



Representing the science center and museum field worldwide

ASTC Input for NGA Governors Guide on STEM Education: Recommendations and Examples—June 2011

How Science Centers Can Help America's Governors Meet Their STEM Goals

It is increasingly evident that organized educational activities outside the classroom can, and do, strengthen core learning skills, spark new interests, and promote greater self-esteem in our youth today. ASTC believes that by opening—or in some cases, expanding—a dialogue involving governors, local school districts, administrators, teachers, and science centers, the opportunities are dramatically increased for comprehensive, coordinated approaches to STEM education. Strategies that take into account the broader STEM learning ecology have the greatest potential for success and will help build upon the strategies and recommendations set forth in the National Governors Association's 2007 report, *Innovation America: Building a Science, Technology, Engineering, and Math Agenda*. Institutions that provide informal science education are already deeply engaged with these relevant educational components at state and local levels.

Broadly, these categories involve:

- **Engaging administrators** in building a broader approach to STEM education
- **Supporting teachers** in employing the widest possible range of tools for professional development in STEM education
- **Ensuring broader student access to Extended STEM Learning Environments**
- **Measuring progress** and expanding STEM education to lifelong learning.

Engaging Administrators

School administrators are key components of every state's STEM education infrastructure; they represent an essential communications link with municipal leaders. American's governors should engage these administrators collectively—and in creative ways—as a first step in building a broader approach to STEM education.

About ASTC and Science Centers: Who We Are

The Association of Science-Technology Centers (ASTC) is a nonprofit organization of science centers and museums dedicated to furthering public engagement with science among increasingly diverse audiences. With nearly 350 members in the United States alone—including at least one in every state—the science center field is primed to play a key role in assisting America's governors with their important efforts to improve the science, technology, engineering, and mathematics (STEM) competencies in every K-12 student, which is critical to the future success of the United States in a rapidly changing global marketplace.

ISE-focused institutions are following this approach. Examples include:

Pacific Science Center, Seattle, Washington

The Washington State Leadership and Assistance for Science Education Reform (LASER) is a partnership program with the National Science Resources Center (NSRC), the Washington State Office of the Superintendent of Public Instruction, Pacific Northwest National Laboratories, Pacific Science Center, and Educational Service Districts and lead school districts from across Washington State.

The Pacific Science Center (PSC) has a strong collaborative partnership with the Association of Washington School Principals (AWSP) and Pacific Northwest National Laboratory through Washington State LASER. AWSP was interested in the development and facilitation of week-long summer leadership retreats for K-12 principals and administrators. All STEM education professional development trainings were based on current research, best practices in the field, and elements of effective instruction. The goals were to: (1) Build shared understanding of quality STEM teaching and learning; (2) Build a toolbox of resources to support STEM teaching and learning; (3) Provide a launching point for leadership to create a culture of STEM education; (4) Build awareness of multiple assessment tools for STEM teaching and learning; and (5) Have fun “wondering” together. Teachers also joined in the STEM education training in order to: (1) Deepen understanding of how to create a culture of STEM education “back home”; (2) Examine new research on STEM education that will give insights into a subset of the students teachers work with (focus on gender); (3) Engage in another first-hand experience, focused on effective teaching and learning, that connects the concept of powerful learning experiences with the STEM design model they experienced last summer; and (4) Receive additional tools for their “toolbox” for use with staff.

Center of Science and Industry (COSI), Columbus, Ohio

COSI is a key component—and founding partner—of the Ohio STEM Learning Network (OSLN), an unprecedented collaborative aimed at building and connecting STEM teaching and learning capacity in regions across the State of Ohio. At its core, the OSLN is focused on student and teacher success, built from a slate of committed partners from Pre-K-12 education, higher education, and business and industry. Designed from a systems engineering approach, the OSLN helps develop and connect a state-wide system of innovative STEM schools and Programs of Excellence, leveraging the ongoing work of regions across the state, along with a \$12 million grant from the Bill & Melinda Gates Foundation and an initial \$2.8 million investment from Battelle. This is being done through a state-level public-private partnership that includes Battelle, Ohio Business Roundtable, Ohio Business Alliance for Higher Education and the Economy, Cleveland Foundation, and the Teaching Institute for Excellence in STEM (TIES). Locally, many partners across the state are involved in this work. The OSLN upholds three overarching objectives: (1) Enhancing STEM teaching and learning capacity that is closely aligned with state-level guiding principles as specified in Ohio Revised Code; (2) Accelerating existing and emerging STEM initiatives such as STEM start-up schools and related K-8 STEM Programs of Excellence; and (3) Creating a network-based infrastructure that promotes and connects innovative, scalable and sustainable STEM initiatives.

