



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

A Compendium of Best Practice K-12 STEM Education Programs

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 C. Jemison'. The signature is fluid and cursive, with a long horizontal stroke at the end.

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

Introduction

Earlier this year, we at Bayer commissioned the 12th *Bayer Facts of Science Education* survey. These annual public opinion research surveys, part of our national award-winning *Making Science Make Sense*[®] program, poll different segments of American society to gauge their attitudes about timely science, science education and science literacy issues.

This year, our *Bayer Facts* survey polled CEOs and other C-Level executives from some of the fastest-growing U.S. science and technology companies about various manpower issues in the science, technology, engineering and math (STEM) workplace.

Specifically, we wanted to continue a dialogue begun in last year's survey, which examined the dual issues of diversity and underrepresentation by women, African-Americans, Hispanic Americans and Native Americans in STEM fields, against the backdrop of rising international competition for STEM workers. In that survey, parents of these students were overwhelmingly confident about their children's ability to succeed in STEM in school and the workplace, viewing STEM jobs as "desirable" and "realistic" for both their daughters and sons.

While acknowledging their own role in helping their children achieve in these areas, parents also assigned responsibility to the STEM communities. For example, they said that STEM companies need to do a much better job communicating the message that their children are both wanted and needed in today's STEM fields. They also believe that the STEM communities have a significant role to play in helping girls and minorities succeed in STEM.

Armed with this information, we went to the executives who are leading today's emerging STEM companies — companies whose vitality and viability depend on a robust and diverse workforce. A workforce that, by all accounts, is diminishing in the United States. It's a situation that is expected to continue as the number of scientists and engineers the United States produces continues to decline, while competition for these professionals from other countries continues to rise.

We were particularly encouraged by the CEOs' responses to a series of questions about the role STEM companies play in education, particularly that of girls and minorities. Most of the senior executives agree that they and their companies have a strong role and responsibility here, particularly in helping to ensure the next generation of inventors, innovators and discoverers. And, while only one-third of the CEOs polled say their companies and/or employees are engaged presently in such programs, nearly three in five of those companies that do not yet participate say they would like to.

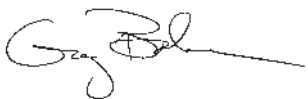
To help facilitate this process and assist our fellow STEM industry colleagues in their efforts to get involved, we are delighted to present **Planting the Seeds for a Diverse U.S. STEM Pipeline: A Compendium of Best Practice K-12 STEM Education Programs**. This first volume of the compendium offers a sampling of some of the country's exemplary programs that have a track record of helping students, especially girls and minorities, to achieve and participate in STEM. In the future, we hope to provide updates as other programs come to our attention.

We would like to acknowledge the National Science Teachers Association, American Association for the Advancement of Science, National Science Foundation, National Science Resources Center, National Research Council and its *National Science Education Standards*, National Action Council for Minorities in Engineering and the Council on Competitiveness and its Building Engineering and Science Talent (BEST) initiative, all of whose work, reports and programs helped inform this compendium.

As a company that has long been actively involved in helping strengthen science education in communities across the country, we at Bayer know that companies can engage in successful business-education partnerships if they possess the necessary commitment and will.

And given the current confluence of trends, the time for such partnerships has never been better.

We invite you to read about these effective STEM education programs and the opportunities that exist for supporting and/or replicating their efforts in your communities and across the country. In addition, we encourage you to take advantage of the list of resources available as you develop your new education collaborations.

A handwritten signature in black ink, appearing to read "Greg Babe".

Greg Babe
President and Chief Executive Officer
Bayer Corporation

Table of Contents

About Bayer Corporation and <i>Making Science Make Sense</i>[®]	5
Key Criteria	6
K-12 Best Practice Programs	7
• American Chemical Society Project SEED	8
• ASSET Inc.	10
• Biotech Partners	13
• Connecticut BioBus Educational Programs	16
• Developmental Approaches in Science, Health and Technology (DASH)	18
• Environment as a Context for Opportunity in Schools (ECOS)	21
• Foundational Approaches in Science Teaching (FAST)	23
• Gateway Institute for Pre-College Education	25
• Illinois Math and Science Academy E2K+	28
• Junior Engineering Technical Society (JETS)	30
• Kinetic City	33
• Math Out of the Box™	36
• Mathematics, Engineering, Science Achievement (MESA)	39
• Merck Institute for Science Education	41
• Omaha Public Schools/Banneker 2000	43
• Project Lead The Way	45
• Science in Motion	47
• Summer Science Academy	50
• TexPREP	52
• Valle Imperial Project in Science (VIPS)	55
• Visualrealization.com	58
Additional Promising Programs	61
These programs either do not yet meet the key criteria or operate outside the K-12 education sphere. However, they offer potential information, resources or a model for STEM companies looking to get involved in improving STEM education.	
• ENTRYPOINT! Internship Program for Students with Disabilities	62
• St. Louis Regional Engineering Academy	64
• Texas Bioscience Institute	66
On-line Resources for Education Programs and Partnership Opportunities	69
• STEM Organizations	70
• Education Organizations	73
• Government Agencies and Organizations	74
• Business Organizations	75

About Bayer Corporation and *Making Science Make Sense*[®]

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

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

More than 30 years ago in Elkhart, Indiana, MSMS was born when Bayer volunteers began helping teachers teach and students learn science the way scientists do – by doing it. Today, in 12 local Bayer site communities across the country, more than 1,000 volunteers work to foster science literacy and ignite student interest in science.

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

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

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

Bayer's national science literacy campaign is led by astronaut Dr. Mae C. Jemison and features the *MSMS Experiment Guides* for parents and children; the *C.A.U.S.E. Challenge*[™] by Bayer Corporation Film Festival, an environmental documentary film competition for high school students in partnership with SciTech Spectacular and Pittsburgh Filmmakers; and an interactive Web site.

Additionally, the annual *Bayer Facts of Science Education* surveys gauge the state of science education in the U.S., helping to measure the public's support for reform and recognition of the roles that science and science literacy play in everyday life.

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

Key Criteria

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

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

1. Challenging Content/Curriculum

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

2. An Inquiry Learning Environment

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


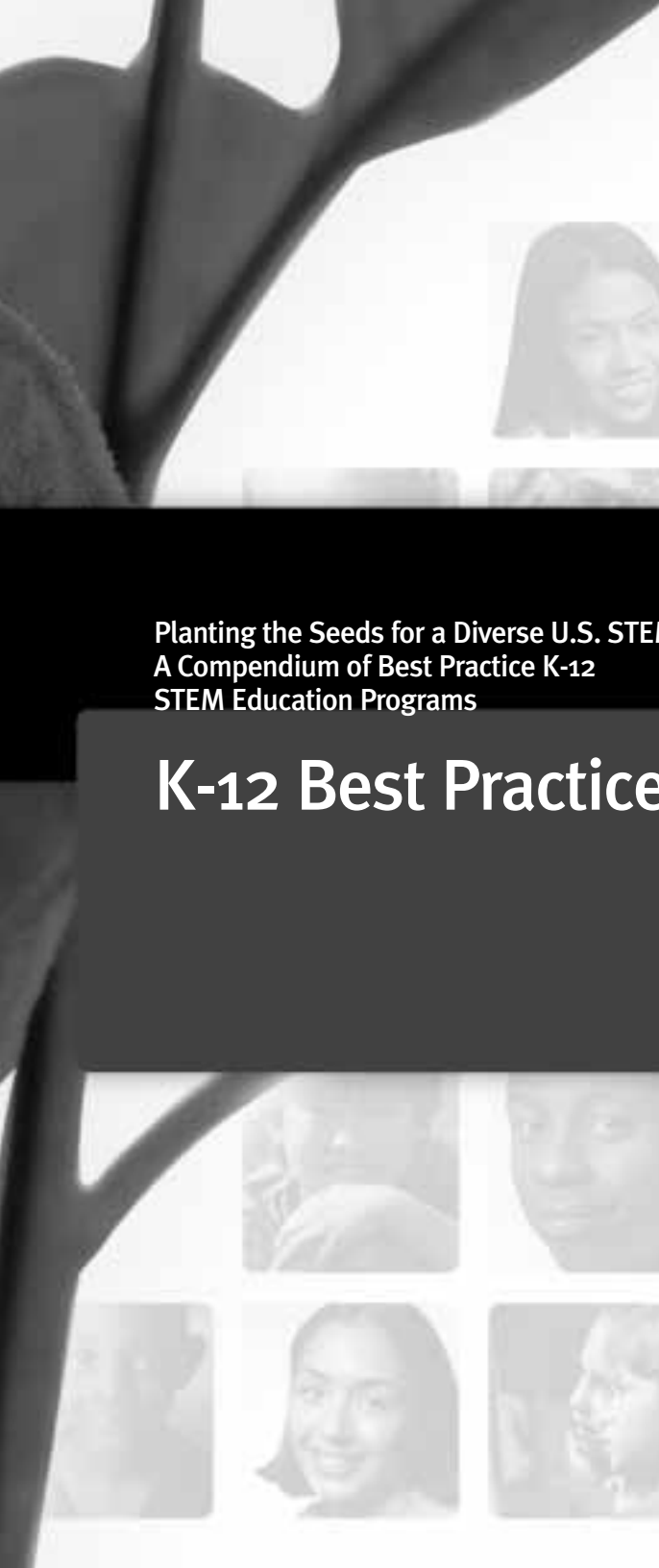
3. Defined Outcomes/Assessment

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

4. Sustained Commitment/Community Support

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

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



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

K-12 Best Practice Programs



American Chemical Society's Project SEED

Program Overview:

