



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

# A Compendium of Best Practice K-12 STEM Education Programs

Updated 2016



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 cursive, with a long horizontal stroke at the end.

**Mae C. Jemison, M.D.**

Principal, 100 Year Starship

Bayer’s *Making Science Make Sense*® Chief Ambassador

# Table of Contents

<b>About Bayer's Making Science Make Sense® Initiative .....</b>	<b>3</b>
<b>Key Criteria.....</b>	<b>4</b>
<b>K-12 Best Practice Programs</b>	
American Chemical Society's Project SEED .....	6
ASSET STEM Education .....	8
Biotech Partners.....	10
Community Resources for Science.....	12
Detroit-Area Pre-College Engineering Program (DAPCEP) .....	14
Developmental Approaches in Science, Health and Technology (DASH).....	16
Engineering is Elementary .....	18
Environment as a Context for Opportunities in Schools (ECOS) .....	20
EQUALS .....	22
Family Math.....	24
Foundational Approaches in Science Teaching (FAST).....	26
Full Option Science System (FOSS).....	28
Great Explorations in Math and Science (GEMS) .....	30
Illinois Math and Science Academy (IMSA) Fusion.....	32
Kinetic City .....	34
Marine Activities, Resources and Education (MARE).....	36
Mathematics, Engineering, Science Achievement (MESA) .....	38
MIND Research Institute .....	40
Pre-freshman Engineering Program (PREP-USA) .....	42
Project Lead The Way .....	44
Science in Motion.....	46
Summer Science Academy .....	48
Science Education for Public Understanding (SEPUP) .....	50
Seeds of Science/Roots of Reading™ .....	52
Stanford Medical Science Youth Program .....	54
Techbridge.....	56
Texas Bioscience Institute.....	58
The Earth We Share (TEWS).....	60
USDA Future Scientists.....	62
VisualRealization.com .....	64
<b>Online Resources for Education Programs and Partnership Opportunities</b>	
STEM Organizations.....	67
Education Organizations .....	68
Government Agencies and Organizations.....	69
Business Organizations.....	70

# About Bayer's *Making Science Make Sense*<sup>®</sup> Initiative

Bayer is a global enterprise with core competencies in the life science fields of health care and agriculture. Its products and services are designed to benefit people and improve their quality of life. At the same time, the company aims to create value through innovation, growth and high earning power. Bayer is committed to the principles of sustainable development and to its social and ethical responsibilities as a corporate citizen.

As a science and innovation company, Bayer has a strong stake in helping to improve science education and working to ensure that all individuals are scientifically literate. Bayer demonstrates this commitment with its national, presidential award-winning *Making Science Make Sense*<sup>®</sup> (MSMS) initiative, a company-wide program that advances science literacy across the United States through hands-on, inquiry-based science learning, employee volunteerism and public education.

MSMS was formalized in 1995; however, the spirit of the initiative dates back to nearly 50 years ago 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, hundreds of volunteers work to foster science literacy and to ignite student interest in science.

Why this commitment to science education? Bayer, with key focus areas in animal health, consumer health, crop science and pharmaceuticals, has its foundation in one common thread: science. This gives Bayer a unique understanding of the integral role science plays in everyday life. The company recognizes that new technologies, concepts and increasing global market competition will continue to demand a workforce that is flexible, scientifically literate and equipped with the critical thinking, problem-solving and collaboration skills fostered by a quality education. Bayer believes it has a responsibility to help ensure that today's students have access to the kind of quality 'science' education that will properly prepare them for tomorrow's workplace, regardless of the careers they choose.

Dr. Mae C. Jemison – former NASA astronaut, physician, chemical engineer, scientist, educator and Principal, 100 Year Starship – leads Bayer's science literacy campaign. Dr. Jemison is not only the nation's first African-American female astronaut to travel to space, but also serves as Chief Ambassador for the MSMS initiative. For more than 20 years, she has been traveling the country on behalf of Bayer addressing STEM education, science literacy and diversity issues before key audiences, including elected officials, education and industry leaders, parents, teachers and students.

An integral part of the MSMS initiative has been Bayer's work to forge long-standing, deep-rooted partnerships and spearhead important curriculum change in a number of its site community schools. Bayer also has created partnerships with school districts, science centers, government and education organizations and other businesses. These partnerships, including the U.S. Department of Education, National Science Teachers Association and National PTA, are changing the way science is taught and learned in and out of the classroom. Together, these groups work to implement standards-based, inquiry-centered curricula and provide teachers with ongoing professional development in science content and pedagogy.

At the heart of MSMS is the dedication of Bayer volunteers. Employees provide hands-on, inquiry-based science learning experiences through STEM-focused activities, classroom visits, teacher workshops and community events near Bayer site locations, including Berkeley, Calif.; Indianola, Pa.; Institute, W. Va.; Kansas City, Mo., Lubbock, Texas; Memphis, Tenn.; Myerstown, Pa.; New Jersey (Morristown, Parsippany, Whippany); Pittsburgh; Research Triangle Park, N.C.; Shawnee, Kan.; and West Sacramento, Calif.

Program materials such as Experiment Cards and the Periodic Table of Elements are also available to help employees bring MSMS into their communities. In addition, Bayer's ongoing commitment to research through its *Facts of Science Education* surveys continues to gauge public opinion on the state of science education in the United States. Bayer has also published and made available several STEM resource guides. These reports provide business leaders and others with information about best practice K-20 STEM education programs and practical advice for how they can support and/or replicate such programs nationally or in their local communities.

At Bayer, it's about making science more accessible and less intimidating – to kids and adults alike. All people must be able to think their way through the day and be equipped with the knowledge to make intelligent decisions about ordinary issues that they encounter.

For more information about Bayer's MSMS initiative, visit: [MakingScienceMakeSense.com](http://MakingScienceMakeSense.com).

# 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.



# K-12 Best Practice Programs

Planting the Seeds for a Diverse U.S. STEM Pipeline:  
A Compendium of Best Practice K-12  
STEM Education 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 8-10 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, more than 400 students participate in Project SEED at more than 100 institutions. In addition, over 400 volunteer scientist-mentors participate in the program (no mentor has more than 2 students). Since 1968, 10,000 high school students have participated in Project SEED. Approximately 65 percent of the students are from underrepresented groups in the sciences, primarily African-American and Hispanic. In addition, 60 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 efforts to providing a meaningful experience for the students.

## Learning Environment:

Students work in academic, industrial or governmental laboratories for 8-10 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.

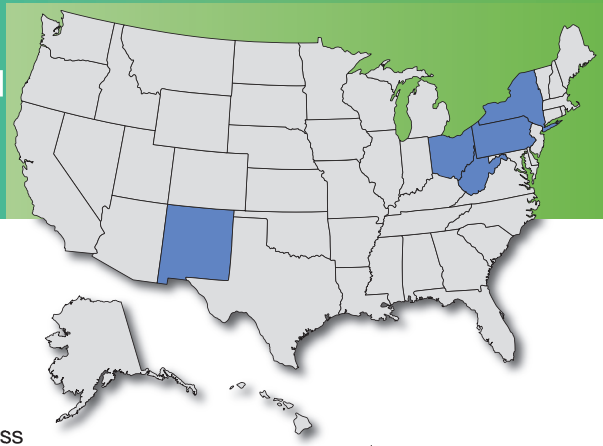


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## Program Overview:

ASSET STEM Education™ (ASSET) is a leading national science, technology, engineering and math (STEM) education improvement nonprofit established by Bayer Corporation and a coalition of community partners in 1994. ASSET fosters STEM fluency and college/career readiness by providing educators of all students pre-K through career, with highly-effective professional development, hands-on educational materials and consulting services. ASSET's programs align with national and state educational standards and are results-oriented, research-grounded and inquiry-based.

ASSET also provides professional development to teachers in New Mexico, New York, Ohio, Pennsylvania and West Virginia and has consulted with educational organizations across the U.S. on STEM education reform and capacity building. All of the organization's 130+ professional development offerings are customizable for more personalized learning opportunities. ASSET's materials support program provides access to cost-effective, hands-on STEM classroom materials refurbished and stored at its 30,000-square-foot Materials Support Center.

ASSET represents Pennsylvania as part of Battelle's STEMx™ national network, a multi-state network with an imperative for action on STEM. The STEMx™ network is comprised of 19 member state networks and currently impacts more than 8 million students nationwide. In 2010, ASSET was selected as one of 49 first-round recipients of a U.S. Department of Education Investing in Innovation Grant (i3) to validate its model in rural and high-needs schools.

## Reach/Target Student Population:

ASSET believes *all* students can learn and should be provided equal opportunities to learn. ASSET currently impacts more than 250 public, charter and private schools and educational organizations in Pennsylvania alone. Annually its programs influence the lives of thousands of educators and hundreds of thousands of students across the nation.

## Community Partners:

ASSET believes that collective impact achieves meaningful results. ASSET has more than 200 community partners—corporations, foundations, universities and school districts—who provide support and an array of services, such as grants, in-kind contributions, fundraising assistance and volunteers. Among ASSET's partners are Bayer Corporation, Buhl Foundation, Dollar Bank Foundation, Duquesne Light Company, FedEx Ground, Freeport-McMoRan, Inc., FTS International, The Grable Foundation, The Heinz Endowments, Kinder Morgan Foundation, The Pittsburgh Foundation, PNC Grow Up Great, PPG Industries, Inc., UPMC and Westinghouse Electric Company.

## Learning Environment:

ASSET is built around the powerful notion that educators are innovators and agents of change to advance the learning experience. 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:

- science is an ideal entry point for students to explore their surroundings, ask questions, collect and analyze data, think critically and pursue new opportunities for their future;
- ongoing professional development is vital to continuously improving teaching and learning;
- an open and collaborative culture creates powerful and sustainable improvement in education;
- when teachers learn, students learn; and
- rigorous research and development is integral to providing teachers with new opportunities to continuously improve their craft.

## Program Results Highlights:

Independent evaluations have consistently demonstrated ASSET's positive effects on educator development and student achievement:

- Fourth-grade students in ASSET member schools scored statistically significantly higher in science on a standardized state assessment than students in demographically-similar comparison schools. ASSET students also achieved higher scores in mathematics and reading (Banilower & Weis, 2009).
- Fifth-grade students in ASSET-supported schools scored significantly higher than the national average on a standardized international science and math assessment and were competitive with seventh graders from high-performing countries (Raghavan, Cohen-Regev & Strobel, 2001).