Museum of Science, Boston, Massachusetts

The National Center for Technological Literacy is an initiative of the Museum of Science, Boston, which is active in all 50 states via partnerships that seek to raise awareness and understanding of

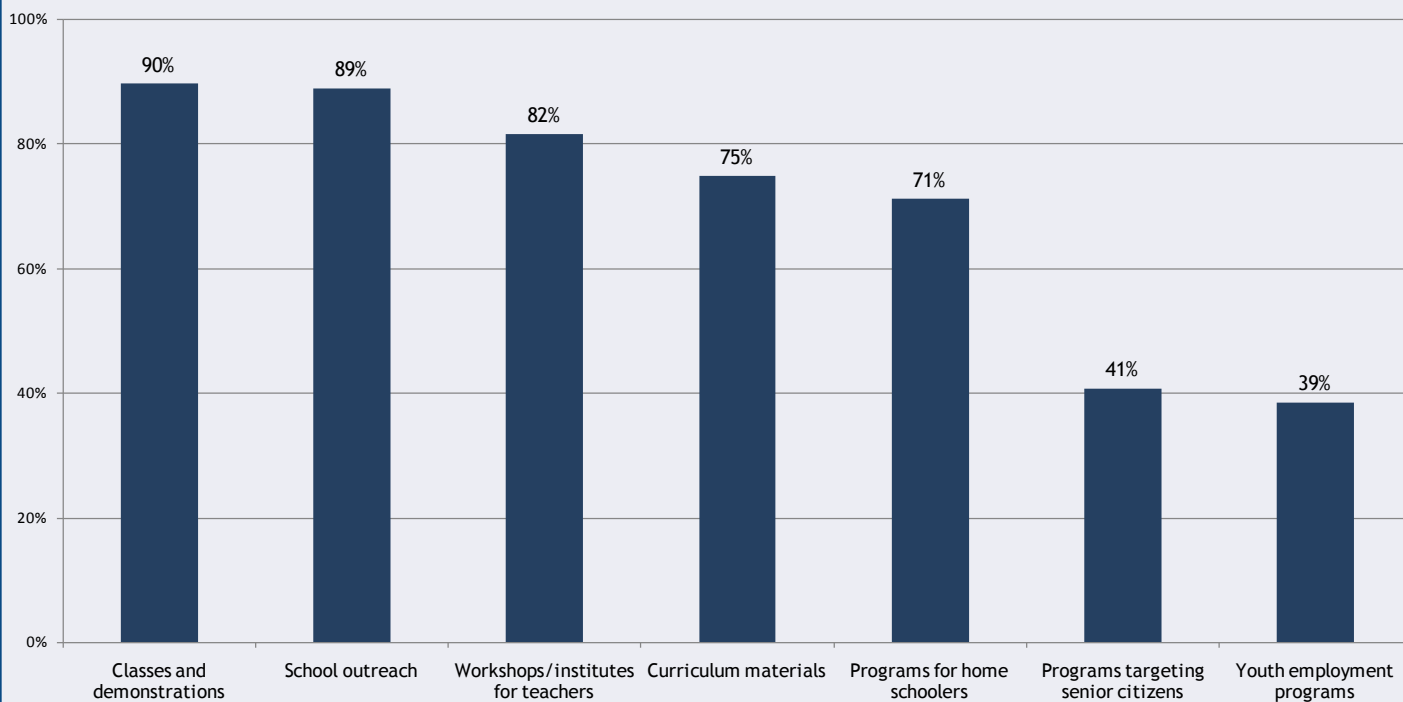
engineering in schools and museums. The NCTL inspires and fosters the next generation of engineers and technology leaders by promoting technology and engineering understanding. To plant the seeds of excitement about science and math, our society must provide an environment where engineering is celebrated and flourishes. Working with local education leaders, the NCTL will play a critical role in turning the tide and raising the understanding of engineering by introducing engineering and technology education into the K-12 curriculum and into exhibits and programs of science museums and other informal educational venues nationwide.

About ASTC and Science Centers: What We Do

ASTC encourages excellence and innovation in informal science learning by serving and linking its members worldwide and advancing their common goals. Through strategic alliances and global partnerships, ASTC also supports science centers and museums in proactively addressing critical societal issues, locally and globally, where understanding of and engagement with science are essential.

