Women in Engineering Project
www.engineeringwomen.org

National Academy of Engineering
www.nae.edu

National Academy of Science
www.nasonline.org

National Action Council for Minorities in Engineering
www.nacme.org

National Society for Black Engineers, Inc.
www.nsbe.org

National Society of Black Physicists
www.nsbp.org

National Society of Professional Engineers
www.nspe.org

National Technical Association, Inc.
www.ntaonline.org

Society for the Advancement of Chicanos and Native Americans in Science
www.sacnas.org

Society of Hispanic Professional Engineers
www.shpe.org

Society of Mexican American Engineers and Scientists
www.maes-natl.org

Society for Science and the Public
www.societyforscience.org

Society of Women Engineers
www.swe.org

The Mathematical Association of America
www.maa.org

The National Alliance of State Science and Mathematics Coalition
www.nassmc.org

Women in Engineering Programs and Advocates Network
www.wepan.org

Women in Technology International
www.witi.com

Education Organizations

Education Trust

www.edtrust.org

Local Systemic Change Network

lsc-net.terc.edu

Math and Science Partnership Network

www.mspnet.org

National Association of Research and Science Teaching

www.narst.org

National Council of Teachers in Mathematics

www.nctm.org

National Science and Technology Education Partnership

www.nationalstep.org

National Science Resources Center

www.nsrconline.org

National Science Teachers Association

www.nsta.org

The International Society for Technology in Education

www.iste.org

Triangle Coalition for Science and Technology Education

www.trianglecoalition.org

Government Agencies and Organizations

Department of Education

www.ed.gov

Department of Energy

www.doe.gov

NASA

www.nasa.gov

National Institutes of Health

www.nih.gov

National Science Foundation

www.nsf.gov

The White House Office of Science and Technology Policy

www.ostp.gov

Business Organizations

Business-Higher Education Forum

www.bhef.com

Council for Aid to Education

www.cae.org

Council on Competitiveness

www.compete.org

Minority Business Roundtable

www.mbrt.net

National Association of Manufacturers

www.nam.org

The Business Roundtable

www.businessroundtable.org

The Conference Board

www.conference-board.org

U.S. Chamber of Commerce

Business Civic Leadership Center

www.uschamber.com/bclc



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