ASSET has also been honored with the 2012 Engineer's Society of Western Pennsylvania (ESWP) "President's Engineering Award" and the 2011 Carnegie Science "Catalyst for Education" award. The organization has also been supported by the National Science Foundation (NSF) and the Pennsylvania Department of Education through the statewide *Science: It's Elementary (SiE)* program, a 5-year (2006-2011), \$50 million investment. An independent evaluator provided remarks regarding SiE'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*.

Additionally, ASSET's Elementary Program met the rigorous criteria for inclusion in the Change the Equation STEMworks Database, a national database of evidence-based STEM programs.

### **Opportunities for Support/Replication:**

ASSET welcomes public and private sector support and accepts contributions through Pennsylvania's Educational Improvement Tax Credit program.

ASSET's STEM Scholarship Program, established in honor of ASSET's 20th anniversary in 2014, will help provide STEM education opportunities to under-resourced and underserved schools and educational organizations. Through the innovative STEM Scholarship Program, ASSET delivers proven results to support students and educators who otherwise would not be able to access its programs and services. For more information about ASSET's STEM Scholarship Program, visit <http://assetinc.org/stem-resources/stem-scholarship>.

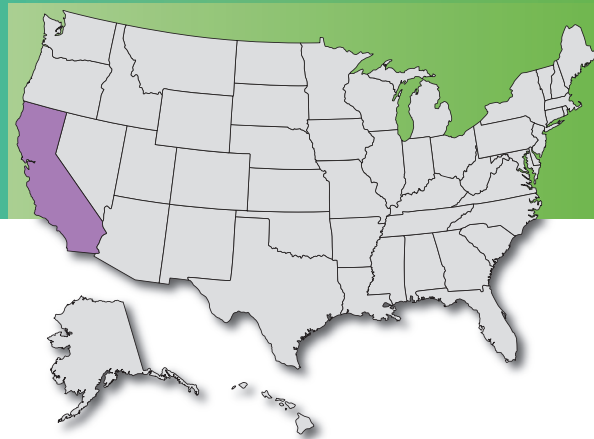


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# Biotech Partners



## Program Overview:

Founded in 1993 as part of a 30-year Development Agreement between Bayer and the City of Berkeley, Biotech Partners is a nationally recognized model for school-to-career partnerships. Biotech Partners, a 501(c)(3) organization, provides a comprehensive, hands-on academic and job-training program to 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.

In 2012, Biotech Partners developed its Strategic Plan with a goal to expand its program services within the Greater Bay Area. Through a Response to Proposals, Biotech Partners selected four new expansion sites for fall 2015 and fall 2016, respectively: South San Francisco High School (San Mateo County); Antioch High School (Contra Costa County); Making Waves (Alameda County); and San Marin High School (Marin County).

## Reach/Target Student Population:

Currently, Biotech Partners works with approximately 170 young people at Berkeley High School, Oakland Technical High School and Peralta Community College District; South San Francisco High School and Antioch High School. More than 90 percent of BP's students are youth of color, 50 percent of all students are female and 85 percent come from low income families. Before entering the Academy, most students have no concept of career opportunities available to them in biotech and little to no confidence that they could ever be employed as "a scientist."

## Community Partners:

Today, Biotech Partners' work is supported by the generous participation of and funding from more than 30 corporate, government, foundation, education and health care partners. Approximately 15 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 Department 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 five Bay Area school districts to provide the educational component of the program: Berkeley Unified School District; Oakland Unified School District; Peralta Community College District; South San Francisco Unified School District; and Antioch Unified School 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. Biotech Partners 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, housing instability and family challenges. 2) In order for academics to matter to Biotech Partners' target population, the curriculum must be engaging, hands-on and, most importantly, 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. 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 1,200 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 from high school, and 99 percent of these students matriculated to post-secondary institutions. 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. 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:**

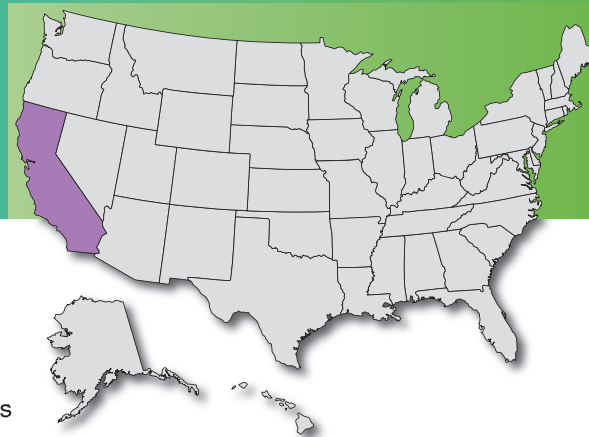
Biotech Partners welcomes financial contributions and student-internship opportunities from corporations and other organizations, as well as scientist-mentor volunteers who can work with its students. Lauded by the U.S. Department of Labor and others as an exemplary school-to-career program, Biotech Partners is scaling up its programs and services within other communities.



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# Community Resources for Science



## Program Overview:

Founded in 1997, Community Resources for Science (CRS) is building a community of educators and scientists working together to get young students excited about learning through science and engineering. CRS serves as a hub for teachers, science and environmental education programs and STEM professionals, providing information, online resources, professional development workshops and direct on-call support to improve elementary science teaching and learning. The CRS Bay Area Scientists in Schools (BASIS) program recruits, prepares and deploys scientists and engineers into classrooms to lead exciting, standards-aligned hands-on, minds-on lessons while serving as diverse, enthusiastic STEM role models.

## Reach/Target Student Population:

CRS serves public K-6 schools in the Bay Area, Calif., primarily in the urban East Bay corridor from West Contra Costa through Berkeley and Oakland. Overall, 75 percent of the schools in our network are in low-income, under-resourced communities. About 25 percent of students served are English language learners; about 40 percent overall are Hispanic/Latino; 32 percent, African-American; 13 percent, Asian/Pacific Islander; 8 percent, white; and the balance is “other.”

In 2015, CRS served nearly 1,400 teachers in over 130 schools across multiple school districts. Together these educators taught over 30,000 young students. The CRS BASIS program involves over 500 active STEM professional volunteers who visit more than 500 classrooms and engage over 12,000 young students in science learning each year.

## Community Partners:

CRS partners include foundation and corporate funders, university and private industry-based STEM professionals who volunteer their time and talent, academic and education leaders and informal education organizations who serve on the CRS Advisory Council. Key partners include the University of California, Berkeley; the Bay Area Science Project; Gateways Regional STEM Network; Oakland Unified School District; informal science education institutions such as Exploratorium, Chabot Space & Science and Cal Academy; and corporate partners such as Bayer and the Clorox Company who contribute grants and employee volunteer time.

## Program Results Highlights:

As a direct result of CRS support services, teachers indicated they:

- |   |     |
|---|-----|
| • Increased the amount of science they teach                          | 80% |
| • See how effectively science activities engage all types of students | 81% |
| • Know where to find information and science teaching resources       | 91% |
| • Added a new field trip, lesson or activity                          | 83% |
| • Became more enthusiastic about science teaching                     | 88% |

Of teachers who DID have BASIS in class presentation, 100 percent indicated that observing their students’ engagement in the BASIS activity encouraged them to include more science activities in their classroom!

Teachers also reported that BASIS presentations had the following impacts on their students:

- |   |      |
|---|------|
| • Presentations helped dispel student stereotypes of “who” is a scientist                       | 90%  |
| • Grew more interested in science   | 100% |
| • Connected what we learned in the classroom with experiences in their lives and the real world | 97%  |
| • Asked thoughtful questions  | 97%  |
| • Discussed their own science observations and ideas  | 99%  |
| • Effectively learned new science concepts  | 99%  |

### **Opportunities for Support/Replication:**

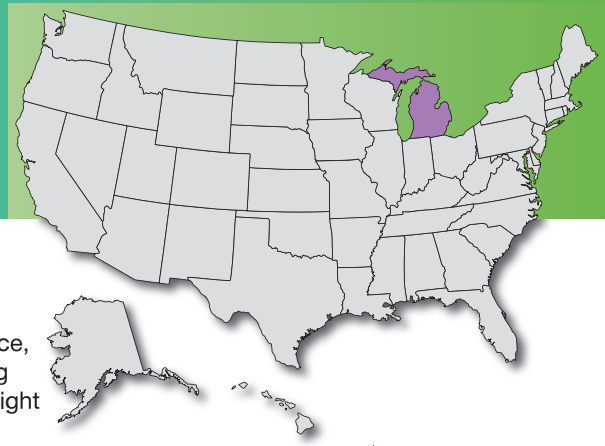
Community Resources for Science welcomes public and private sector partnerships to further develop the quality and quantity of science and engineering teaching and learning for students in the critical early years of the K-12 progression. CRS has successfully implemented regional scale up and is exploring opportunities to bring more science resources and STEM professionals as volunteers to more teachers, students and classrooms. Together we can inspire the next generation of makers, inventors, innovators, leaders and problem solvers. Each investment of \$10,000 allows CRS to bring science support to 40 additional teachers and up to 3,000 additional students.



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# Detroit Area Pre-College Engineering Program (DAPCEP)



## Program Overview:

DAPCEP is an educational organization that provides state-of-the-art science, technology, engineering, mathematics and medicine (STEMM) programming to underrepresented youth in metropolitan Detroit. DAPCEP partners with eight Michigan universities to develop and facilitate engaging curricula that are designed to increase the number of students who graduate from high school and pursue degrees in STEMM subjects. Programming targets youth pre-Kindergarten through 12th grade.

## Reach/Target Student Population:

- Over 4,000 students served annually
- 70% City of Detroit residents
- 50% Detroit Public School students
- 50% Female
- 30% Attend Charter schools
- 40% Free/Reduced Lunch eligible

## Community Partners:

DAPCEP works extensively with 8 Michigan Universities, technical corporations and K-12 systems to provide over 4,000 students annually in out-of-school time and in-school educational programming:

- Universities: University of Detroit Mercy, Wayne State University, Michigan State University, Michigan Technological University, Lawrence Technology, Oakland University, the University of Michigan Ann Arbor, University of Michigan Dearborn
- Technology-Based Corporations: Nissan, Ford Motor Company, General Motors Company, Quicken Loans, Kidpreneur, Walker-Miller Energy Consulting
- K-12 Systems: Detroit Public Schools, Chandler Park Academy, University YES Academy, Cornerstone Schools, DEPSA

## Learning Environment:

Through partnerships with Michigan universities, community organizations and corporations, we offer students a variety of hands-on courses in both fundamental and advanced STEM topics on Saturdays during the fall and spring. Students in Grades 4 to 12 have over 30 courses to choose from each semester. Each semester course is comprised of a series of six (6), 3 - 4 hour sessions. Courses are held on university, corporate or community campuses, providing students critical and exciting exposure to higher educational and professional environments. DAPCEP provides bus transportation from three locations in Detroit and Southfield.