ASTC estimates that there were 89.6 million visits to member science centers and museums worldwide last year, with an estimated 62.9 million visits made to ASTC’s science center and museum members in the United States. Here in the United States, 90% of our members offer school field trips, and we estimate that nearly 11 million children attend science centers and museums as part of those groups each year. Field trips, however, are just the beginning of what science centers and museums contribute to the educational experience of students and teachers alike.

Percentage of ASTC science centers and museums in the United States offering educational programs, by type



Furthermore, more than half offer afterschool programs—especially noteworthy given that more than 15 million school-age children, including more than 1 million in grades K-5—are on their own after school.

At a time when schools face shrinking resources and growing demands, reversing this trend depends on leadership from civic institutions that partner with families, communities, and schools. Science museums are ideally positioned for this leadership role. Their strategic visions, robust education programming, and inspirational exhibits linked to classroom curriculum make science museums natural partners in improving STEM education.

About ASTC and Science Centers: Why We Do What We Do

The Association of Science-Technology Centers (ASTC) is a nonprofit organization of science centers and museums dedicated to furthering public engagement with science among increasingly diverse audiences. With nearly 350 members in the United States alone—including at least one in every state—the science center field is primed to play a key role in assisting America’s governors with their important efforts to improve the science, technology, engineering, and mathematics (STEM) competencies in every K-12 student, which is critical to the future success of the United States in a rapidly changing global marketplace.

Programming offered by science museums aims to shape the attitudes about and participation in science. The short-term goal is to increase awareness, interest, and participation in science, and longer-term goals include influencing youth to choose STEM careers, sustaining a supportive climate at the community level for science engagement and participation, and facilitating high-quality science teaching and learning in schools. Science museums have multifaceted approaches and target students, teachers, community organizations, and families at a community-wide level. They are also a proving ground, thoroughly analyzing and evaluating the programs they deliver and implementing the best ideas.

Science museums offer sustained, academic, year-long professional development coursework for teachers, targeting educators with limited experience teaching science. Effective classroom teaching is critical to helping children develop the essential thinking skills they need to weigh evidence, solve problems, balance risks and rewards, and make sense of their environment. Teachers dive into professional development workshops at science museums, where they explore science topics relevant to their classroom science curriculum and return to the classroom with new ideas, greater confidence, and the resources they need to make science engaging for their students. The focus is on enabling teachers who are in the classroom today and creating a pipeline of quality teachers with the skills to inspire passion and excitement of about science. Many science centers aim to provide quality professional development while working with local school districts towards placing a content-qualified teacher in every STEM classroom. They also provide graduate level coursework, assisting school districts that require teachers who teach in STEM fields to have an endorsement in their field of study. Credentials themselves are not enough. With partners, science museums work to ensure that instruction will have an impact on student science achievement. Professional development workshops at science centers are designed to increase teachers’ knowledge of science content, improve their teaching skills, and demonstrate how to use museum programs and exhibits to enhance science curriculum.

Science museums have created programs that expand their role in their communities. New partnerships with schools and community organizations are extending science engagement beyond the classroom and museum walls and into places where students already spend their time after school. As a result, children and teens from diverse backgrounds get an opportunity to discover new interests, develop new skills, prepare for college, and learn about careers in science and engineering. Science museums partner with schools and community-based organizations to offer pre-teen students early, hands-on exposure to science through after-school clubs. These programs often aim to increase science literacy and interest in science in underserved neighborhoods.

ASTC has partnered with the Noyce Foundation, which is interested in significantly increasing the number of youth in the United States who pursue STEM careers, and has stated that “it is a national imperative to impel ongoing innovation, solve major national and international environmental issues, enhance economic competitiveness, and address other issues.” To that end, the Noyce Foundation has outlined its support of STEM education for the following reasons:

1. A scientifically and technologically literate citizenry requires lifelong STEM learning.
2. A strong technical workforce means getting students interested early in life.
3. Informal STEM experiences are especially effective in sparking children’s interests in ways that broaden participation in STEM.
4. Afterschool and summer learning experiences can increase school performance.
5. Informal learning opportunities can help engage students and reduce the achievement gap.