Established in 1968, Project SEED is an American Chemical Society (ACS) program for high school students from economically disadvantaged backgrounds who have an interest in pursuing science as a career. The program provides an opportunity for students to participate in scientific research and learn what it is like to work in science-related fields through on-the-job experience. Project SEED places students in academic, industrial and governmental research laboratories for eight-to-10 weeks during the summer months to perform hands-on scientific research under the supervision of a volunteer scientist-mentor. First-year students receive a stipend of \$2,275 and second-year students receive \$2,600.

Reach/Target Student Population:

Currently, more than 325 students are participating in Project SEED at more than 100 institutions. In addition, some 300 volunteer scientist-mentors participate in the program (no mentor has more than two students).

Since 1968, more than 8,400 high school students have participated in Project SEED. Approximately 70 percent of the students are from underrepresented groups in the sciences, primarily African-American, Hispanic American and Native American. In addition, 62 percent are female.

Community Partners:

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

Learning Environment:

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

During the summer experience, students:

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

Program Results Highlights:

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

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

Opportunities for Support/Replication:

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

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Program Overview:

ASSET Inc. is an independent non-profit educational reform initiative dedicated to continuously improving the abilities of teachers – and the performance of students – with initial efforts in K-8 science education. Since its founding in 1994, with funding by the National Science Foundation and Bayer Corporation, ASSET has quietly, but effectively, established itself as a major driver of systemic education reform in western Pennsylvania and beyond. ASSET's approach is modeled on the National Science Resources Center's five tenets of education reform, including:

- high-quality, hands-on curriculum materials in science and math;
- ongoing teacher professional development;
- refurbishment of hands-on curriculum materials;
- assessment and program evaluation; and,
- community and administrative involvement.

In July 2006, ASSET received \$10 million dollars in Pennsylvania Governor Ed Rendell's 2006 education budget to begin the immediate rollout of its program statewide.

Reach/Target Student Population:

Currently, ASSET serves 48 school districts, and charter and private schools, directly impacting the teaching and learning process of 3,000 teachers and 125,000 students in 5,000 classrooms in four western Pennsylvania counties. Beginning in September 2006, the ASSET program will be implemented in an additional 78 schools in 36 counties across the state.

Community Partners:

ASSET has dozens of community partners who provide an array of support and services. For example:

- Bayer Corporation (provides grants, in-kind support, volunteers and public relations and fundraising assistance)
- Westinghouse (provides public relations and fundraising assistance)
- Bombardier (provides financials)
- RJ Lee Group (co-created web-based simulator to enhance curriculum kits)
- Universities (provide assistance with research, cutting edge methodologies and teacher preparation)
- Foundations (provide funding and guidance)
- School districts (provide R&D for new products and services)

Learning Environment:

ASSET supports an inquiry-based learning approach which “involves a process of exploring the natural or material world and that leads to asking questions, making discoveries, and rigorously testing those discoveries in the search for new understanding. Inquiry, as it relates to science education, should mirror as closely as possible the enterprise of doing real science” (*Foundations Volume II: Inquiry*, the National Science Foundation 99-148, p. 2). Inquiry often involves hands-on and interactive activities, where materials and resources are readily available to all students and desks are in clusters, promoting discussion and collaboration on learning. An essential element of inquiry in elementary science education is a focus on the following process skills (as identified in *Foundations* p. 53):

- **Observing** – watching carefully, taking notes, comparing and contrasting
- **Questioning** – asking questions about observations; asking questions that can lead to investigations
- **Hypothesizing** – providing explanations consistent with available observation
- **Predicting** – suggesting an event in the future, based on observations
- **Investigating** – planning, conducting, measuring, gathering data, controlling variables
- **Interpreting** – synthesizing, drawing conclusions, seeing patterns
- **Communicating** – informing others in a variety of means: oral, written and representational

Program Results Highlights:

Annually, ASSET conducts an analysis of the student results on the Pennsylvania state tests of reading and math and compares them to the hours of professional development teachers in their districts have received. Based on last year’s state test scores in math and reading, a possible correlation was found between teacher participation in ASSET’s Institute for Inquiry (five-day professional development experience) and student test scores, indicating that the Institute for Inquiry may be a factor that positively contributes to overall performance by students, especially in low socio-economic status districts.

Another earlier study by University of Pittsburgh researchers used fourth and seventh-grade science questions from the 1995 Third (Trends In) International Math and Science Study (TIMSS) test to assess 1,500 ASSET fifth-grade students. They found that, compared with the official TIMSS scores from the United States and high-performing countries, ASSET fifth-grade students’ mean scores were:

- Significantly higher than United States students’ scores; and

- Competitive with seventh-grade student scores from high-performing countries, such as Japan, Singapore, Korea, England, Hungary, and the Czech Republic.

In addition, the total scores of students involved with ASSET since 1995 were significantly higher than those of students in districts that joined ASSET later, suggesting that sustained involvement in the program positively impacts student learning.

Opportunities for Support/Replication:

ASSET welcomes public and private sector support. In addition, it seeks scientist-mentor volunteers who can work with its teachers and students, as well as volunteers who can help to refurbish science kits in its Materials Support Center, such as organizations serving individuals with disabilities. ASSET Inc. was one of 88 Local Systemic Change (LSC) initiatives funded by the National Science Foundation. Other communities with LSC initiatives are located in California, New Jersey and Delaware, among others.

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Biotech Partners

(formerly Berkeley Biotechnology Education Inc./BBEI)

Program Overview:

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

Reach/Target Student Population:

Each year, Biotech Partners works with approximately 70 Berkeley High School students, 45 Life Academy students and 20-30 Laney College students. Nearly all (97 percent) are students of color, 54 percent are young women and many are from low-income households.

Community Partners:

Today, Biotech Partners' work is supported by the generous participation of and funding from more than 35 corporate, government, foundation, education and health care partners. Approximately 20 Bay Area biotech companies and organizations provide paid summer internships for high school participants and yearlong co-op jobs for the community college participants. These include Bayer, Novartis AG (formerly Chiron Corp.), Genentech, Inc., Joint Genome Institute/U.S. Dept. of Energy, Lawrence Berkeley National Laboratory, U.S. Dept. of Agriculture, Kaiser Permanente Medical Center, U.S. Environmental Protection Agency and Brookside Community Health Center, among others.

Biotech Partners also partners with three local school districts to provide the educational component of the program: Berkeley Unified School District in Berkeley, CA (Berkeley High School); Oakland Unified School District (Life Academy); Peralta Community College District (Laney College).

Learning Environment:

Two core principles underpin Biotech Partners' programmatic structure. 1) Young people are more than just students, and to help them succeed in school often means addressing issues that are not necessarily "academic" in nature. BBEI staff works with the students individually to help identify and resolve many of the barriers preventing their success. These can include lack of self-motivation, child-care issues, housing instability and family problems. 2) In order for academics to matter to Biotech Partners' target population, they must be engaging, hands-on and, most important, relevant. To achieve this, Biotech Partners has structured a program where the demands of paid employment and those of the classroom are inextricably linked.

Recruited in 10th grade, students participate in the program in 11th and 12th grades, taking four specialized bioscience classes and an additional chemistry class, along with their regular course load. Biotech Partners emphasizes interactive laboratory experiences, a skills-based and industry-informed curriculum and industry/research-oriented speakers who come into the classroom to show students the real-world significance of what they are learning. Through this approach, students grasp the relevance of their coursework and are motivated to stay engaged. Full-time paid internships in biotech and health care settings are arranged for every qualified student during the summer between 11th and 12th grades.