Program goals include:

- Increase student interest in STEM.
- Expose students to campus-centered, academic activities to enrich traditional academic programming and get students excited about higher education.
- Increase student proficiency in their respective STEM courses.
- Expose students to opportunities in STEM fields to generate excitement about future careers.
- Motivate students to graduate from high school and matriculate into college.

Working with our university and corporate partners, DAPCEP program participants will have the opportunity to gain life changing experiences designed to expose, motivate and prepare them for promising technology-based careers and/or post-secondary education. An investment from the Fifth Third Foundation will enable DAPCEP to continue its development of the next generation of technical entrepreneurs and STEM professionals.

## Program Results Highlights

- Key vehicle to expose students to post-secondary education and career pathways in STEMM fields:
  - Engineers and technical professionals are not created overnight: DAPCEP provides students valuable exposure to STEMM fields in a format that is exciting, relevant and challenging. Without DAPCEP, many of the participants would not have access to these opportunities.
- Statewide exposure to careers and universities:
  - Students participate in programs at the following locations outside of Southeast Michigan: Michigan Technological University, Oakland University, University of Michigan Ann Arbor, Michigan State University and Dow Corning.
- Parental engagement in the educational process:
  - DAPCEP provides resources and opportunities to train parents to advocate for their child's education.
- DAPCEP, as a nonprofit organization, is more nimble than K-12 school systems. This is beneficial when working with industry and universities to implement programs for young people.
- DAPCEP employs hundreds of educators and project managers to implement our educational programming to over 4,000 students annually.

## Opportunities for Support/Replication:

DAPCEP is looking to expand exposure opportunities to the Medical and Life Science fields through the development of Saturday courses and research. The organization has developed a “drop-in” volunteer exposure program called STEM+M Squad for technical professionals and corporate volunteers. The program provides volunteers training and a framework for middle school and high school student engagement. For more information, please contact Maria Webb (mwebb@dapcep.org /313-831-3050 X227).

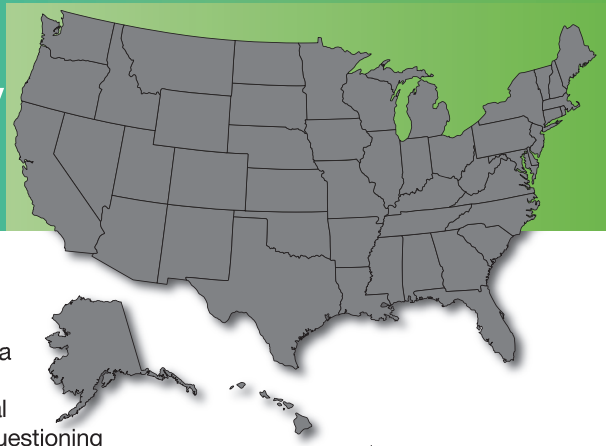


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# Developmental Approaches in Science, Health and Technology (DASH)



## Program Overview:

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 the National Research Council's A Framework for K-12 Science Education and is adaptable to state and national standards. DASH recognizes teachers' needs for content, skills and pedagogy instruction and requires teacher training.

## Reach/Target Student Population:

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.

## Community Partners:

DASH was originally developed with a consortium of 14 universities. Several centers continue to support the program including Carnegie Mellon University, Shippensburg University and the Curriculum Research & Development Group (CRDG) of the University of Hawaii.

## Learning Environment:

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 student log of activities typically recorded electronically or on roll paper), a Responsibility Chart, a Wonder and Discovery Book (record of things yet to be investigated) and Working Dictionary (the dictionary of concepts 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.

## Program Results Highlights:

The program was 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 5 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 2003, the Engineering is Elementary® (EiE®) project aims to foster engineering and technological literacy among children. EiE has created a research-driven, standards-based and classroom-tested curriculum for Grades 1-5 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 a variety of online resources, creates and disseminates afterschool curricula and conducts rigorous educational research.

## Reach/Target Student Population:

As of August 2015, the EiE curriculum has reached more than 87,000 educators and 8 million students in 1st through 5th grades and is used in all 50 states plus the District of Columbia, where it is being implemented district wide. 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 “train-the-trainer” model, working with a variety of regional partners to deliver the program to local schools and support implementation. These partners include:

- professional development collaborators
  - Educators in locations across the country who provide EiE professional development to teachers in their local districts and serve as regional advocates for the EiE curriculum; EiE collaborators include the Institute for Science Education at the University of Alabama in Huntsville, Center for Science Teaching and Learning at Northern Arizona University, Arizona State University, the WestEd agency in California, Connecticut Science Center, Imaginarium Science Center and Orlando Science Center in Florida, Blue Heron STEM Education in Massachusetts, Science Museum of Minnesota, North Carolina State University, Foundation for Family Science and Engineering in Oregon, ASSET STEM Education in Pennsylvania, Center for STEM Education for Girls in Tennessee, Texas Tech University T-STEM Center, CESA SciMaTech program, Marquette University College of Engineering in Wisconsin and many others.
  - EiE is constantly adding new collaborators.
- preservice teacher education partners
  - more than 40 universities, colleges and community colleges across the United States have incorporated EiE into their preservice teacher education programs.
- corporate and foundation partners
  - National Science Foundation, The Cargill Foundation, The Gordon Foundation, Cisco Foundation, Raytheon, S. D. Bechtel, Jr., Foundation, Liberty Mutual Foundation, Cognizant, i2 Camp, Intel Foundation, NASA, National Institute of Standards and Technology, Google Community Grants Fund of Tides Foundation, Massachusetts Board of Education Pipeline Fund, U.S. Institute of Museum of Library Services, U.S. Small Business Administration, SheGives Boston, Oracle, Hewlett-Packard, Millipore and Samueli Foundation have provided generous financial support.
- school district partners
  - scores of school districts have implemented EiE district wide in all first through fifth grade classrooms; notable examples include the Washington, D.C., Public Schools (DCPS), Baltimore City Public Schools, Minneapolis Public Schools, Harford County, Maryland, and Orange County, North Carolina. EiE is also used statewide in Delaware and in Iowa’s statewide STEM Scale-Up program.

## 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:

Research by the EiE project and by external evaluators finds:

- Students who experience EiE show greater gains in science learning than students who use traditional science curricula
- EiE fosters improved attitudes about the value of science and engineering in all students, but particularly girls
- EiE promotes students’ interest in science and engineering careers
- EiE addresses students’ misconceptions about engineering and technology, helping them gain a more accurate, standards-based understanding
- EiE promotes students’ knowledge of engineering content and awareness of the diverse fields of engineering

Research on teachers suggests:

- Teachers who use EiE notice their students (especially underrepresented racial minorities) are more engaged. Students improve their performance in science and in school in general
- Teachers who experience EiE’s professional development feel more prepared to teach engineering, technology and problem-solving

As of August 2015, EiE is in the third year of a four-year, \$3 million National Science Foundation-funded “gold standard” efficacy study of the curriculum.

## Opportunities for Support/Replication:

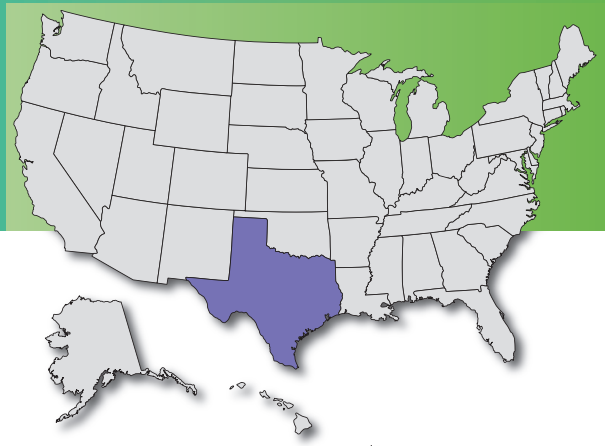
As a program that has been implemented in school districts and communities around the country, EiE is highly replicable. EiE is always looking for new partners (both funding and programming) to bring EiE to more elementary school classrooms in the United States.



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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 has developed and evaluated 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. Development of the ECOS model was 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:

ECOS teaching materials are in use in Houston schools and across the United States to integrate science instruction aligned with the Next Generation Science Standards with reading/ language arts and other subjects. All materials are available free-of-charge on BioEd Online ([www.bioedonline.org](http://www.bioedonline.org)).

The project is aimed at schools with high enrollments of underrepresented minorities (African-American and Hispanic) and economically disadvantaged students (based on statistics for free/reduced lunch). During field testing of the materials, students demonstrated statistically significant content knowledge gains and improved use of science vocabulary.

## Community Partners:

- Houston Independent School District
  - co-planned with district administrators and assistance in the recruitment of schools;
- 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 for the NIEHS-funded grant.

## 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 available on the Website BioEd Online ([www.bioedonline.org](http://www.bioedonline.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 Website BioEd Online ([www.bioedonline.org](http://www.bioedonline.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:**

Agency, authority and identity build mathematically proficient students' character as expected in the current Common Core State Standards for Mathematics. The EQUALS program helps teachers learn how to create a culture of learning that develops students' positive mathematical identity, helping all children 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. EQUALS is part of the Center for Mathematics Excellence and Equity (CeMEE). The Center creates unified and coherent approaches to equity and excellence in mathematics that are responsive to current conditions and expectations in the field. The Center offers services—coaching, professional development and technical assistance—and products to school districts, county/regional offices of education, afterschool organizations, science centers and others in the education field. In addition to professional development programs, a network comprised of thousands of teachers uses 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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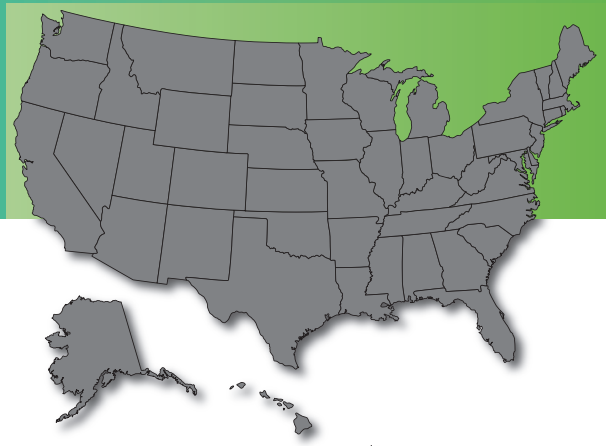
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# Family Math



## Program Overview

Founded in 1981, Family Math and Matematica Para La Familia is a series of books and workshops that provide 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 learning workshops and curriculum materials to parents, educators and community members enabling them to establish Family Math programs in their schools and communities.