Supporting Teachers

Non-school environments for informal science provide valuable, cost-effective venues for teacher training and support. America's governors should avail themselves of this existing—and highly-effective—opportunity. Of ASTC's 346 members in the United States, 84% engage in teacher training programs. Future teachers obtain skills to address STEM education challenges in the regular classroom. Teachers collaborate with peers, and providing mentoring and professional development opportunities. Teachers report that the flexibility and creativity that they learn through this training directly transfers to their teaching during the regular school day. Examples include:

Chabot Science Center, Oakland, California

Techbridge is a national program that offers curriculum that's girl-friendly, training for role models, expertise in after-school and summer programming, and programs-in-a-box for Girl Scout councils. The program was launched in 2000 with support from the National Science Foundation to help increase the representation of females and underrepresented minorities in technology, science, and engineering. Since its founding, Techbridge has served over 2,800 girls through after-school and summer programs for girls, primarily in underserved communities, as well as thousands more girls through partnerships with the Girl Scouts and other national organizations. Evaluation results have demonstrated the positive outcomes of Techbridge on girls' skills, confidence and interest in technology, science and engineering.

Arizona Science Center, Phoenix, Arizona

The Institute for Teaching, sponsored by APS, offers a variety of professional development opportunities. The mission of the Institute is to deliver effective, standards-driven programs designed to meet the ever-changing needs of today's educators while supporting district, state and federal mandates. Offerings include:

- APS Back to School Resource Fair and Reception
- Field Trip Orientation Workshops (earn professional development hours)
- Educator Workshops and Events (earn professional development hours)
- Educator Memberships.

Connecticut Science Center, Hartford, Connecticut

The Connecticut Science Center (CSC) and the Connecticut State University System (CSUS) launched the i4 Initiative last July. The initiative brings science applications developed by faculty at Central, Eastern, Southern and Western Connecticut State Universities to CSC visitors. i4 will showcase the science research and applications currently underway at the four CSUS universities through a variety of in-house and online programming at the Science Center. The CSC will feature daily i4 Initiative gallery science activities and on-site demonstrations about research unique to Connecticut with artifacts on display for visitors to see and touch. The i4 Initiative also aligns with Connecticut State Science Framework Standards and highlights career paths for young people pursuing careers in science. The Initiative's website also includes podcasts with CSUS faculty as well as activities and resources for learning more about each initiative. The first i4 initiative programs include genetics, geology, navigation and technological simulations in nursing.

Also last summer, thanks to a generous grant from The Hartford Financial Services Group, Inc., 20 teachers from four of Connecticut's priority school districts (Hartford, New Britain, Groton and Danbury) went back to school for high impact professional development provided by the CSC. The Hartford Financial Services Group Teacher Recognition and Scholarship Award, a two-year program, included a week-long workshop in August for the selected teachers and Science Center workshops and demonstrations for the students directly in the teachers' classrooms and school districts. The program also included the creation of an online professional learning community so that the teachers can share ideas and collaborate on lesson plans.

The CSC's 2011 Educators Guide provides a very explicit description (including a matrix) to show how its exhibits and programs are created to directly support specific topics and outcomes of the state's "No Child Left Behind"-driven science framework. As a result, the CSC is positioned as a "solution provider" to help teachers get better at teaching science (professional development), and to help them get their kids to be better at learning science through field trips, programs, etc. Schools have responded very strongly to this: of 550,000 people served since they opened, 100,000 are school field trip students, and they've trained more than 1,000 teachers as well.

Exploratorium, San Francisco, California

The Exploratorium has several highly regarded professional development programs, including the Teacher Institute, which supports secondary science and math teachers, and the Institute for Inquiry, which offers workshops about the theory and practice of inquiry-based teaching and learning.

Each year, about 450 middle school and high school science and math teachers attend Teacher Institute (TI) programs, with many teachers participating in multiple institutes and workshops. Some teachers have attended TI programs every year for more than a decade. Involvement with TI typically begins with a participant attending a four-week summer institute. There are four institutes per year, each focusing on a different science or math topic, but all of the institutes are designed to help teachers experience the benefits of inquiry-based teaching, develop expertise with hands-on activities, and strengthen their content knowledge. Institute graduates become TI alumni (there are about 1,900 active alumni) and are invited to attend a variety of workshops and two-week advanced institutes.

The Institute for Inquiry (IFI) is a highly sought-after professional development program that addresses the theory and practice of inquiry-based science education. Inquiry is an approach to learning that gives students the opportunity to explore the natural or material world in a way that leads to asking questions, making discoveries, and testing those discoveries in search for new understanding. IFI workshops and seminars are tailored to a variety of participants: professional developers, administrators, lead teachers, national education reform leaders, out-of-school educators, and the university community. Since its inception in 1995, educators from 600 school districts in 46 states have attended IFI programs, as have participants from 10 countries. In addition, IFI has published a series of facilitator's guides online for professional developers working with classroom teachers. These guides enable professional developers to lead their own workshops about the fundamentals of inquiry and the role of formative assessment in inquiry-based teaching and learning.