Program Results Highlights:

Since 1993, Biotech Partners has placed nearly 700 youth in internships and co-op work positions. Recent evaluation results show Biotech Partners' program works. Approximately 97 percent of students who complete at least one year of the program graduate high school. This is in marked contrast to the other students in the school districts that Biotech Partners serves and significantly higher than the overall state graduation rate of 71 percent. Furthermore, the study found that Biotech Partners' students who enroll at Laney College have a 54 percent completion rate, which is nearly double the national completion average for students attending non-four-year, post-secondary institutions. Usually within 30 days of graduation, Biotech Partners students are employed in industry. Employers report Biotech Partners' graduates "outperform their peers at work" and are "significantly better than their co-workers 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."

Opportunities for Support/Replication:

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

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Connecticut BioBus Educational Programs

Program Overview:

Established in 2001, the BioBus Educational Programs consist of two main components. The BioBus is a 40-foot-long, custom designed mobile bioscience laboratory fully equipped to allow students and teachers to conduct advanced biotechnology experiments. It visits schools for one-to-two days. The BioConnection component of the programs lends the same equipment, samples, and reagents available on the BioBus to teachers for use in the classroom for two-week periods. Teachers are provided comprehensive training for participation in the programs, as well as inquiry-based, hands-on activities to undertake in the classroom. All programs are free to schools.

Reach/Target Student Population:

On average, 100 schools, 15,000 students, and 120 teachers per year benefit from the two programs. Those numbers will grow as the number of equipment modules available for loan grows. The BioBus program targets grades 4–12 of inner-city schools and population-dense areas. The BioConnection program targets middle and high schools in inner-city and low-income areas of Connecticut. The programs partner with local agencies to provide training and experiment opportunities to minorities, at-risk girls and various community outreach initiatives.

Community Partners:

BioBus Educational Programs partners with:

- Regional universities (provide teacher training and sites for student activities and tours)
- Corporations (provide funding and donate equipment and supplies)
- Corporate employees (serve as visiting scientists; active on advisory board for curriculum and programs)

Learning Environment:

When students enter the BioBus, they realize quickly that they are in a real science laboratory, conducting real experiments. They are introduced to the vortex, micropipette, digital scale and electrophoresis instruments, among other lab equipment, that they will use alone or with a partner. During their time on the bus, the students engage in hands-on activities directly connected with a particular scientific experiment associated with a health issue, such as Sickle Cell Anemia, or forensics science applied, for example, to discriminating between the real Mona Lisa and a fake painting. The impact of the BioBus is far-reaching, extending well beyond the roughly 100 students who participate per school visit. Since the program enables teachers to learn new techniques and concepts in bioscience, receive research updates from real scientists, and practice relevant hands-on activities, the teachers learn new skills that they then bring to their classrooms all year, every year.

While the BioBus rolls onto a school campus, the BioConnection program rolls directly into schools' classrooms. It gives teachers and students the opportunity to experience real-world science lessons and experiments. Each lending curriculum kit consists of three storage bins of the same research-grade equipment available on the BioBus, complete with all reagents, samples and safety gear necessary to conduct program experiments in the classroom for two weeks.

Program Results Highlights:

A 2005 independent evaluation of the BioBus program found that the hands-on approach using state-of-the-art technological equipment, scientific processes, relevant social/medical problems and exciting curriculum content led to an increase in the interest of most students in bioscience and science in general. Additionally, teachers are better able to identify students who wish to pursue advanced study of bioscience, who show increased interest in career fields focused on bioscience, and who wish to use bioscience as a subject for classroom projects, activities and competitions.

The same study found that exposure to the BioConnection program helps students to better understand "real science" and how it fits into their everyday life. They also have a better understanding of the scientific process and become proficient with scientific techniques, processes and content. This enables them to solve problems and gain confidence in their own ability to complete a lab experiment. In addition, the study found that based on the students' experience, some have indicated they will consider pursuing this field as a career.

Opportunities for Support/Replication:

The BioBus Educational Programs welcome public and private sector support, donations of equipment and supplies, as well as scientist-volunteers who can visit classrooms and help shape future outreach activities.

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Developmental Approaches In Science, Health and Technology

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. (*Expert Panel on Mathematics and Science Education, U. S. Department of Education in recognition of the designation of Development Approaches in Science, Health and Technology as a Promising Science Program.*)

Established in 1986, DASH is designed for heterogeneous classrooms and is effective with both genders and diverse ethnic, socioeconomic and ability student populations. DASH aligns with National Research Council Standards and American Association for the Advancement of Science Benchmarks and is adaptable to state standards. DASH recognizes teachers' needs for content, skills and pedagogy instruction and requires teacher training.

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 socioeconomic groups;
- African-American, Hispanic American, Native American, Asiatic and Pacific Islander groups; and,
- males and females.

Community Partners:

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

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 log of activities recorded on roll paper), a Responsibility Chart, a Wonder and Discovery Book (record of things yet to be found) and Working Dictionary (the dictionary of terms in construction) are posted. Space is provided for ongoing activities, pets and out-of-class growing areas for gardens.

There is no materials kit for DASH. Instead, equipment found in most elementary settings is used, including hammers, pliers, screwdrivers, saws, shovels, rakes, hoes, hoses, animal cages, scissors, etc. Other equipment is constructed by the students out of standard classroom supplies—rulers, file cards, paper clips, brads, string, color pens, etc., and collectable materials such as paper plates, coffee cups, wood, wire coat hangers, jars and the like.

Program Results Highlights:

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

- K-5 students demonstrated an understanding of foundational science concepts and use of essential skills of inquiry, data collection and concept application;
- teachers also showed significant increases in their sense of personal efficacy and their demonstrated capacity to interact with students;
- despite a wide spectrum of socioeconomic, 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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Environment As A Context For Opportunities In Schools

Program Overview:

Established in 2002 in Houston at Baylor College of Medicine, the Environment as a Context for Opportunities in School (ECOS) project responds to the need to improve K-5 science education in schools with high enrollments of minority and economically disadvantaged students. ECOS aims to develop and evaluate a scalable model for integrating science content across the elementary school curriculum using environmental themes that are relevant to students. Specific project objectives are to: (1) collaboratively design, implement and evaluate an instructional program in elementary schools that integrates science, health, reading/language arts and mathematics; (2) improve teacher practice through summer and school-year professional development over multiple years; and (3) support schoolwide reform of teaching and learning.

ECOS is funded by the National Institute of Environmental Health Sciences (NIEHS), a component of the National Institutes of Health (NIH). The project builds on previous National Science Foundation-funded teacher professional development programs and curriculum development programs funded by NIEHS and the National Center for Research Resources of the NIH, conducted by the same team at Baylor College of Medicine.

Reach/Target Student Population:

During the 2005-2006 school year, 11 elementary schools, 143 teachers and 3,575 students from the Houston Independent School District participated. The ECOS program is being implemented across all grades K-5 in the participating schools.

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

Community Partners:

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

Learning Environment:

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

Program Results Highlights:

Student assessments indicate that the project's integrated instructional approach is contributing to the closure of the science achievement gap between underrepresented students and other groups at a rate that exceeds progress in the district or state of Texas.

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.

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Foundational Approaches In Science Teaching

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, socioeconomic, and ability student populations. FAST is aligned with National Research Council Standards and American Association for the Advancement of Science Benchmarks and adjustable to state standards. FAST recognizes teachers' needs for content, skills, and pedagogy instruction and requires teacher training.

Reach/Target Student Population:

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

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

Community Partners:

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

Learning Environment:

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

- three student books of sequenced inquiries, one for each grade level;

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

Program Results Highlights:

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

Opportunities for Support/Replication:

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

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Gateway Institute For Pre-College Education

Program Overview:

Established in New York City in 1986, the Gateway Institute for Pre-College Education is an organization that works with New York City public high schools and also has created three of its own high schools. With an emphasis on medicine, engineering and other science-related fields, Gateway provides thousands of low-income and minority students the opportunity to prepare for college and careers. Based at the City University of New York, the Gateway program maximizes student achievement by:

- keeping students and teachers together during the four-year high school experience;
- reducing class sizes and utilizing a team approach;
- designing and providing a rigorous curriculum;
- providing appropriate teacher professional development;
- exposing students to many educational and cultural opportunities, both inside and outside the classroom, through enrichment programs offered by partners including universities, museums, hospitals, research laboratories, corporations and other institutions; and
- helping students identify summer placement and internship opportunities, college planning and visits.