## Reach/Target Student Population:

Family Math helps parents understand the challenges and opportunities presented by the shifts in expectations for students' deeper reasoning and academic communication in the current set of Common Core State Standards for Mathematics. The Program is part of the Center for Mathematics Excellence and Equity (CeMEE). The Center creates unified and coherent approaches to equity and excellence in mathematics that are responsive to current conditions and expectations in the field. The Center offers services—coaching, professional development and technical assistance—and products to school districts, county/regional offices of education, afterschool organizations, science centers and others in the education field.

## Community Partners:

Family Math has received support from the U.S. Department of Education, the National Science Foundation and various corporate and foundation 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 and has conducted extensive media and community outreach to 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:

Family Math has been demonstrated to be a program that is highly replicable for communities large and small, and the Center for Mathematics Excellence and Equity (CEMEE) offers programs and services to assist with implementation to meet a variety of needs in a wide range of settings.



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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 aligns with National Research Council's A Framework for K-12 Science Education and is adaptable to state and national 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 developed a collaborative group of 14 universities. Several centers continue to support the program including Carnegie Mellon University and the Curriculum Research and 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:

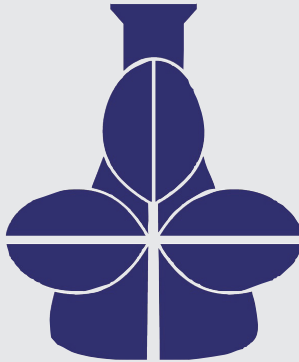
- three student books of sequenced inquiries, one for each grade level;
- three companion reference libraries of monographs detailing laboratory and field techniques;
- printed student data sheets to standardize data collection;
- an instructional guide explaining the program's pedagogy;
- a teacher 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:

The FAST program was assessed by the Expert Panel on Mathematics and Science Education Promising Practices and identified as one of two exemplary programs. 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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# 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 at the Lawrence Hall of Science, University of California, Berkeley, under four separate National Science Foundation grants, including a recent one on the FOSS assessment system. 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 currently 38 K-6 modules (between 2 editions, FOSS Third Edition and FOSS Next Generation Edition—the latter is fully aligned with the Next Generation Science Standards) and 9 middle school courses. Each module includes student materials, an *Investigations Guide*, a collection of *Teacher Resources* and a copy of *Science Resources*, the student readings. FOSSweb is the companion website with videos, science notebook masters and additional electronic resources. 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 by more than 100,000 teachers and 2 million students and is in approximately 16 percent of the nation's school districts. The target population is all K-8 students and teachers.

## 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 the Berkeley Evaluation and Assessment Center, SRI International, WestEd, Center for Applied Special Technology (CAST), TERC, Stevens Institute of Technology, The 21st Century Research and Development in Cognition and Science Instruction, Change the Equation STEMworks, Boulder Language Technologies and many universities, colleges and school districts.

## Learning Environment:

Typical of an inquiry-oriented, interactive 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 firsthand exploration of materials augmented by information from video and text, followed by a reflective discussion of their discoveries to develop student understanding of important science concepts. The students work in collaborative teams to investigate, experiment, gather data, organize information and reach conclusions.

## Program Results Highlights:

FOSS is used in 50 of the 100 largest U.S. school districts. WestEd recently completed a four-year efficacy study using FOSS modules with fourth grade students under a Department of Education grant. In addition, there have been many state and city assessments that underscore the impact of FOSS on underrepresented students. Here are some examples of the impact of FOSS. Details can be found at <http://www.deltaeducation.com/foss/results-testimonials/case-studies>.

- Hartwood Elementary School in Hartwood, Va., uses FOSS in grades 3-5. When a new, more rigorous state assessment was released, students in FOSS classrooms performed measurably better than those in non-FOSS classrooms in reading, math and science.
- Guiding Education in Math and Science Network is an outreach project that develops partnerships with K-8 teachers and administrators from 9 school districts throughout Rhode Island, advising the districts on curriculum, monitoring effectiveness and working to build teacher leadership. They currently use FOSS in all nine districts and have gathered quantifiable evidence of improving student understanding.
- Oakland Unified School District—*A Vision for Elementary Science*  
Walk into any one of the 54 elementary schools in Oakland, Calif., and chances are you'll see students engaged in science using the FOSS curriculum. What's different is that not long ago only a small percentage of Oakland students were receiving comprehensive science instruction on a regular basis. Now, active-learning science is happening in every classroom. And a growing number of teachers are using science as the context for reading, writing and academic discussions in ways that support student understanding of science content, develop literacy skills and promote language acquisition.

- Riverside Unified School District—*Creating a Science-Centered Elementary School*  
Initiating a new curriculum, using FOSS, not only to improve science, but as the focus for developing English language literacy and reinforcing math skills, is a gargantuan task! At Hyatt Elementary School in Riverside Unified School District (Southern California), they are using the FOSS program as the curriculum core for engaging students in learning and in developing language skills. This work has spread to the STEM Academy in Riverside and now to a district-wide Math Science Partnerships Project.
- Montebello and Conejo Unified School Districts—*Making Connections through FOSS: Science, Math, English Language Arts and English As A Second Language*

These two school districts are using FOSS to do some amazing things with their curriculum, improving students' scientific practices and science content knowledge. They are also advancing language literacy by integrating science and English language arts, developing basic language proficiency by scaffolding science lessons to support English-language learners and exercising math skills and concepts by teaching math in context as a fundamental way to think and process information in the enterprise of science. Very deliberate processes have moved these schools and their students to higher levels of achievement.

### **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 can be adopted at the state, city or district level.

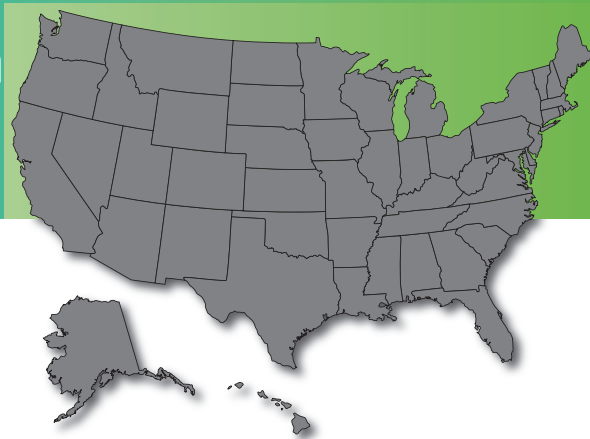


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# Great Explorations in Math and Science (GEMS)



## 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; the McConnell Foundation; the McDonnell-Douglas Foundation and the McDonnell-Douglas Employee 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.



### **THE LAWRENCE HALL OF SCIENCE**

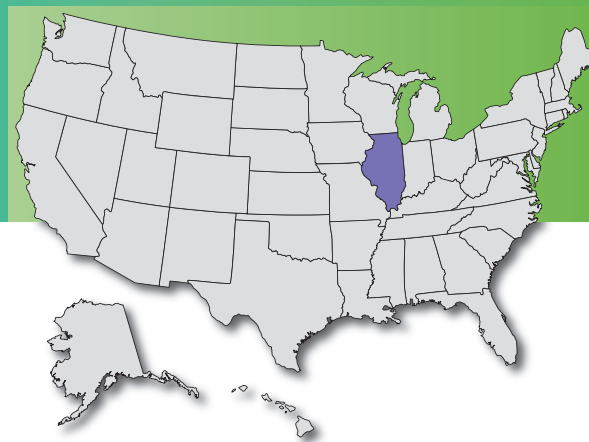
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# Illinois Math and Science Academy (IMSA) Fusion



## Program Overview

The Illinois Math and Science Academy (IMSA) Fusion outreach program is designed to promote excellence in science, technology, engineering and math (STEM) serving students and educators throughout Illinois. The program is both a teacher professional development and an enrichment program for students who are talented, interested and motivated in STEM with a special emphasis on students who are historically under resourced and underrepresented in these areas. The program focuses on late elementary and middle school grades (4th-8th) as research indicates that these teachers need more opportunities to gain content knowledge and that these years are where most students lose interest in science and math. By design, the Fusion curriculum exemplifies IMSA's core expertise which centers upon competency-driven learning experiences that are inquiry-based, problem-centered and integrative. Participating schools are provided not only with curricular materials and training, but with a kit of lab materials for hands-on, minds-on activities for two curricula per school year. Fusion teachers acquire knowledge and skills that transfer into their regular classrooms and benefit all students. Ongoing site visits and support combined with STEM experiences for family and community members are provided to ensure success.

## Reach/Target Student Population

IMSA Fusion has served more than 22,000 students since piloting the program in 2000. For the 2014-2015 school year, Fusion worked with 302 teachers and 3,510 students with 165 programs at 110 sites across Illinois. To help increase access to programming for students who are historically underrepresented in mathematics and science throughout 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

IMSA Fusion has built and fostered a number of long-standing, supportive, community partnerships. In addition, participating schools and administrators are given materials and training to assist them in building program sustainability by promoting and encouraging community involvement. Funding partners have included the Harris Family Foundation, the Pritzker Foundation, the Chicago Community Trust, the Lloyd A. Fry Foundation, Underwriters Laboratories, Ameren, ComEd, an Exelon Company, Boeing, AbbVie, Motorola and Scott Air Force Base. Additionally, 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

IMSA Fusion focuses on helping students “learn how to learn” and emphasizes 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 that affect their local community. Instructional approaches emphasize hands-on, student-centered, engaged learning that integrates mathematics, science and technology.