Fort Worth Museum of Science and History, Fort Worth, Texas

The Fort Worth Museum of Science and History is the home of the Texas Center for Inquiry. Since the Center began, the museum has served over 1,000 educators throughout the state of Texas. Three institutes are offered during the summer: (1) Introduction to Inquiry: Professional Development

Design, an institute for science supervisors, staff developers, and teacher leaders in position to train and support educators in their district; (2) Building Capacity for Classroom Inquiry, the second part of Introduction to Inquiry; and (3) Teaching Science through Inquiry, an institute is designed for the classroom teacher who would like to learn more about inquiry-based education and how to implement it into their classroom.

Lawrence Hall of Science, Berkeley, California

Lawrence Hall of Science (LHS) is a dynamic center for teacher education, research, and curriculum development in pre-K–12 science and math education. LHS helps students reach and exceed national standards and benchmarks for science and math education. Professional development programs for teachers and administrators feature:

- Scientific investigations and mathematical problems that build critical thinking skills
- Interactive curricula on key topics
- Activities that enable all educators—regardless of background or training—to successfully bring activity-based, inquiry-driven learning to students.

LHS emphasizes ongoing professional development that supports long-term instructional improvements at our partner schools. Every year more than 22,000 teachers participate in LHS professional development programs. Instructional materials developed at LHS

- are in use in all 50 states
- are in use in over 20% of the country's elementary schools
- have been translated into 27 languages.

LHS school programs, on-site and through the Hall's extensive outreach efforts, bring workshops, assemblies, festivals, and classes to more than 350,000 students annually, in California and beyond.

Oregon Museum of Science and Industry (OMSI), Portland, Oregon

The OMSI Summer Science Institutes for Teachers offers teachers the chance to revitalize their curriculum with some creative ideas and activities from a wide range of science disciplines. This year, the Institute will take on a new format, filling the day with breakout sessions and speakers to provide teachers with options that best meet their needs. The day's schedule is still under development, but will include elements from OMSI's most popular workshops, including "Engineering Design," "Expedition Northwest," and "No Hassle Messy Science with a Wow!"

In 2009, OMSI received two grants for its School Partnerships program. Wells Fargo awarded a \$10,000 grant to OMSI to enable four Oregon schools to participate in the program, designed to reach students with unique, ongoing science education experiences and provide professional development opportunities. The Wells Fargo grant assisted select schools in Baker, Klamath, Multnomah, and Lincoln Counties, providing hands-on education to more than 1,340 students and professional development training to their teachers in 2009. Through the program, OMSI staff makes personal contact with teachers and administrators at the schools and develops personalized educational resource packages. The customized packages respond to the needs of each of the selected schools and its teachers.

In addition, science exploration expanded for students at the Pauling Academy of Integrated Sciences (on the Marshall High School campus) thanks to a partnership with OMSI and a \$25,000 grant from the Jordan Fundamentals grants program. OMSI's School Partnerships program makes it easier for schools to use OMSI's resources in their science curriculum. Teachers choose from a menu of OMSI resources and services to create a year-long program tailored to their school's needs. Pauling Academy students used such OMSI resources as: outdoor science school, reserved labs at the museum, instruction from an OMSI educator, a planetarium show, an OMSI-organized school assembly, an OMNIMAX movie, and more. Many Pauling Academy students come from families earning low incomes and many speak English as a second language.

Museum of Science and Industry, Chicago, Illinois

The Museum of Science and Industry and the Illinois Institute of Technology (IIT) offer a series of courses that allow educators to earn a Master of Science Education degree or a middle-school science endorsement in as little as two years. Programs begin with the Museum's professional development courses for 4th- through 8th-grade teachers. Participants gain a broad science background through courses in life science, environmental science, physical science, and earth and space science. IIT provides required pedagogy courses. The master's program requires 11 courses (33 graduate credit hours), and the endorsement requires 8 courses (24 graduate credit hours). Courses are offered at a reduced tuition rate during the academic year and summer.

Students can experience the thrill of scientific discovery in the Museum's Learning Labs. Led by a Museum educator, labs are focused, hands-on, multidisciplinary programs for school groups that align with Illinois Learning Standards in science. Teachers receive a Lab Guide with key vocabulary and activities to share before their visit as well as follow-up activities and resources to continue the exploration back in the classroom. They may choose from 15 Learning Labs, including four new labs exploring the physics and chemistry concepts featured in the Museum's "Science Storms" exhibit.