Reach/Target Student Population:

Currently, 12 New York City public high schools have Gateway programs and there are three independent Gateway Schools (Queens Gateway to Health Sciences Secondary School, S.T.A.R. High School at Erasmus in partnership with Brooklyn College and Gateway High School for Environmental Research and Technology). In total, Gateway works with 3,000 ninth- through 12th-grade students and 200 teachers. Gateway students are Hispanic American (23 percent), African-American (60 percent), Asian (12 percent) and other (5 percent).

Community Partners:

- New York City Department of Education (provides access to schools, funding at the school sites)
- City University of New York (provides resources in implementing programs)
- Science Entry and Technology Program or STEP funded by New York State Legislature (provides funding for school services and supplies not provided by New York City Dept. of Education)
- Medical schools (provide placements for students, visits to facilities and support for teachers)
- Public hospital system (provide placements for students)
- Private industry/corporations (provide funding and placements for students)
- Colleges and research institutions (provide placements for students)
- 3,000 alumni (provide resources for current students, serve as mentors)

Learning Environment:

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

Program Results Highlights:

The success of Gateway is measurable, with more than 90 percent of ninth-graders continuing through graduation; more than half of Gateway's graduates are female. Gates Millennium Scholarships were offered to 25 students from all of New York City's public schools in 2006; four of the 25 were Gateway students (16 percent). In 2006, Gateway students accounted for more than 80 of the 160 students participating in the Citywide Science Fair. Seven Gateway students presented at the 20th Annual Association of Minority Health Professionals Foundation Biomedical Symposium. In addition, Gateway has followed 80 percent of its high school graduates and 75 percent of those graduates have completed college in four or five years. Recently, Gateway selected 100 alumni who are 10 years post-high school for a survey and found that 97 percent had completed college and more than two-thirds had entered graduate school and are working in a variety of science, technology, engineering, math or teaching professions.

Opportunities for Support/Replication:

Gateway Institute for Pre-College Education welcomes public and private support, and student internship opportunities from corporations and other organizations, as well as scientist-mentor volunteers who can work with its students. Having begun in one New York City high school in 1986 and expanded to 15 city schools today, the Gateway program is highly replicable.

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Illinois Math And Science Academy Excellence 2000+

Program Overview:

Illinois Math and Science Academy (IMSA) Excellence 2000+ (E2K+) is a three-year, after-school enrichment program for middle school students who are talented, interested and motivated in mathematics and science, with special emphasis on students historically underrepresented and underserved in mathematics and science. Students may also participate in related field trips and other enrichment activities. By design, the E2K+ curriculum exemplifies IMSA's core expertise which is competency-driven learning experiences that are inquiry-based, problem-centered and integrative. The program also includes professional development for the mathematics and science teachers who present the after-school program. These teachers acquire knowledge and skills that transfer directly into their regular classrooms and benefit all students. Site visits and sessions for principals and parents are also provided to ensure success.

Reach/Target Student Population:

In the 2005-2006 school year, IMSA E2K+ served 894 students and 96 teachers from 46 schools at 32 sites in 12 counties throughout Illinois. During the summer of 2006, 96 additional students participated in weeklong day programs and 19 students participated in a two-week residential program at IMSA. In helping to increase access to programming for students who are historically underrepresented in mathematics and science and for all areas of the state, when reviewing applications, preference is given to schools that serve African-American and Hispanic populations, as well as schools in rural areas.

Community Partners:

The IMSA E2K+ program has enjoyed the support of a number of community partners. In addition, participating schools and administrators are given materials and training to assist them in building program sustainability by promoting and encouraging community support. Funding partners include: the Harris Family Foundation, the Pritzker Foundation, the Chicago Community Trust, the Lloyd A. Fry Foundation, Lehman Brothers Foundation, Underwriters Laboratories and ComEd, an Exelon Company. A partnership with Illinois Institute of Technology has been formed as a site for professional development for the Chicago and Cook County sites. Finally, individual sites have received support from a variety of community partners, including state senators, county health departments, and local businesses, as well as school boards and parent organizations.

Learning Environment:

The learning experiences focus on helping students “learn how to learn” and emphasize logic, mathematical thinking and experimental scientific thinking. Topics relate to the students’ lives, arousing their curiosity and increasing their motivation to study the phenomena and their causes. Instructional approaches emphasize hands-on learning that integrates mathematics, science and technology. Students tell IMSA: *“The different problems we work on are real interesting. And I love the projects and the games we play. It’s a lot of fun!”*

Program Results Highlights:

The 2006 E2K+ Global Evaluation surveyed participating students, parents, teachers and administrators from schools, and focused on the program’s integrity and impact in relation to its stated goals. It found that almost all students agree that math and science are useful subjects, and important to them and the world in the future. The majority believe that most or all of the E2K+ activities are interesting. Most would recommend the program to their friends. Most parents and principals agree E2K+ students develop deeper interest and understanding in math and science. Most parents believe the program is a valuable, meaningful learning experience and should be a permanent part of IMSA programming. The first longitudinal study of high school students who had participated in the E2K+ program showed that the majority of them retained an interest in both mathematics and science that was higher than the national average.

Opportunities for Support/Replication:

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

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JETS (Junior Engineering Technical Society)

Program Overview:

Established in 1950, JETS (Junior Engineering Technical Society) is a nationwide, non-profit educational organization dedicated to promoting engineering and technology careers to America's high school students. JETS works to increase interest in and awareness of engineering and related careers that will help meet the future workforce demands of our society. JETS' programs offer unique opportunities for high school students to be immersed in the worlds of science, technology, engineering and math (STEM) and presents them with real-world scenarios showcasing the critical role engineers play in the world around us. Helping students make informed decisions about their futures and developing the next generation of engineers, JETS major program components include:

- two competitions [TEAMS (Tests of Engineering Aptitude, Mathematics, and Science) and National Engineering Design Competition (NEDC)];
- a free monthly electronic newsletter (Pre-Engineering Times);
- a summer minority program (U.S. Army UNITE);
- a self-assessment tool (NEAS);
- a weekly word problem (JETS Challenge); and
- print and Web-based career exploration materials.

Reach/Target Student Population:

JETS' programs directly impact a national audience of more than 40,000 students and 10,000 educators in 6,000 high schools each year. JETS' reach is extended to more than 200,000 students through the distribution of its career exploration materials and free electronic newsletter.

JETS connects with students from all backgrounds and during 2005-2006, 45 percent of participating students were female and/or minority. In fact, JETS' flagship program, TEAMS, held significant interest for females with a participation rate of 35 percent. JETS also coordinates the U.S. Army UNITE program – a minority-focused summer program introducing students to freshman-year college math, science and engineering courses. The most recent program included nearly 600 students, of whom 94 percent were historically underrepresented and 56 percent were female. The largest population represented was Hispanic American.

Community Partners:

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

- Teachers (volunteer as coaches for TEAMS and NEDC)
- School guidance counselors (use and distribute Career Exploration materials)
- Universities and colleges (host the TEAMS competition, purchase career brochures, utilize the assessment tool and support pre-college engineering education by becoming JETS' affiliates)
- Professional societies (provide discipline-specific content for career guidance information and JETS e-newsletter, work collaboratively on outreach projects, coordinate TEAMS competitions, serve as engineering advisors and become JETS' affiliates)
- Corporations (provide support for area TEAMS competitions, offer employee-volunteers as engineering mentors before and during competitions, distribute JETS' materials at local school career fairs, and support JETS as a national program)

Learning Environment:

The study of science is a form of discovery, trial and error, and evaluation. With JETS' programs, students and teachers are encouraged to examine creative approaches for problem-solving. For instance, to advance in the NEDC, the team must follow and apply the Engineering Design Process. Students must discover and identify a problem, research it, identify possible solutions, evaluate and assess their solutions, and defend the final prototype to a panel of experts. This entire process gives students a chance to participate in a tangible, cross-curricular learning experience.

JETS' hands-on activities provided in each issue of Pre-Engineering Times also give teachers the chance to conduct quick classroom, science-based activities, such as Make a Thermometer, Land and Sea Breezes, Seltzer Tablet Rocket, Make Your Own Soda Pop and Build a Bacterial Terrarium.

The TEAMS competition most often places students on college and university campuses presenting them with a firsthand view of the campus, and engineering and technology programs. Students and teachers are frequently given tours of the campus, a chance to speak with university faculty and department professors, and are provided with academic program information.