## Program Results Highlights

The most recent annual Fusion evaluation conducted by the Center for Evaluation & Education Policy (CEEP) at Indiana University surveyed participating students, parents, teachers and administrators from schools and utilized external evaluations of participating teachers to analyze the program’s impact on students and performance in relation to stated goals. In the comprehensive report, students and parents indicate a strong increase in both student interest and ability in math and science after participation in the program. Additionally, the majority of principals stated that teachers have enhanced their regular classroom instruction because of IMSA Fusion. Participating teachers identified a variety of their classroom teaching duties and instruction that are directly influenced by their experiences as instructors in the IMSA Fusion program, including using real-world examples in their teaching of content; having students work in pairs/teams to collect and analyze information; having students identify problems/issues; using open-inquiry strategies in questioning students about their knowledge; and having students engage in group discussions to reflect on their learning.

### Opportunities for Support/Replication

IMSA and the Fusion program welcome and need outside support, including new opportunities for hands-on student experiences. As the program has grown from 7 programs in 2000 to approximately 200 in 2015, the program is one that lends itself easily to replication and further growth.



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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 8 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 8-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 on a high-tech super train, thwarting villains, helping their friends and solving science mysteries.
- *Kinetic City Spark Club* - This eight-week afterschool program teaches students about energy sources and culminates in an energy fair at which the students show off their work and demonstrate sustainable ways to generate electricity.

## Reach/Target Student Population:

Kinetic City’s target population is upper elementary and middle school students, ages 9-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. Hispanic and African-American students comprise a large portion (more than half) of Kinetic City’s members.

## Community Partners:

Kinetic City has worked with:

- a consortium of 11 public charter schools and other D.C. schools, who participated in the *Kinetic City Spark Club* program through a grant from the National Science Foundation.
- 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.
- Afterschool programs at 50 Air Force bases around the country.

## 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:

Evaluation results are available at [www.kcmtv.com](http://www.kcmtv.com). Highlights include:

- 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.
- students made substantial improvements in language arts skills.

## 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 learning 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:

MARE participates in an extensive network of partnerships to promote ocean literacy nationwide and globally, including:

- Institute of Marine and Coastal Sciences, Rutgers University, N.J.;
- Consortium for Ocean Sciences Exploration & Engagement;
- National Marine Educators Association;
- Marine Learning Center, Okinawa, Japan;
- Scripps Institution of Oceanography, Calif., and
- European Marine Science Educators Association

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). Students in upper elementary years explore offshore marine habitats that are more conceptually abstract (kelp forest, open ocean and islands). The curriculum addresses standards in earth, physical and life science, as well as inquiry, language arts, environmental issues, art and music. MARE has also developed new materials that are aligned to the Next Generation Science Standards: The Ocean Sciences Curriculum Sequence for Grades 3-5 and Grades 6-8.

## Program Results Highlights:

MARE evaluation reports over the last 20 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, the Eisenhower Regional Consortia, U.S. Department of Education and the Office of Educational Research and Improvement selected MARE as 1 of the 50 most promising science and mathematics education programs in the country. In 1999, MARE was selected as 1 of 38 "Ideas That Work in Science Professional Development" by the Eisenhower National Clearinghouse. The Ocean Sciences Sequences have been widely acknowledged to be among the first NGSS-designed materials in the country. In 2015 MARE remains the longest running elementary ocean sciences education program in the nation.

### **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.



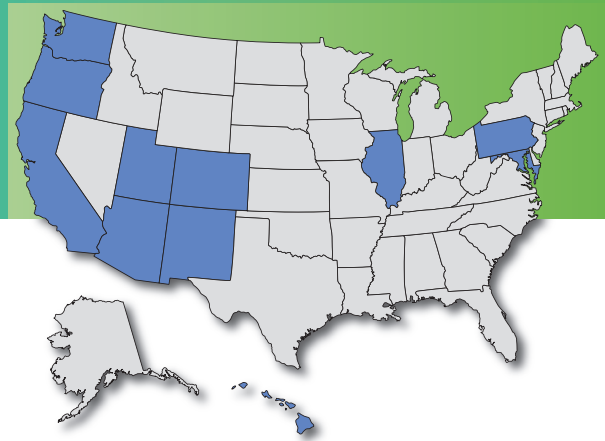
### **THE LAWRENCE HALL OF SCIENCE**

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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 10 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 are among the most underperforming in the state. Within the remaining third, MESA directs its services to the most educationally disadvantaged students. MESA's 3 programs serve 28,192 students at 63 locations in California. It serves 13 universities, 37 community colleges, 99 school districts, 164 senior high schools, 174 middle and junior high schools and 55 elementary schools. The MESA Schools Program serves 20,299 students at 19 centers. The MESA Community College Program serves 4,707 students at 37 centers. The MESA Engineering Program serves 3,186 students at 13 centers at 4-year institutions. MESA centers are located at the University of California, California State University, California Community College and independent college and university campuses. MESA works with 610 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 executive 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. Seventy-six percent of MESA high school graduates go to college, compared to forty-one percent of all California high school graduates. Of California MESA high school graduates overall, 54 percent go on to post-secondary 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:

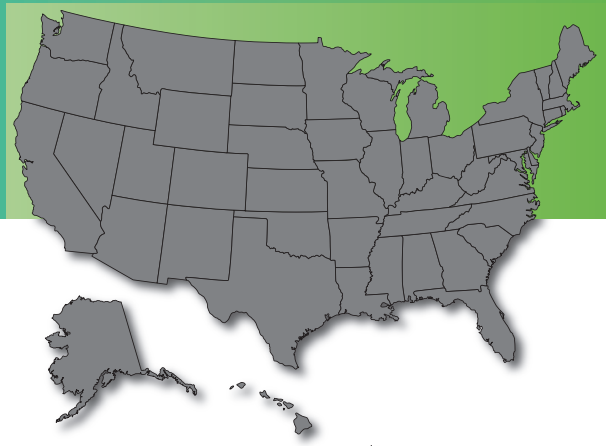
California MESA is the model for similar academic preparation programs in 10 other states, which together are known as MESA USA. These states include Arizona, Colorado, Hawaii, Illinois, Maryland, New Mexico, Oregon, Pennsylvania, Utah and Washington.



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## Program Overview:

MIND Research Institute is a neuroscience and education social benefit organization dedicated to ensuring that all students are mathematically equipped to solve the world's most challenging problems. MIND's distinctive visual approach to math and problem solving is the basis of its innovative, research-proven Spatial-Temporal (ST) Math® programs for elementary and secondary schools. The visually-based ST Math program has been shown to double or triple schools' growth rates in math proficiency. In 2014, MIND initiated a MathMINDs movement to engage the community and students in hands-on mathematical experiences outside of the classroom.

## Reach/Target Student Population:

In 2014, MIND reached 2,500 schools in 40 states with 800,000 students and 31,000 teachers participating. MIND targets K-12 students. Approximately two-thirds of MIND schools serve low-income, low-performing students. About 70 percent of students using ST Math are from traditionally underserved backgrounds: 47 percent Latino and 38 percent African-American. The breakdown by gender is 50 percent male and 50 percent female.

## Community Partners:

The MIND Research Institute receives support for its work and programs from private and family foundations and corporations and/or corporate foundations, including:

- foundation support
  - The Arnold and Mabel Beckman Foundation, Bloomfield Family Foundation, Carol and James Collins Foundation, Croul Family Foundation, The Ella Fitzgerald Foundation, S.L. Gimbel Foundation, The Green Foundation, Norris Foundation, The Rose Hills Foundation, Roth Family Foundation, Sacchi Foundation, Ueberoth Family Foundation, W.M. Keck Foundation, The Cummins Foundation, Podlich Family Fund, The Ahmanson Foundation, WHH Foundation; and
- corporate support
  - PricewaterhouseCoopers, Phillips66, Hyundai Motor America, American Honda Foundation, The Boeing Company, The Capital Group, Chevron, Chicago Mercantile Exchange, Cisco Foundation, Cox Charities for Orange County, Edwards Lifesciences, Emulex Corporation, Flour Corporation, The Gas Company, Hitachi, Microsemi, Northrop Grumman, SchoolsFirst Credit Union, Southern California Edison, Toyota USA Foundation, Verizon, Windsong Trust, John Deere Foundation, Alcoa Foundation, Macy's/Bloomingdale's, OneWest Foundation, The Xerox Foundation, Transcanada and DIRECTV.

## Learning Environment:

Born out of neuroscience research at the University of California, Irvine, MIND's unique approach accesses the brain's innate "spatial-temporal" reasoning ability. This ability, which lies at the core of innovative thinking and sophisticated problem solving, allows the brain to hold visual, mental representations in short-term memory and to evolve them in both space and time, thinking multiple steps ahead. MIND's approach consists of language-independent, animated representations of math concepts delivered via the Spatial-Temporal (ST) Math® software games. 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. A 2014 WestEd study analyzing test score data of more than 19,980 students at 129 California schools showed that after just a year of ST Math, 6.3 percent more students scored proficient or better on state standardized math tests, compared to those at similar schools without the program. This WestEd study measured the impact of ST Math using a statistical term called "effect size," which is basically a measurement of how strong an impact of an input (in this case ST Math implementation) has on an outcome (such as test scores). The larger the effect size, the greater the impact. WestEd found ST Math's effect size across the grades in California to be 0.47 – well beyond the federal What Works Clearinghouse criteria of 0.25 for "substantively important" effect. The What Works Clearinghouse, part of the Institute of Education Sciences, gives educators information about what education programs, practices, products and policies actually work.

**Opportunities for Support/Replication:**

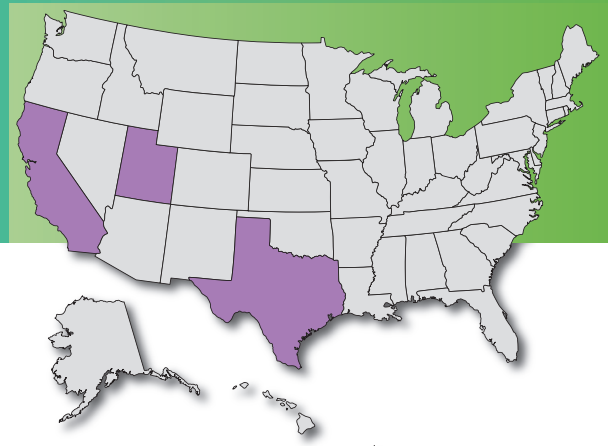
As a social benefit organization, philanthropy plays a central role in carrying out MIND Research Institute’s mission to ensure that all students are mathematically equipped to solve the world’s most challenging problems. MIND partners with corporations, foundations and individuals who are investing in its nationwide and regional initiatives through grants, in-kind donations and employee volunteers.