Serving Students in Extended Learning Environments

Non-school learning environments provide valuable venues for informal STEM experiences, generating interest, engagement, capacity, and pursuit of academic and career paths. **Eighth-grade students** who indicated interest in science careers were **1.9 times** more likely to obtain an undergraduate degree in **life sciences** and **3.4 times** more likely to obtain an undergraduate degree in **physical sciences** or engineering, than those who had no such aspirations in eighth-grade. **61%** of scientists surveyed first became interested in science by **age 11**. Informal science experiences at an early age were as positive as experiences in school. Youth who participate in out-of-school STEM programs improved significantly in three major areas: feelings and attitudes, indicators of behavioral adjustment, and school performance. All result self-confidence and self-esteem, positive social behaviors, and accomplishment in school settings. Crime and delinquent behavior are replaced by productive, growth oriented activities.

Among ASTC members, nearly **50%** of the moderate to large science centers in the nation provide **multiyear programs for youth**. These include:

- **44 volunteer** programs
- **8 intern** programs
- **49 youth** programs.

Programs include: hands-on workshops, lectures by scientists, field trips, laboratory research projects, environmental restoration projects, mentored student assistance, and more. Many partner with community based organizations, corporations and other groups to benefit children and communities. Many serve teens from groups historically underrepresented in STEM fields, with a large percentage of students going on to college and majoring in sciences. America's governors should support science centers and museums in their efforts to promote positive, productive, and growth-oriented societal behavior among youth in diverse communities. Many museums and science centers offer programs for youth from underserved populations. The examples below provide only a snapshot of these programs, many of which originated through ASTC's *YouthAlive!* initiative with the support of the DeWitt-Wallace Reader's Digest Fund.

Saint Louis Science Center, St. Louis, Missouri

The Youth Exploring Science (YES) program further promotes the Saint Louis Science Center's mission "to stimulate interest in and understanding of science and technology throughout the community." In an effort to do so, the YES program works with 250 underserved teenagers throughout the course of their high school career, providing them with an inquiry learning environment that focuses on science, mathematics, and technology. YES teens are recruited from over twenty partnered community based organizations who are committed to serving low-income families throughout the St. Louis area. Participants of YES gain professional, academic, and real world skills that assist in building self-confidence and personal success. YES teens interact directly with organizations and community partner members to help facilitate science events and activities. The Youth Exploring Science program is comprised of several components that include:

- **Community Partnerships:** The Saint Louis Science Center launched the YES program in 1997 by recruiting fifteen low-income minority teens from community organizations. Today's YES teens continue to be recruited from more than twenty community partners which help to serve low-income families in the St. Louis community.
- **Fall and Spring Programs:** In September of each year, YES teens engage in Saturday Learning Labs and after-school programs structured to help them continue to develop both academic and process skills and create a knowledge base in science, technology, engineering and math. The teens participate four to ten hours per week with YES staff, learning and teaching science in after school programs, and reflecting on their teaching practices and work skills.
- **Summer Program:** For 8 weeks during the summer, YES teens participate 5 days a week, engaging in Learning Labs and work based-skills workshops. Teens also demonstrate their confidence in core STEM concepts by facilitating hands-on activities, workshops, and demonstrations to a variety of public audiences.
- **Year-Round Professional Development:** Throughout the year, YES teens participate in professional development workshops that address the developmental needs of teenagers and focus on timely and relevant topics that face today's youth. In addition, they develop fundamental workplace skills that include managing diversity, improving interpersonal communication, and developing a positive self-image.

Carnegie Science Center, Pittsburgh, Pennsylvania

The Girls, Math & Science Partnership (GMSP) was created to address issues regarding girls, their participation in science, and the expansion of their opportunities in and influence on the science and technology workforce. Working with girls ages 11-17, their teachers, parents, and mentors, GMSP draws organizations, stakeholders, and communities together in an effort to ensure that girls succeed in math and science. The partnership's mission is to engage, educate, and embrace girls as architects of change.

Lawrence Hall of Science, University of California, Berkeley, California

LHS helps students reach and exceed national standards and benchmarks for science and math education and is a national leader in providing and supporting quality afterschool science learning opportunities. Their work in this arena happens in many ways: direct service; science curriculum for afterschool programs; support to afterschool providers; advocacy, evaluation, policy. LHS is a provider of high quality afterschool science content and programs to San Francisco Bay Area youth and youth-serving organizations through model afterschool programs housed on-site at LHS, in schools, and in community based organizations.