Program Results Highlights:

A recent assessment of students, coaches and university hosts participating in TEAMS found that:

- the program saw a 68 percent increase in new school participation during 2006;
- its retention rate is strong, with 85 percent reporting the intent to participate in the 2007 competition;
- the student population is diverse, with 42 percent historically underrepresented in STEM fields; and
- 50 percent of surveyed students indicate they will choose engineering as a college major (this does not account for chosen majors in other disciplines such as math, science or technology).

The UNITE program expanded in 2005 and included two new hosting sites. Nearly 80 percent of UNITE program participants continue their education and enroll in a college or university.

The Pre-Engineering Times e-newsletter continues to grow with an average of 100 new subscribers each month.

Opportunities for Support/Replication:

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

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Kinetic City

Program Overview:

Kinetic City is an innovative, award-winning, after-school science club produced by the American Association for the Advancement of Science (AAAS). It is a unique combination of on-line content (at www.kineticcity.com) with off-line science activities and experiments. Kinetic City combines 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 on-line account and receive collectible trading cards. 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. Kinetic City began as a radio show in 1994, a book series in 1999, and an after-school science club in 2004.

Reach/Target Student Population:

Kinetic City’s target population is elementary school students, ages 9 to 11 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 12,000 students currently participate in Kinetic City as registered users. Approximately 3,500 of those are participating through official Kinetic City After School Clubs at 125 sites around the country. Hispanic and African-American students comprise a large portion (more than half) of Kinetic City’s members.

Community Partners:

Kinetic City works with a variety of partners in different communities nationwide. For example:

- **Washington, DC**

- DC Children and Youth Investment Trust Corporation (provides programs and ancillary evaluation in non-school-based, after-school programs)
 - Fannie Mae Foundation (supports school-based after-school programs)

- **Boston**

- Timothy Smith Network (provides technology-based programming)

- **New York**

- I Have a Dream Foundation (provides materials for their “Dreamers”— young people teamed with mentors helping them achieve their academic goals)

- **New Jersey**

- 21st Century Community Learning Centers (provides academic enrichment at their centers)

- **Louisiana**

Louisiana Department of Education (provides the program to 35 after-school programs throughout the state)

- **California**

San Diego County Office of Education (provides the program to school-based programs)

Learning Environment:

Kinetic City Clubs are divided into five different stations. These are the Mind Game station, which requires a computer with internet access; a Fab Lab station, which requires a table-top and the appropriate Kinetic City materials; a Move Crew area, which is generally an open space for performing the active, physical education activities; a Smart Art area, with large tables and art supplies; and a quiet Write Away area, for performing the creative writing challenges. Most clubs divide their group into five teams, with each team going to a different station. Each activity takes just under an hour, including reporting on the results in the student Case Journals. Once every team has done all the activities (this may take a week or two, depending on how often the Club meets), each student goes on-line to play a computer game that tests their science knowledge. They get points in their account depending on how well they do. This environment lets students participate in different ways, and gives them all opportunities to shine.

Program Results Highlights:

Kinetic City's latest evaluation, performed by the Edumetrics Company, took place in Spring 2005 among students in the poorest sections of Washington, DC. Most of the students participating were African-American or Hispanic. It found that:

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

In addition, the evaluation found a marked improvement in students' ability to read a complex science essay and perform a creative writing challenge based on the information in the essay. Students' improvement in scores for this challenge was extraordinary. Kinetic City plans to look at this more closely in its next evaluation.

Opportunities for Support/Replication:

Kinetic City welcomes financial and other in-kind support from corporations and organizations, both in the communities that already host programs and in communities that would like to start programs.

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Math Out Of The Box™

Program Overview:

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

The Math Out of the Box project is currently under development with the first two strands available through the Carolina Biological Supply Company, a publisher with experience in the development of inquiry science curricula. The final two strands remain under development. The third strand will be published early in 2007. The number strand will be published beginning in 2008.

Reach/Target Student Population:

Math Out of the Box is designed for all K-5 elementary school students and teachers. Currently the program is being field-tested and piloted in four states: South Carolina, New Jersey, Pennsylvania and Illinois. In terms of field test sites, there are 20 schools, 130 teachers and 1,500 students using the curriculum; pilot sites reach 50 schools, 500 teachers and 10,000 students.

Community Partners:

- Clemson University, College of Engineering and Science (provides financial support, administrative support, release time for mathematical professors, graduate students and in-kind support)
- Educational Testing Service (creates assessment items, tests evaluation instruments, collects and analyzes qualitative and quantitative data, evaluates the Lawrence Township, N.J. project)
- Carolina Biological Supply Company (publishes the curriculum, provides financial support to Clemson University, develops the hands-on materials in partnership with Clemson University, and provides in-kind support for field tests and pilots)
- Corporations and foundations, including DuPont Office of Education, Michelin North America, Fluor Daniel, American Honda Foundation, John Deere Foundation, Self Family Foundation, Ford Foundation, General Electric Fund (fund pilot programs and research projects and provide networking opportunities)

- Other Partnerships – SECME (Southeastern Consortium of Minority Engineering), Call Me MISTER, ASSET, Comanche Nation College, and others (mentor the development team, provide networking opportunities and collaborate in research)

Learning Environment:

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

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

Program Results Highlights:

Field test projects have taken place since 2004, with a number of schools field testing units in 2004, 2005, and 2006 at particular grade levels. The data from the sites that have field tested for three years show considerable gains in student mathematics achievement, with gains continuing each successive year. In every field test site, achievement gaps among subgroups of students have diminished, with all groups experiencing improvement. And underrepresented subgroups have experienced the greatest gains.

Opportunities for Support/Replication:

Math Out of the Box is a math curriculum appropriate for school districts around the country. Companies, organizations and individuals can work with their local school districts to bring the Math Out of the Box curriculum to their elementary school students.

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California Mathematics, Engineering, Science Achievement

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.

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 three programs serve 21,800 students at 50 locations in California. It serves 10 universities, 29 community colleges, 84 school districts, 130 senior high schools, 110 middle and junior high schools and 50 elementary schools. The MESA Schools Program serves 16,000 students at 19 centers. The MESA Community College Program serves 3,300 students at 29 centers. The MESA Engineering Program serves 2,500 students at 10 centers at four-year institutions. MESA centers are located at University of California, California State University, California Community College and independent college and university campuses. MESA works with 650 math and science public school teachers throughout the state who serve as MESA Advisors in the classroom.

Community Partners

- Higher education and local school districts (provide local funds and in-kind support)
- Local schools (provide release time for teachers who become MESA advisors)
- State legislature in partnership with the University of California (provides infrastructure and funding)
- More than 250 corporations (offer resources and financial support and sit on local and state advisory boards)

Learning Environment

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

Program Results Highlights

Of California MESA high school graduates who are African-American, Hispanic American and Native American, 29 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-Americans and 6.5 percent for Hispanic Americans.

Of California MESA high school graduates overall, 57 percent go on to post-secondary education as math, science or engineering majors.

Opportunities for Support/Replication

California MESA is the model for similar programs in more than a dozen other states, including a national Hewlett-Packard community college initiative designed to increase the number of African-American, Hispanic American and Native American engineers and computer scientists.

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Merck Institute For Science Education

Program Overview:

Merck & Co., Inc. founded the Merck Institute for Science Education (MISE) in 1993 with the mandate to improve student performance and participation in science. Focusing on K-8 students, the Institute is based on the National Science Resources Center's tenets for exemplary science programs:

- standards-based instructional materials in science;
- high-quality professional development for teachers;
- systems of support for instruction;
- assessments that inform teaching and program evaluation; and,
- community and administrative support.

The hallmark of the Institute's work is the establishment of vital partnerships with educators, parents, Merck employees and policy makers.

Reach/Target Student Population:

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

Community Partners:

Working with teachers, administrators, parents and Merck volunteers, MISE has helped make standards-based science education a reality in its partner school districts. Through these partnerships, the Institute has demonstrated the ability to:

- create an effective and comprehensive professional development program;
- move classroom practice steadily closer to the vision of good science teaching;
- change classroom and school culture;
- increase alignment of district policy with standards-based practice; and
- influence state and national policies in science education.

Learning Environment:

The impact of the MISE partnership on the science classroom is apparent. Before MISE, students did little inquiry-based, hands-on science. Science class was predominately teacher-centered; experimentation by students was rare. Now science has taken on an entirely new meaning. Teacher-directed, textbook lessons still occur, but they are intermingled with hands-on experiments and inquiry.