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# Pre-freshman Engineering Program (PREP-USA)



## Program Overview:

The Pre-Freshman Engineering Program (PREP-USA) is a college-based, academically intense, mathematics-related summer enrichment program, which stresses the development of abstract reasoning skills and their applications. PREP-USA 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 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 2014, PREP-USA served approximately 4,500 students. The students are from middle and high schools in 100+ school districts in Texas, Utah and California. PREP-USA is conducted on 37 community and senior-college campuses throughout the states where it operates. The instructional staff includes approximately 180 teachers and 190 program assistants who are current college students majoring in STEM fields.

## Community Partners:

- State of Texas
- Participating college and university PREP-USA sites
- Local school districts
- Texas Department of Housing Services
- Private industry like Tesoro, Inc., etc.
- Other public and private agencies

## Learning Environment:

A typical day (Monday through Thursday) for a PREP-USA 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 (PREP-USA version of Jeopardy!) and field trips to science or engineering related facilities. In a typical summer, PREP-USA 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 (PREP-USA 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. The program consists of academic, mentoring and career components. In Texas, students who successfully complete the program during the summer and attend a public ISD are awarded one elective high school credit for each summer that they complete successfully.

### Program Results Highlights:

Since the inception of PREP-USA in 1979, over 40,000 middle and high school students have successfully completed at least one summer component of PREP-USA. Of these students, 80 percent have been members of minority groups, 53 percent have been women and 38 percent represent economically disadvantaged families (students who are financially eligible for the school lunch program).

- 81% attend college
- 52% graduate from college
- 73% of the graduates are members of underrepresented groups
- 44% of the college graduates are STEM majors
- 48% of the STEM majors are women and
- 67% of the STEM graduates are members of underrepresented minority groups

### Opportunities for Support/Replication:

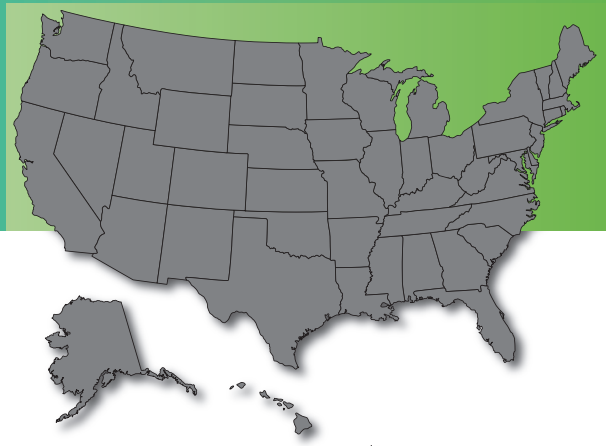
PREP-USA is a proven response towards increasing the number of engineers and scientists within the U.S., and it needs support from outside organizations to maintain and increase the number of students it serves. In addition, public and private sector organizations can provide career awareness speakers.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



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# Project Lead The Way



## Program Overview:

Project Lead The Way (PLTW) is the nation's leading provider of K-12 science, technology, engineering and math (STEM) programs. PLTW delivers its interdisciplinary, project-based programs to more than 8,000 elementary, middle and high schools in all 50 states and the District of Columbia. PLTW schools can be found in rural, urban and suburban districts, across all income levels, as well as in public, private and charter schools.

To compete globally, the future U.S. workforce requires strong STEM skills – skills such as critical thinking, problem solving, collaboration and communication. For PLTW, it's not about turning more students into engineers—it's about inspiring and developing tomorrow's problem solvers, critical thinkers and innovators.

In addition to world-class curricula, PLTW also focuses on providing high-quality teacher professional development to each PLTW instructor. Since 1997, PLTW has trained more than 20,000 teachers using its 3-phase proven approach.

Finally, through an engaged network of educators, post-secondary institutions, policymakers and philanthropic and corporate partners, PLTW helps bring real-world, relevant experiences to students and teachers:

## Reach/Target Student Population:

PLTW engages students through hands-on learning and real-world problem solving in five programs of study. Together, these programs create K-12 pathways in engineering, biomedical science and computer science:

- PLTW Launch (K-5)
- PLTW Gateway (6-8)
- PLTW Biomedical Science (9-12)
- PLTW Computer Science (9-12)
- PLTW Engineering (9-12)

## Community Partners:

- Autodesk
- Chevron
- Kern Family Foundation
- Lockheed Martin

## 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:

PLTW contributes a strong, positive impact to mathematics and science achievement and offers a pathway to prepare and motivate students to enter careers in STEM fields.

- 70 percent of high school seniors taking PLTW courses intend to study engineering, technology, computer science or another applied science. A 2014 Indiana University-Purdue University-Indianapolis study found that students who took PLTW in high school were three-four times more likely to major in engineering than non-PLTW students.
- Over 93 percent of PLTW students intend to pursue at least a 2-year or 4-year degree after high school.
- Many post-secondary institutions actively recruit PLTW students and provide recognition opportunities like preferred admissions and scholarships.

## **Opportunities for Support/Replication:**

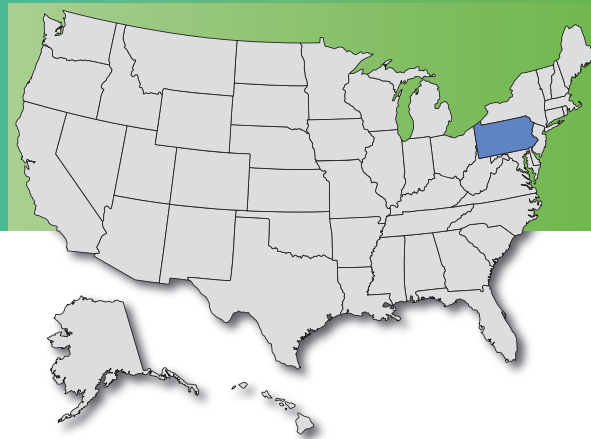
Contact the Project Lead The Way Development Team.



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# Science In Motion



## Program Overview:

Most Pennsylvania high schools cannot afford the modern, well-maintained equipment that it takes to prepare students for today's modern technological careers in science, engineering and other technical fields. Science In Motion is an award winning, 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 Pennsylvania secondary science students in districts surrounding the consortium's higher-education partners. During the 2014-2015 school year, the Pennsylvania Science In Motion Consortium provided outreach support to 623 teachers in 270 public, private and parochial schools. Mobile educators from these sites supported a total of 1,709 classes. Equipment loans and prepared experiments were delivered to an additional 6,018 classrooms. Altogether, 143,723 student experiences were provided through Science In Motion.

## Community Partners:

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

Juniata College has support from local businesses (D.C. Goodman, John R. Wald, Kish Bank, Northwest Savings, Lititz Mutual, First National Bank) through donations made through the Pennsylvania Earned Income Tax Credit Program.

## 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 2008, Science In Motion initiated pilot pre- and post-testing for individual labs both to measure student learning as well as improve curriculum quality. Students across the Commonwealth participating in the Science In Motion program in 2008 demonstrated an average 67 percent improvement in the pre/post-test results for laboratory modules.

### **Opportunities for Support/Replication:**

Science In Motion welcomes support from the public and private sector. Modern scientific training is especially expensive as it requires multiple sets of equipment so that each student can get a hands-on, inquiry-based experience. This classroom deficiency is accompanied by the added need for intensive maintenance and management of equipment and software, training to keep teachers up-to-date on advances in science and technology and access to relevant, standards-aligned activities that utilize the technology.

Twenty years ago, Alabama implemented their own version of Science In Motion using the Pennsylvania program as a model. The Alabama program reaches all high schools in the state.



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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 8 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 disseminate 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. SEPUP designs instructional materials for upper 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 and engineering practices 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 yearlong courses. SEPUP materials are designed for 6th 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, N.Y.; Stamford, Conn.; Charleston, S.C.; Chicago, Ill.; Denver, Colo.; Grand Rapids, Mich.; Portland, Ore.; and Catawba County, N.C.

## 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 adoption 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.



**THE LAWRENCE  
HALL OF SCIENCE**

UNIVERSITY OF CALIFORNIA, BERKELEY

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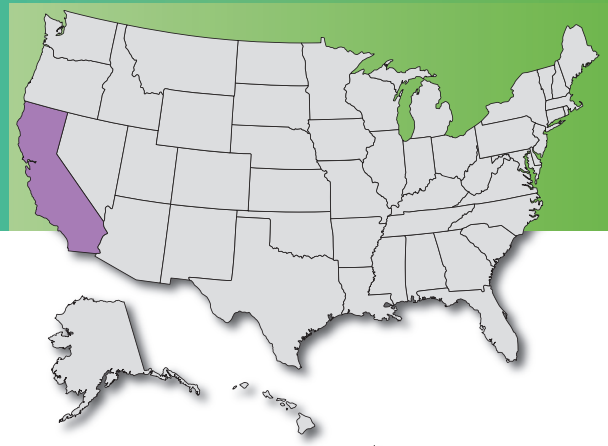
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# Stanford Medical Youth Science Program



## Program Overview:

The Stanford Medical Youth Science Program (SMYSP) addresses the critical need for low-income and underrepresented minority (URM) students in science and medicine. 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, are created. Opportunities that teach students about hands-on science relevant to their families and community are also fostered. SMYSP provides multi-disciplinary and cross-departmental teaching, leadership, public service and learning opportunities for undergraduate, graduate and medical students.

## Reach/Target Student Population:

The program is open to rising juniors and seniors (10th and 11th grade). All participants in this selective program are from low-income families and must live in 1 of 20 counties in Northern California: Alameda, Contra Costa, Fresno, Madera, Marin, Merced, Monterey, Napa, Sacramento, San Benito, San Francisco, San Joaquin, San Luis Obispo, San Mateo, Santa Clara, Santa Cruz, Solano, Sonoma, Stanislaus and Yolo.