The Museum of Science and Industry, Chicago, Illinois

MSI has developed the Science Minors program, in which students aged 14-18 attend 10 weeks of science education and training by Museum staff and external scientists, then volunteer to conduct interactive science experiments for Museum guests. Science Minors gain a better understanding of science, a first-hand look at science careers, and public speaking skills. Since 2003, more than 600 Science Minors have contributed over 100,000 hours of volunteer service. Teens who complete the Science Minors program are eligible to become Science Achievers. Science Achievers deepen their work by pursuing more rigorous science topics, meeting with working science professionals, preparing for college and careers, and having the opportunity for paid internships.

Detroit Science Center, Detroit, Michigan

The Detroit Science Center has a strong commitment to providing exciting educational opportunities and outstanding visitor service. Community members can be part of the Science Center's team by volunteering to help with every aspect of the Science Center's operations, from conducting demonstrations to giving directions. Of the two types of volunteer opportunities, the Newton Society Science Program focuses on teens who have a strong desire to learn and are interested in assisting visitors, helping with clerical projects, or working behind-the-scenes.

Crissy Field Center, San Francisco, California

The Center offers a variety of programs for middle and high school youth, including Inspiring Young Emerging Leaders (I-YEL), which encourages, prepares, and challenges young people from diverse backgrounds to be advocates for environmental and social change. I-YEL is initiated, designed, and coordinated by youth. Through leadership development, career exploration, and goal setting, I-YEL participants acquire the skills necessary to be the teachers and leaders of today and the future and also have the opportunity to teach youth programs at the Center, outreach in communities, attend conferences, and create their own community service projects.

National Science Center (Fort Discovery), Augusta, Georgia

The NSC is in partnership with the Army's Cadet Command to provide hands-on math and science training for high school cadets. The NSC provides curriculum and materials for 8 hours of activities (4 hours of science and 4 hours of math) that involves "learning by doing." Cadets construct battery-powered cars, spinning coil motors, series and parallel circuits, flashlights, burglar alarms, telegraph keys, electromagnets, and engraving pencils, often using such simple materials as wire and paper clips. The NSC provides the instructional material and supplies to participating camps across the nation.

Measuring Progress Among Youth and Within the Broader Community

America's governors should obtain from local ISE institutions the best examples of measurable successes in support to STEM education, and should provide necessary support to expand these successes as broadly as conceivably possible. Moreover, governors should encourage ISE institutions to continue serving not only youth but also the lifelong learning community, demonstrating the values of STEM education in broadest possible terms. A scientifically and technologically literate citizenry requires lifelong STEM learning: the time spent on science and math classes make up less than 1% of the persons waking hours. In contrast, adults report using a variety of informal science education sources for lifelong learning. Successful ISE programs not only meet the inspirational and growth-oriented societal objectives noted above. In addition, these activities should be offered in a setting that demonstrates the continuum between STEM education for youth and public engagement in STEM-related issues in all aspects of society among all age groups.

Successes are measurable. Examples include:

MOSI (Museum of Science & Industry), Tampa, Florida

MOSI's YES! Team (Youth Enriched by Science) program is a career and educational enrichment program designed to help at-risk youth, between the ages of 13 and 17, develop and progress in a supportive peer-group environment. Established in 1992, the focus of the program is to provide an opportunity for students to develop self-confidence, improve communication skills, build self-esteem and exhibit leadership skills. In addition, students are encouraged and motivated to pursue science both as a career and as an essential element of their total education. 90% of participants have furthered their education by attending college; 87% become mentors for current YES! Team members; 20% currently assist with designing science curriculum as a MOSI InterActor; and nearly 82% of YES! Team members pursue careers in math and science.

Project Exploration, Chicago, Illinois

Project Exploration is a nonprofit science education organization that works to ensure communities traditionally overlooked by science—particularly minority youth and girls—have access to personalized experiences with science and scientists. Project Exploration students are significantly more likely to graduate from high school, go to college and major in science than their peers, and they attribute their persistence in school and in science to participating in Project Exploration's programs. 95% of field students graduate high school; 58% enroll in a four-year college; and 32% of all students and 40% of girls who graduate high school as Project Exploration field alumni choose to major in science.