Program Results Highlights:

Results indicate that students receiving science instruction from teachers who participated in the MISE partnership professional development over several years outperformed students whose teachers had only one or no years of MISE training. Another measure of MISE's achievement is its success in building the capacity of the districts to sustain improvement over time. While MISE initially bore a significant portion of the cost of purchasing new curriculum materials and providing professional development for teachers, the partners leveraged other funds to expand their efforts and reallocated their resources to sustain the work. In the last few years, financial responsibility has been borne by the districts.

Opportunities for Support/Replication:

This program is an example for other corporations, as well as all technical assistance organizations, whether they be sponsored by states, universities, non-profit organizations or professional organizations. The challenge now facing the Institute is to leverage the success of its efforts so that increasing numbers of classrooms throughout the state and country become centers of standards-based teaching and learning.

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Omaha Public Schools/Banneker 2000

Program Overview:

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

Reach/Target Student Population:

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

Community Partners:

Banneker 2000 works with a number of partners, including:

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

Learning Environment:

The Banneker 2000 classroom environment:

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

Program Results Highlights:

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

Opportunities for Support/Replication:

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

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Project Lead The Way

Program Overview:

Established in 1996, Project Lead The Way (PLTW) is a non-profit pre-engineering education program found in 1,700 secondary schools in 47 states nationwide. Its sequence of courses, when combined with appropriate mathematics and science courses in middle and high school, introduces students to the scope, rigor and discipline of engineering and technology prior to entering college. The program's formal curriculum is rigorous and contemporary, problem/project-based and is supported by relevant teacher professional development, which is provided in a required immersion format and further augmented in an ongoing manner through a Web-based Virtual Academy.

Reach/Target Student Population:

PLTW is available to all sixth- through- 12th grade students nationwide. One of PLTW's strategic goals is to recruit and retain more female and underrepresented minorities to the program. In September 2006, 1,700 schools in 47 states will have enrolled more than 175,000 students. They will be taught by more than 3,500 individual teachers, all of whom have been trained by PLTW. They will be counseled by more than 2,500 school counselors, all oriented by PLTW.

Community Partners:

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

- 30 colleges and universities (support teacher professional development in their states)
- 40 state departments of education (collaborate with universities and schools which oversee program implementation in their states)
- Corporations like Intel and Rolls Royce (underwrite national and state initiatives for teacher training)
- Agencies like NASA (collaborate on curriculum development)
- Associations like the National Fluid Power Association and the Society of Manufacturing Engineers (collaborate on curriculum development and extra-curricular initiatives)
- Organizations like the National Action Council for Minorities in Engineering and the National Association for Partnerships in Equity (collaborate on the minority and female participation issues)
- Institutions like the National Academy of Engineering's Center for the Advancement of Scholarship in Engineering Education (recognizes PLTW as the top pre-college engineering education program)

Learning Environment:

The problem/project-based nature of the curriculum necessitates a classroom environment which emphasizes group collaboration and inquiry.

Program Results Highlights:

A 2005 study by True Outcomes of York, Pennsylvania reported that:

- 80 percent of PLTW seniors planned on attending college or community college compared to 65 percent nationally;
- 54 percent planned to enroll in engineering or engineering technology compared to 10 percent nationally;
- 19 percent planned on attending community college or technical school;
- overall schools offering PLTW were representative of their state's population;
- minority student participation met or exceeded the proportion of bachelor's degrees awarded in engineering in 2004 to minority students by race;
- representation of Hispanics and African-Americans in PLTW courses was double their representation in post-secondary engineering programs nationwide; and
- female student participation in PLTW was comparable or exceeded the total proportion of females earning bachelor degrees in engineering in 2004, in the fields of mechanical, electrical and computer engineering, and in engineering technology, but less than the percentage in biomedical and environmental fields.

Opportunities for Support/Replication:

Support is welcomed by corporations, organizations and/or individuals. With 1,700 participating middle and high schools, PLTW offers a curriculum that can be adapted by school districts across the country.

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Science In Motion

Program Overview:

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

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

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

Reach/Target Student Population:

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

Community Partners:

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

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

Learning Environment:

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

Program Results Highlights:

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

Opportunities for Support/Replication:

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

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Summer Science Academy

Program Overview:

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

Reach/Target Student Population:

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

Community Partners:

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

Learning Environment:

The Summer Science Academy is staffed by local high school science teachers and Xavier science majors; the presence of the Xavier student permits regular interactions with someone who is actively pursuing a career in science. Classes are held in the science complex on the University’s campus, which provides the science backdrop and also allows for interactions with college science majors. The curriculum is standardized. The lessons are strategically designed in a series of modules, each with clear learning goals, a copious amount of practice problems, and relevant homework. Additionally, the presence of local high school teachers as directors/lecturers lends a hand in forming the collaborative bond between secondary schools and college campuses.

Program Results Highlights:

Due to Hurricane Katrina, much assessment data has been lost. However, 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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Texas Pre-Freshman Engineering Program

Program Overview:

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

Reach/Target Student Population:

In 2005, TexPREP served 2,641 students, of whom 2,339 completed the program. Three-quarters (74 percent) of the students are Hispanic, 10 percent African-American, 9 percent Asian and 7 percent Caucasian. Slightly more than half (51 percent) are female. The students are from middle and high schools in 106 Texas-based independent school districts, and numerous parochial, private, charter and home schools. The TexPREP program is conducted on 20 community and senior college campuses throughout Texas. The instructional staff includes approximately 110 teachers and 120 program assistants who are current college students majoring in STEM fields.

Community Partners:

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

- The state of Texas
- Participating college and university PREP sites
- Local school districts
- Texas Health and Human Services Commission
- U. S. Department of Agriculture Summer Food Service Program
- Private industry
- Other public and private agencies

Learning Environment:

A typical day (Monday through Thursday) for a TexPREP I student runs from 9:00 a.m. – 3:00 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 computer science and engineering; 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 PREParady (TexPREP version of Jeopardy) and field trips to science- or engineering-related facilities. In a typical summer, TexPREP students learn that through hard work and persistence they can be successful in a college environment. Moreover, they acquire the preparation and motivation to successfully pursue a college preparatory program when they return to their schools in the fall. In subsequent summers (TexPREP II and III) student classes include physics, algebraic structures, geometry, trigonometry, probability and statistics, and technical writing.

Program Results Highlights:

Since 1979, more than 23,700 middle and high school students have successfully completed at least one summer component of TexPREP. Of these students, 81 percent are members of minority groups who are underrepresented in science and engineering, 53 percent are women and 38 percent represent economically disadvantaged families (students are financially eligible for the school lunch program). Of the 11,048 who are of college age, 6,578 responded to the 2005 annual survey, reporting:

- 99.9 percent are high school graduates;
- 97 percent are college students (3,309) or senior college graduates (3,045);
- 82 percent of the college attendees graduate from college;
- 78 percent of the senior college graduates are members of underrepresented minority groups;
- 50 percent of the senior college graduates are STEM or computer science majors; and
- 74 percent of the STEM and computer science senior college graduates are members of underrepresented minority groups.

Opportunities for Support/Replication:

TexPREP needs support from outside organizations to maintain and increase the number of students it serves. In addition, public and private sector organizations can provide career awareness speakers. Since its establishment in 1979 as San Antonio PREP, TexPREP has expanded significantly with its statewide rollout beginning in 1986.

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Valle Imperial Project In Science

Program Overview:

The Valle Imperial Project in Science (VIPS) began in 1996-97 and was funded by the National Science Foundation (NSF) as a Local Systemic Change (LSC) Initiative through 1999-2000 as a collaborative partnership between the 14 Imperial County school districts and San Diego State University, Imperial Valley Campus and Imperial Valley College. It was preceded by three years of a pilot effort on the part of the El Centro Elementary School District. During this period, three pilot schools were established; a fully functioning materials resource center was set up; hands-on, inquiry-based curriculum kits were purchased; and a cadre of lead teachers selected and trained. Today, the program is self-sustaining and has marked its 10th anniversary.