## Community Partners:

SMYSP has developed lasting partnerships with a number of community-based organizations as well as academic and health institutions. These partners provide college admission workshops and tours, individual and group academic and medical demonstrations, technology workshops and information sessions and hospital and clinic shadowing experiences and tours. In addition, Stanford University, Stanford University School of Medicine and Stanford HealthCare provide enormous in-kind support. Many Stanford faculty, staff and students volunteer annually by giving academic lectures, conducting workshops and serving as mentors, as well as providing academic and professional guidance.

## Learning Environment:

SMYSP supports teaching and learning models of instruction where students directly observe and participate in hands-on activities and where “thinking is visible.”

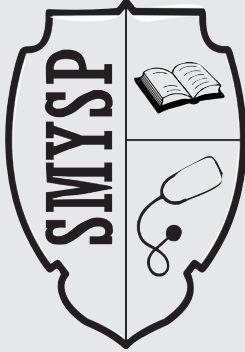
## Program Results Highlights:

To date, 642 young people have participated; 62 percent have been African-American, Latino or Native American. The program addresses the need to increase the number of underrepresented minority students who enter scientific and health professions. The results are transformative. While only 15 percent of their low-income peers in California graduate from college, 90 percent of SMYSP participants graduate. Forty-four percent of SMYSP participants who graduate from college have become or are currently studying to become health professionals.

What started as a small mentoring and tutoring program for students in East Palo Alto, Calif., has evolved into a national model for science education that was the recipient of the 2011 Presidential Award for Excellence in Science, Mathematics and Engineering Mentoring from the White House and the National Science Foundation.

## Opportunities for Support/Replication:

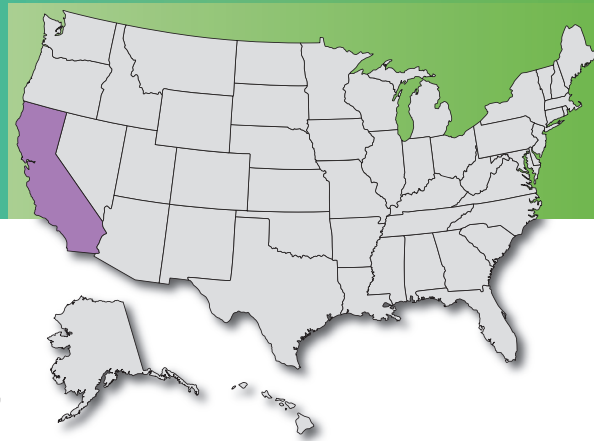
Stanford Medical Youth Science Program welcomes public and private sector support, as well as science, medical and education professionals who can serve as guest lecturers and mentors.



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## Program Overview:

Founded in 2000 by Chabot Space and Science Center, Techbridge offers free afterschool 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 17,000 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 over 6,000 girls in 5th through 12th grades. 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; University of California-San Francisco; and Stanford University
- corporate
  - Chevron; Google; Intel; Yahoo!; LeapFrog; eBay; Cisco; Bechtel; Clorox; Pixar Animation Studios; Bayer; Samsung; Microsoft; Facebook; and Sales Force
- government
  - National Science Foundation; and San Francisco Department of Children, Youth and Their Families
- community organizations
  - CollegeWorks; Berkeley Foundation for Opportunities in Information Technology; The Tech Museum; Museum of Flight; and California Academy of Sciences

## 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 afterschool 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.

A longitudinal study has shown that girls who participate in Techbridge programs are twice as likely as the national average to choose STEM majors in college.

Recently, based on the success of its program, the National Science Foundation has funded the national scaling of Techbridge afterschool programs; Techbridge launched programs in Seattle in 2014 and Washington, D.C., in 2015. Meanwhile, with a major grant from the Noyce Foundation, Techbridge is now launching a national partnership with YMCA to train afterschool providers on Techbridge's proven methods to engage youth across our country in STEM activities using techniques that promote gender equity.

### **Opportunities for Support/Replication:**

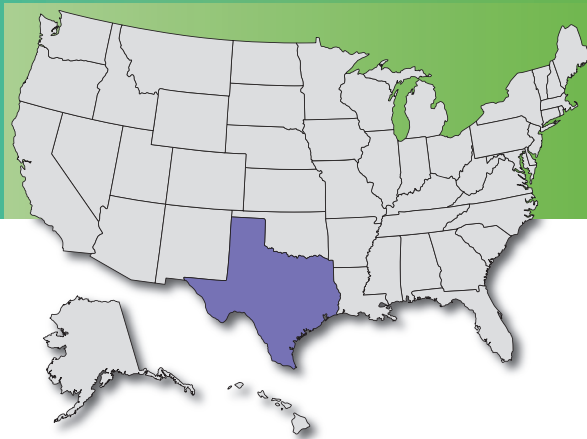
A highly replicable program, Techbridge is looking for public and private sector support to continue the expansion of its program nationally. In addition, it is looking for STEM professionals to serve as mentors and role models to students. Techbridge also offers professional development programs and science learning communities that share our best practices to build the capacity of afterschool providers and teachers to better engage young people in STEM. Current partners include Girl Scouts, YMCA, Boys and Girls Clubs, Society of Women Engineers, Oakland Unified School District and San Francisco Department of Children, Youth and Their Families.



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# Texas Bioscience Institute



## Program Overview:

The Texas Bioscience Institute is a program established to develop a seamless, comprehensive system for training biotechnology and other STEM 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 technology.

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 990 students from the following independent school districts: Temple, Belton, Holland, Killeen, Academy, Troy, Bartlett, Cameron, Chilton, Gatesville, Rosebud-Lott, Salado and Rogers; the private schools of Holy Trinity Catholic High School and Central Texas Christian School; and homeschool students. As of the 2014 school year, the approximate demographics of the student group are 51 percent white and 49 percent minority (Asian/Indian-15 percent, Hispanic-16 percent and African-American-18 percent). With regard to gender, approximately 63 percent are female; 37 percent, male.

## Community Partners:

- **Education Partners:** Temple, Belton, Holland, Killeen, Academy, Troy, Bartlett, Cameron, Chilton, Gatesville, Rosebud-Lott, Salado, Gatesville and Rogers Independent School Districts; the private schools of Holy Trinity Catholic High School, Central Texas Christian School; and home school students
- **University/College Partners:** Temple College, Central Texas Tech Prep Consortium; Texas A&M University-Central Texas; University of Mary-Hardin Baylor; and the Baylor Scott & White Clinical Laboratory Science Program;
- **Workforce Partners:** Central Texas Workforce Board and Central Texas Workforce Centers, including WIAO and youth programs; and
- **Industry Partners:** Baylor Scott & White Health (Hospital, Clinics and Research); Texas A&M University College of Medicine-Temple Campus; Central Texas Veterans Health Care System; Cancer Research Institute; Cardiovascular Research Institute; Institute of Regenerative Medicine; Cancer Research Institute; 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, 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, TBI started a new grant-funded "2-STEP" project that is supported by a \$1.2 million STEP (Science Talent Enhancement Program) grant 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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Website: <http://templejc.edu/about/center-locations/texas-bioscience-institute/>

# The Earth We Share™ International Science Camp



## Program Overview:

Founded in 1994 by astronaut Dr. Mae C. Jemison, The Earth We Share™ (TEWS) is the premiere program of the Dorothy Jemison Foundation for Excellence, a 501(c)(3) organization designed to promote science literacy for all students. In order to accomplish this mission, TEWS has developed teaching methods, curricula, materials and programs to bolster students' critical thinking skills, integrating science, technology and society. *The International Science Camp* is a 4-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. *TEWS – Space Race* was launched in the summer of 2011 to improve science achievement in Los Angeles-area students underserved and underrepresented in the sciences. Over 4 years, its goal is to directly impact up to 10,000 middle school students and train 600 teachers using TEWS.

## 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 2.0 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, thousands of boys and girls have participated in the program. Additionally, over 700 teachers and 100 college interns have been trained; 75 guest teachers from various professions have attended the science camps.

## 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 services and resources, website, public relations, computer hardware and software and other services. The National Aeronautics and Space Administration (NASA) awarded \$750,000 over 4 years to the Dorothy Jemison Foundation for Excellence (DJF) for TEWS-Space Race.

## 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 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 stargazing 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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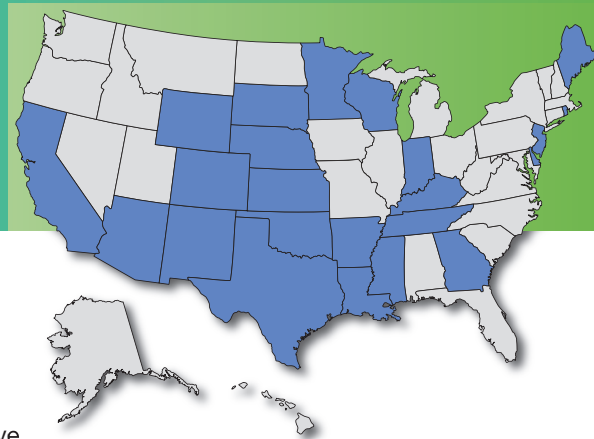
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Website: [www.jemisonfoundation.org](http://www.jemisonfoundation.org); [www.tews-spacerace.org](http://www.tews-spacerace.org)

# USDA Future Scientists



## Program Overview:

Founded in 2004 as the Future Scientists: Sowing the Seeds for Success, the program is now recognized by NSTA as an Exemplary Science Program (ESP) and is known as the USDA Future Scientists program. It is designed to inspire students to continue their studies in science. It develops a collaborative research community between the United States Department of Agriculture (USDA)/Agricultural Research Service (ARS) laboratories and their local communities and schools. The program engages 4th grade through 12th grade teachers and students in hands-on, inquiry-based activities that are linked to current USDA/ARS research and adhere to the Next Generation Science Standards (NGSS). 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 \$1 billion dollars' worth of damage and control expenses annually.

## Reach/Target Student Population:

In the last 11 years, over 1,000 teachers and 100,000+ students have participated in various Future Scientists programs at USDA/ARS laboratories in 36 states, including Arizona, New Mexico, Oklahoma, Texas, Arkansas, Colorado, California, Kansas, Kentucky, Louisiana and Mississippi. The ethnic make-up of participating students is largely determined by the geographic location of the participating USDA/ARS labs.