Miami Science Museum, Miami, Florida

The Center for Interactive Learning (CIL) is a joint venture with the University of Miami, aimed at fostering the linkages between informal science education and the formal education and research community. Primary goals of the Center are to: (1) Develop and test models that improve our understanding of how people learn science in informal environments, and (2) Bring this heightened understanding to bear on the design of programs, exhibits and experiences that provide enhanced science learning opportunities. The Center's programs and projects serve a diverse audience including girls, low-income youth, and other traditionally underserved groups, future and practicing teachers, early childhood educators, faculty, school leaders, and parents.

The museum's Professional Development Decisions Using Data (PD3), was created in collaboration with SRI International, developing and testing an observation tool for science, mathematics and reading, helping to identify staff development needs; providing feedback to future teachers completing their internships; supporting peer coaching efforts; and providing data in support of research studies. CIL is also collaborating with University of Miami's Department of Psychology and SRI International on a research study aimed at obtaining evidence of the potential efficacy of a museum-developed early science readiness curriculum and related teacher professional development. And, in its Afterschool Program Exploring Science (APEX, CIL completed comprehensive field-testing of eight thematic units, designed to enhance hands-on investigative science in after-school programs run by local community-based organizations.

Other Points for Further Consideration

As noted, the value of informal learning institutions, like science centers and museums, rests in the creative, inspiring environments they provide to visitors of all ages—an environment that allows them to connect with the fabric of science learning wherever it exists. Some of these “places for learning science” (to borrow from the National Research Council of the National Academies) are not predictable ones, but the opportunities they offer should not be dismissed. With an open mind, governors could readily tap into the STEM-related learning in offerings like these:

FIRST Robotics

FIRST Robotics teams compete at local and regional events in cities throughout the world. The city of St. Louis has hosted FIRST Regional competitions for nine years and has hundreds of volunteers involved in all four programs within FIRST including: Junior FIRST LEGO® League; FIRST LEGO® League; FIRST Tech Challenge; and FIRST Robotics Competition. The local community, spearheaded by the Saint Louis Science Center, assists all of the local robotics teams with mentors, venues and financial support.

4-H's 2011 National Science Experiment, Wired for Wind

4-H recently announced the 2011 National Science Experiment, Wired for Wind, which will introduce young people to the possibilities of using wind as a clean, widely available, and low-cost source of renewable energy. This exciting annual youth science event brings together youth from all around the nation to complete a single, innovative experiment on 4-H National Youth Science Day, which will be held on Wednesday, October 5, 2011. Designed by the University of Nebraska – Lincoln Extension and working in partnership with KidWind, the 2011 National Science Experiment will demonstrate how implementing alternatives to traditional energy production can have a positive impact on

communities and ecosystems. 4-H youth will enhance their engineering skills by designing, building and testing two different wind turbine models. Wired for Wind will also help youth relate their scientific experiences back to their own lives as they determine the best location for a wind farm in their state or local area by calculating wind power and studying wind data and maps.

Café Scientifique, Science Center of Iowa, Des Moines, Iowa

Last month, the Science Center of Iowa hosted a special edition of Café Scientifique to discuss the crisis in Japan and how Iowans can be prepared. This special edition of Café Sci featured presentations from a panel of experts on earthquakes, disaster relief and nuclear disaster. The discussion focused on the crisis in Japan including facts and myths regarding the Fukushima Nuclear Plant, disaster relief efforts and how Iowans can help. The presentations were followed by a half-hour for guests to ask questions in an open forum.

Wonder Years: The Science of Early Childhood Development, Science Museum of Minnesota, St. Paul, Minnesota

Visitors to the Science Museum of Minnesota's new *Wonder Years: The Science of Early Childhood Development* exhibition will see the world through the eyes of the children they once were. Through hands-on activities and multimedia experiences, visitors will learn that children make great strides in cognitive and social development between birth and five years of age, and they'll discover the ways in which that growth is an important factor for success later in life. *Wonder Years*, a permanent exhibition in the Science Museum's Human Body Gallery, gives visitors a powerful glimpse at how early experiences shape the platform for children's growth and development.

Eat Well, Play Well Exhibition

In the *Eat Well, Play Well* exhibition (now at the McWane Science Center in Birmingham, Alabama), visitors will find answers to questions like: What is in the food we eat? Are fruits and vegetables important? Can everyday activities burn calories? This highly-interactive exhibit encourage healthy living by teaching the science of making healthy food choices and helping children and adults discover that there are many fun and interesting ways to stay active. Visitors will discover what an appropriate serving size looks like, see firsthand what it takes to burn off calories, test their flexibility and balance, review the latest clinical research and realize that they can reduce their risk of disease with healthy choices that are within their reach.