Reach/Target Student Population:

VIPS serves approximately 22,500 K-6 students and 1,100 teachers in 43 schools in 14 school districts in Imperial County, California. Many Imperial County residents live in extreme poverty, with household incomes declining in real dollars over the last decade. The IRS reported a 2000 mean per capita income of \$17,353, the lowest of all California counties. The county's unemployment rates increased from 17.1 percent in 1991 to 23.2 percent in 1999, while statewide unemployment rates remained fewer than 5.2 percent. Imperial County ranks highest in poverty of all 58 counties in California. Most Imperial County residents have strong cultural and linguistic ties to Mexico. Of the 22,500 K-6 students served, 81 percent are Hispanic. Caucasians (11 percent), African-Americans (5 percent), Asians (1 percent) and Native Americans (1 percent) make up the rest of the population. More than half of the students in the county are Limited English Proficient, with 10 percent children of migrant workers. Nearly all of the county's schools qualify for Title I, with more than 70 percent of all students eligible for free and reduced lunches.

Community Partners:

VIPS, itself, is a collaborative partnership between the 14 Imperial County school districts and San Diego State University, Imperial Valley Campus and Imperial Valley College. One of the program's key strengths is that the 14 districts form a true partnership where time, resources and support are provided by the central offices and building principals. In addition, VIPS receives strong community support from science professionals, representing the local university, community college and private industry sectors.

Learning Environment:

Students are exposed to four curriculum kits per year, except at the kindergarten level where three are introduced. The kits provide a balance of topics drawn from life, physical and earth science areas. Using these kits, students are provided with rich opportunities to become directly engaged in science process skills development, such as critical thinking, problem solving and team working. Science content is covered in greater depth compared to the more superficial traditional textbook approach. Each topic then becomes a vehicle for the construction of important scientific concepts that are both developmentally appropriate and able to capture the curiosity of the students. All kits are aligned to the National Science Education Standards.

Program Results Highlights:

All fourth- and sixth-grade students in the El Centro School District were assessed on the Science Section of the Stanford Achievement Test, 9th Edition, Form T in addition to the required Reading, Mathematics, Language and Spelling sections. The results of this study were statistically significant and have been well-documented in the literature (Amaral et al, 2002; Jorgenson and Vanosdall, 2002; Saul, et al, 2002; Klentschy and Molina-De La Torre, 2002 and 2004). The results indicate that the longer students were exposed to a high-quality program of instruction in science supported by sustained professional development of teachers, the better they achieved. The results also indicate that achievement gaps between English speakers and English learners were closed though the lesson adaptations made by the project staff (Amaral et al, 2002). And finally, local decision-makers have been influenced by the research evidence, both published and in the process of being published, indicating the impact of a strong program of instruction in science on reading, writing and mathematics. Taken together, these results have contributed to VIPS sustainability.

Opportunities for Support/Replication:

VIPS welcomes public and private sector support. The VIPs program, while tailored to meet the needs of California's Imperial County, was one of 88 LSC initiatives funded by the National Science Foundation. Other communities with LSC initiatives are located in western Pennsylvania, New Jersey and Delaware, among others.

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Program Overview:

Founded in 1999, Visualrealization.com (VR program) is a teacher professional development program that is recognized by the National Science Teachers Association (NSTA) as an Exemplary Science Program to effectively produce superior student learning. The VR program centers on a learning technology called *Digital Imagery as an Instructional Mode for Student Achievement (DIIMSA)*. The *DIIMSA Model*, created by the VR program, stimulates a better learning environment by activating more senses – sight, sound, touch – during learning, which increases retention and provides teachers with an effective way to increase student achievement at a high level. Students are then able to move to the next level of learning in a leveled playing field regardless of ethnicity, socioeconomic status or background.

Reach/Target Student Population:

In Texas, the VR program reaches 920 teachers, representing 72 schools with 108,000 students across six school districts. Additional program participants include university students in STEM disciplines and pre-service teachers. The target population includes: elementary and secondary school teachers and students spanning African-American, Hispanic, Asian, Native American and Anglo groups from rural, urban and suburban school districts.

Community Partners:

The VR Program partners with:

- Texas Parks and Wildlife – Sheldon Lake Environmental Learning Center (project site for students and teachers)
- A.C. Green Youth Foundation (Project STEM-LEADRS program)

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

Learning Environment:

“The sky is the limit” is a phrase that captures the essence of the VR program. Students and their teachers are revitalized and reenergized. The study of science becomes alive and the boundaries of the science classroom disappear. Teachers and students work side-by-side, questioning, discovering, sharing and learning. Teachers can effectively and successfully lead a science research project by involving students in all aspects of inquiry. Through its teacher professional development, the VR program prepares teachers to provide the foundational knowledge, skills and experiences students need for future educational achievement, while allowing them to become more involved in the

processes of science. It levels the learning field for students, not by lowering standards or resources, but by raising the bar and bringing all students and teachers up to it.

Program Results Highlights:

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


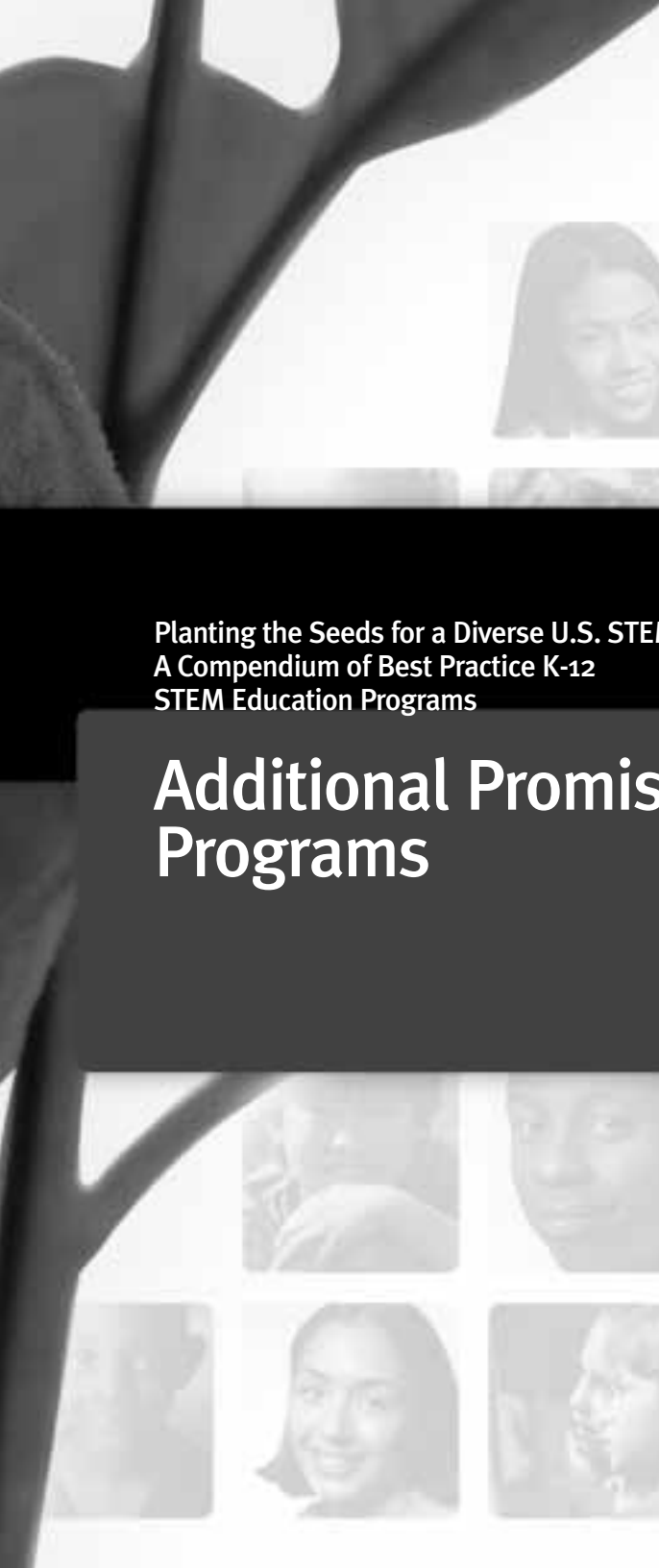
Opportunities for Support/Replication:

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

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

Additional Promising Programs



ENTRYPOINT! Internship Program for Students with Disabilities

Program Overview:

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

Reach/Target Student Population:

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

Community Partners:

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

Program Results Highlights:

Since 1996:

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

Opportunities for Support/Replication:

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

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St. Louis Regional Engineering Academy

Program Overview:

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

Reach/Target Student Population:

Implementation of the PLTW curriculum in the St. Louis area schools began in 2002, with Riverview Gardens as the first school district to offer the program to 10 students. In just four years, the program has grown to 20 high schools and more than 1,100 students.