## 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, Tex., 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 nationwide participate and have opened their facilities to teachers;
- 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 four-five 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. In addition, the studies are cross-curricular to include the subjects of science, language arts and social studies, while introducing students to the concepts of food chains and environmental issues, e.g., 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 research scientists. Students overwhelmingly mention that they are actually "doing" science. Quantitatively, an assessment of Beaumont, Tex., 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. Similar results were achieved by all Bryan ISD (Tex.) schools.

The program garnered two awards in 2014: Society of Environmental Toxicology (SETAC) MacKenzie Environmental Educational Award and Federal Laboratories Consortium (FLC) 2014 Outstanding Accomplishment in STEM Education Support.

## Opportunities for Support/Replication:

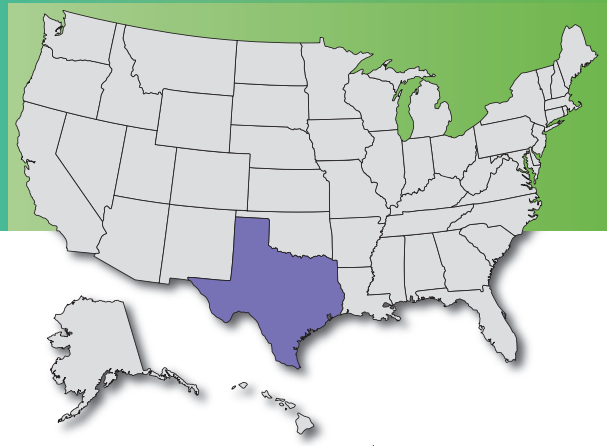
The USDA Future Scientists Program is looking for public and private sector support to help offset operating costs and develop other research activities that complement the corn earworm studies and align with USDA/ARS laboratory locations.



### For more information, please contact:

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Fax: 979-260-9415  
Website: <http://www.hsi.usda.gov/CornEarWorm/>





## Program Overview:

VisualRealization.com 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. VisualRealization.com has strong linkages to state and national standards including the Next Generation Science Standards (NGSS).

VisualRealization.com centers on a learning technology model called Digital Imagery as an Instructional Mode for Student Achievement (DIIMSA®). DIIMSA, developed by VisualRealization.com educational leaders, provides teachers with unlimited opportunities to engage learners in activities for long-term learning of science concepts, while instilling scientific processes. DIIMSA allows program participants to integrate Conceptual Teaching (Inquiry-Based, Student-Centered and Authentic Assessment); Collaborative Learning (Problem-Based Learning and Project-Based Study/Learning Methods including Student Project Artifacts); and Enabling Technologies (Digital Imagery, Authoring Technology, STEM Equipment and Computer Toolsets) in classroom teaching that can be demonstrated as students perform campus-based, field excursion, laboratory and case study experiences.

DIIMSA researchers continue making science and professional development real and relevant for the DIIMSA Professional Learning Community (DIIMSA-PLC). DIIMSA-PLC experiences are practice-based, ongoing and designed to help DIIMSA participants integrate the methods and strategies learned into the curriculum and align them with student learning goals. DIIMSA-PLC includes access to the *DIIMSA Experienced-Based Digital Imagery Content Repository (DIIMSA-EXPERT)* 24 hours a day, 365 days a year. DIIMSA-EXPERT is VisualRealization.com's unique digital content repository designed to assist DIIMSA participants as they implement activities, methods, strategies and projects. This online resource uses authentic digital imagery scenes integrated with higher-order questions, vocabulary and concepts. All DIIMSA-EXPERT content was captured and developed by DIIMSA researchers as part of the ongoing research to make STEM real and relevant.

## Reach/Target Student Population:

In Texas, VisualRealization.com reaches 7,500 teachers/facilitators, representing 185 schools with over 350,000 students across 15 school districts and institutions. Additional program participants include university professors and students in STEM disciplines and pre-service teachers. The target population includes pre-service teachers, 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:

VisualRealization.com partners with:

- Texas Parks and Wildlife – Sheldon Lake Environmental Learning Center which serves as a project site for students and teachers
- National Science Teachers Association
- National Park Service
- United States Geological Survey
- University of Houston
- A.C. Green Youth Foundation
- Lamar University
- The University of Houston
- SectorWare, LLC – Information Technology Solutions
- Sony

In addition, VisualRealization.com 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:**

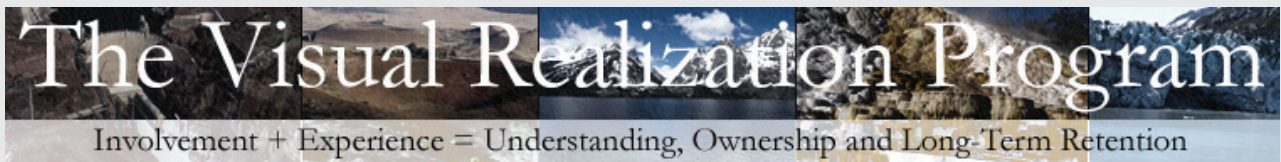
“The sky is the limit” is a phrase that captures the essence of VisualRealization.com. Students and their teachers are revitalized and re-energized. The study of science becomes alive, and the boundaries of the science classroom disappear. Teachers and students work side by side questioning, discovering, 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, VisualRealization.com 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 VisualRealization.com’s efforts continue to improve teacher enhancement and yield a surge in student achievement across the board.

### **Opportunities for Support/Replication:**

VisualRealization.com 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 DIIMSA as a link to any curriculum.



### **For more information, please contact:**

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# Online Resources for Education Programs and Partnership Opportunities

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

# STEM Organizations

American Association for the Advancement of Science  
[www.aaas.org](http://www.aaas.org)

American Association of Engineering Societies  
[www.aaes.org](http://www.aaes.org)

American Chemical Society  
[www.acs.org](http://www.acs.org)

American Chemistry Council  
[www.americanchemistry.com](http://www.americanchemistry.com)

American Indian Science and Engineering Society  
[www.aises.org](http://www.aises.org)

American Institute of Biological Sciences  
[www.aibs.org](http://www.aibs.org)

American Institute of Chemical Engineers  
[www.aiche.org](http://www.aiche.org)

American Mathematical Society  
[www.ams.org](http://www.ams.org)

American Society for Engineering Education  
[www.asee.org](http://www.asee.org)

American Society of Agricultural and Biological Engineers  
[www.asabe.org](http://www.asabe.org)

American Society of Civil Engineers  
[www.asce.org](http://www.asce.org)

Association for Women in Computing  
[www.awc-hq.org](http://www.awc-hq.org)

Association for Women in Science  
[www.awis.org](http://www.awis.org)

Association of American Indian Physicians  
[www.aaip.org](http://www.aaip.org)

Association of Women in Mathematics  
[www.awm-math.org](http://www.awm-math.org)

Council for Chemical Research  
[www.ccrhq.org](http://www.ccrhq.org)

National Academy of Engineering  
[www.nae.edu](http://www.nae.edu)

National Academy of Science  
[www.nasonline.org](http://www.nasonline.org)

National Action Council for Minorities in Engineering  
[www.nacme.org](http://www.nacme.org)

National Society for Black Engineers, Inc.  
[www.nsbe.org](http://www.nsbe.org)

National Society of Black Physicists  
[www.nsbp.org](http://www.nsbp.org)

National Society of Professional Engineers  
[www.nspe.org](http://www.nspe.org)

National Technical Association, Inc.  
[www.ntaonline.org](http://www.ntaonline.org)

Society for the Advancement of Chicanos and Native Americans in Science  
[www.sacnas.org](http://www.sacnas.org)

Society of Hispanic Professional Engineers  
[www.shpe.org](http://www.shpe.org)

MAES – Latinos in Science and Engineering  
[www.maes-natl.org](http://www.maes-natl.org)

Society for Science and the Public  
[www.societyforscience.org](http://www.societyforscience.org)

Society of Women Engineers  
[www.swe.org](http://www.swe.org)

The Education Trust  
[www.edtrust.org](http://www.edtrust.org)

The Mathematical Association of America  
[www.maa.org](http://www.maa.org)

The National Alliance of State Science and Mathematics Coalition  
[www.nassmc.org](http://www.nassmc.org)

The Women in Engineering ProActive Network  
[www.wepan.org](http://www.wepan.org)

Women in Technology International  
[www.witi.com](http://www.witi.com)

# Education Organizations

Math and Science Partnership Network  
[www.mspnet.org](http://www.mspnet.org)

National Association of Research and Science Teaching  
[www.narst.org](http://www.narst.org)

National Council of Teachers in Mathematics  
[www.nctm.org](http://www.nctm.org)

National PTA  
[www.pta.org](http://www.pta.org)

National Science Teachers Association  
[www.nsta.org](http://www.nsta.org)

STEM Education Coalition  
[www.stemedcoalition.org](http://www.stemedcoalition.org)

The International Society for Technology in Education  
[www.iste.org](http://www.iste.org)

Triangle Coalition for STEM Education  
[www.trianglecoalition.org](http://www.trianglecoalition.org)

Department of Education  
[www.ed.gov](http://www.ed.gov)

Department of Energy  
[www.energy.gov](http://www.energy.gov)

# Government Agencies and Organizations

NASA

[www.nasa.gov](http://www.nasa.gov)

National Governors Association

[www.nga.org](http://www.nga.org)

National Institutes of Health

[www.nih.gov](http://www.nih.gov)

National Science Foundation

[www.nsf.gov](http://www.nsf.gov)

The White House Office of Science and Technology Policy

[www.ostp.gov](http://www.ostp.gov)

# Business Organizations

Business-Higher Education Forum  
[www.bhef.com](http://www.bhef.com)

Change The Equation  
[www.changetheequation.org](http://www.changetheequation.org)

Council for Aid to Education  
[www.cae.org](http://www.cae.org)

Council on Competitiveness  
[www.compete.org](http://www.compete.org)

Minority Business Roundtable  
[www.mbrt.net](http://www.mbrt.net)

National Association of Manufacturers  
[www.nam.org](http://www.nam.org)






The Business Roundtable  
[www.businessroundtable.org](http://www.businessroundtable.org)

The Conference Board  
[www.conference-board.org](http://www.conference-board.org)

U.S. Chamber of Commerce  
Corporate Citizenship Center  
[www.uschamber-foundation.org/corporate-citizenship-center](http://www.uschamber-foundation.org/corporate-citizenship-center)



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-  **YouTube** [youtube.com/user/BayerChannel](https://youtube.com/user/BayerChannel)
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