Community Partners:

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

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

Learning Environment:

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

Program Results Highlights:

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

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

Opportunities for Support/Replication:

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

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Texas Bioscience Institute

Program Overview:

With its inaugural class beginning in August 2006, Temple College's Texas Bioscience Institute (TBI) is a program for high school juniors and seniors, giving them the opportunity to receive college credit while still in high school. Participating high school juniors and seniors attend high school for half a day and TBI for the other half. The purpose of TBI is to prepare central Texans to work in the bioscience industry.

Reach/Target Student Population:

Eleventh- and 12th-graders are the target population. In its first year, 61 students representing 15 high schools from nine central Texas school districts and two private schools, as well as home school students, attended TBI. Priority is given to underserved populations and students who represent the first generation in their family to attend college. In addition, students are selected based on academic scores, attendance and completion of Algebra I, Chemistry I and Biology I. TBI's first class is 43 percent Caucasian, 7 percent Asian, 21 percent Hispanic and 29 percent African-American. More than half are female.

Community Partners:

TBI brings together nine different school districts, two private schools, home school students, numerous universities, the Temple Bioscience community, the Cancer Research Center, Scott & White Hospital, Texas A&M Medical School, Veterans Medical Center and numerous other programs/organizations.

Learning Environment:

Students attending TBI engage in a real-world, project-based curriculum, attend seminars led by world-class scientists and physicians, and are introduced to the world of science. Housed in a hospital research facility, students are able 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:

TBI has just been named a Texas Science, Technology, Engineering, and Math (T-STEM) Academy Early Innovator. As an Early Innovator, the Texas Bioscience Institute will receive a grant totaling \$150,000 from the Texas High School Project T-STEM Initiative. The grant will support the continuation of the Academy's work and be used to share the best practices of the Institute with schools across the state of Texas.

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 mentors.

FOR MORE INFORMATION, PLEASE CONTACT:

Nelda Howton


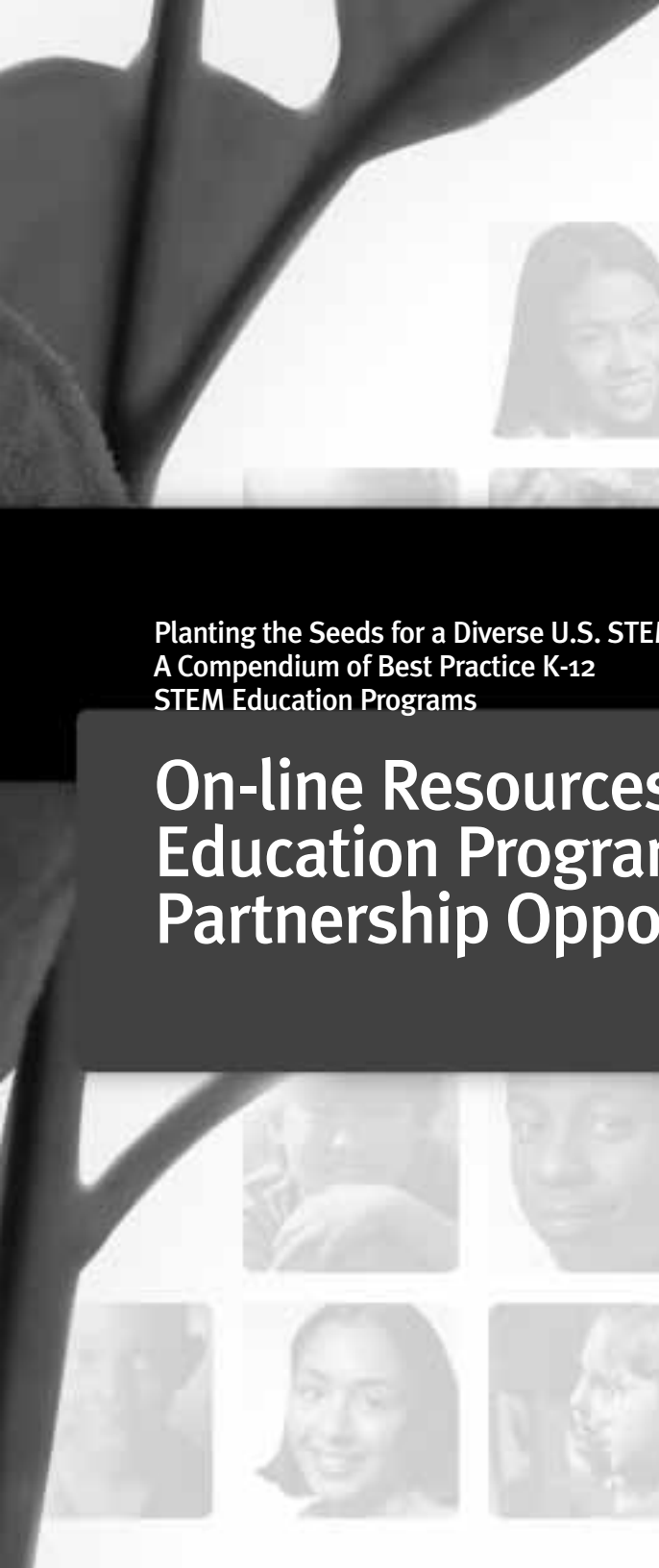
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Planting the Seeds for a Diverse U.S. STEM Pipeline:
A Compendium of Best Practice K-12
STEM Education Programs

On-line Resources for Education Programs and Partnership Opportunities



STEM Organizations

American Association for the Advancement of Science

www.aaas.org

American Association of Engineering Societies

www.aaes.org

American Chemical Society

www.chemistry.org

American Chemistry Council

www.americanchemistry.com

American Indian Council of Architects and Engineers

www.aicae.org

American Indian Science and Engineering Society

www.aises.org

American Institute of Biological Sciences

www.aibs.org

American Institute of Chemical Engineers

www.aiche.org

American Mathematical Society

www.ams.org

American Society for Engineering Education

www.asee.org

American Society of Agricultural Engineers

www.asae.org

American Society of Civil Engineers

www.asce.org

Association for Women in Computing

www.awchq.org

Association for Women in Science

www.awis.org

Association of American Indian Physicians

www.aaip.com

Association of Women in Mathematics

www.awnm-math.org

Community of Science

www.cos.com

Council for Chemical Research

www.ccrhq.org

Extraordinary Women in Engineering Project

www.engineeringwomen.org

National Academy of Engineering

www.nea.edu

National Academy of Science

www.nasonline.org

National Action Council for Minorities in Engineering

www.nacme.org

National Council of Black Engineers and Scientists

www.ncbes.org

National Society for Black Engineers, Inc.

www.nsbe.org

National Society of Black Physicists

www.nsbp.org

National Society of Professional Engineers

www.nspe.org

National Technical Association, Inc.

www.ntaonline.org

Science Service

www.scicerv.org

Society for the Advancement of Chicanos and Native Americans in Science

www.sacnas.org

Society of Hispanic Professional Engineers

www.shpe.org

Society of Mexican American Engineers and Scientists

www.maes-natl.org

Society of Women Engineers

www.swe.org

The Mathematical Association of America

www.maa.org

The National Alliance of State Science and Mathematics Coalition

www.nassmc.org

Women in Engineering Programs and Advocates Network

www.wepan.org

Women in Technology International

www.witi.com

Education Organizations

Education Trust

www2.edtrust.org

Local Systemic Change Network

www.lsc-net.terc.edu

Math and Science Partnership Network

www.mspnet.org

National Association of Research and Science Teaching

www.narst.org

National Council of Teachers in Mathematics

www.nctm.org

National Science and Technology Education Partnership

www.nationalstep.org

National Science Resources Center

www.nsrconline.org

National Science Teachers Association

www.nsta.org

The International Society for Technology in Education

www.iste.org

Triangle Coalition for Science and Technology Education

www.trianglecoalition.org

Government Agencies and Organizations

Department of Education

www.ed.gov

Department of Energy

www.doe.gov

NASA

www.nasa.gov

National Institutes of Health

www.nih.gov

National Science Foundation

www.nsf.gov

The White House Office of Science and Technology Policy

www.ostp.gov

Business Organizations

Business-Higher Education Forum

www.bhef.com

Council for Aid to Education

www.cae.org

Council on Competitiveness

www.compete.org

Minority Business Roundtable

www.mbrt.com

National Association of Manufacturers

www.nam.org

The Business Roundtable

www.businessroundtable.org

The Conference Board

www.conference-board.org

U.S. Chamber of Commerce

Business Civic Leadership Center

www.uschamber.com/bclc



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