



Afterschool Alert

ISSUE BRIEF



Partnerships with STEM-Rich Institutions

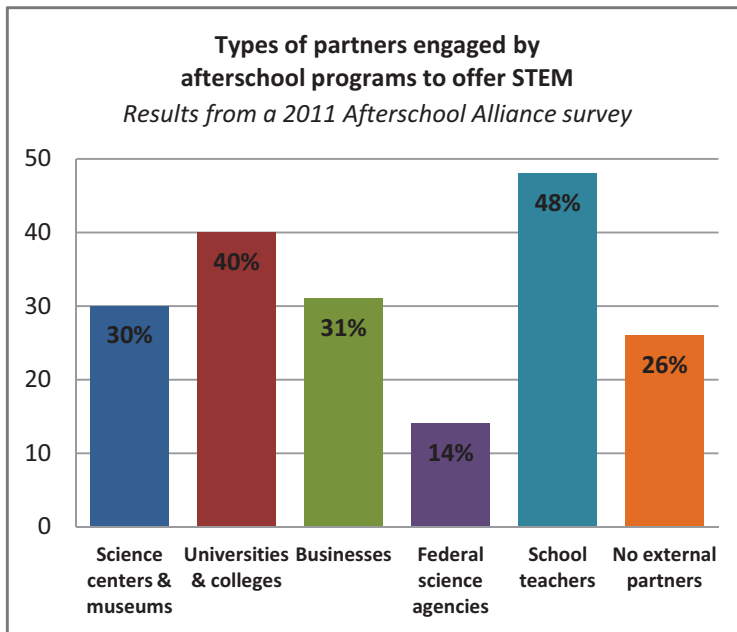
The Afterschool Alliance is proud to present the first in a series of two issue briefs on afterschool STEM programs, generously supported by the Noyce Foundation. The issue brief topics represent emerging discussions within the afterschool field and are drawn from the two award categories of the 2013 Afterschool STEM Impact Awards: (1) partnerships with STEM-rich institutions, and (2) computing & engineering in afterschool. The briefs feature the award winners and other exemplary afterschool programs that are having a significant impact on participants and demonstrate the potential of the afterschool space to contribute to broader national STEM education goals.

Afterschool programs around the nation have enthusiastically embraced science, technology, engineering and math (STEM). Some major afterschool providers, like 4-H and Girls Inc., have long made STEM a priority and in recent years, the vast majority of providers have also come to value providing STEM learning opportunities as an important part of their programming. An Afterschool Alliance poll of afterschool programs conducted in 2010-2011 showed that 99 percent of respondents thought that offering some sort of STEM programming was important, even if that wasn't the focus of their program.ⁱ


The afterschool environment provides a space for rigorous, hands-on STEM learning and engages a diverse group of children and youth. It provides a different mode of intervention—one that allows for learning experiences to be matched to students' interests and facilitates project-based learning that drives home the relevance and importance of STEM in our daily lives. It gives young people the opportunity to learn through solving problems and through failing—an element crucial to research, experimentation and innovation; science and engineering fields require persistence in the face of failure to solve the world's problems. Additionally, mentoring and exposure to role models—key components of afterschool—especially important for engaging youth of color.ⁱⁱ Afterschool STEM programs are proving to be highly effective and they deliver important outcomes. Youth in high-quality afterschool STEM programs show (1) improved attitudes toward STEM fields and careers; (2) increased STEM capacities and skills; and (3) a higher likelihood of graduation and pursuing a STEM career.ⁱⁱⁱ However, many youth do not have access to these opportunities. A 2012 study, conducted by Nielson for Change the Equation, revealed that only 20 percent of households have children enrolled in afterschool STEM programs.^{iv}

As interest and commitment to STEM learning in afterschool grows, there is an increased need for support to build the capacity of afterschool programs to offer innovative and robust STEM programming. The Afterschool Alliance poll of afterschool programs also asked respondents to describe what supports they saw as most essential. Unsurprisingly, funding was ranked as the highest need, but a close second was a desire for partnerships with STEM professionals and STEM-rich institutions, as well as more opportunities for professional development.

Afterschool programs have a long and rich history of leveraging community resources to best meet the needs of the youth they serve.^v They recognize that STEM-rich institutions—science centers and museums, universities and colleges, corporations and businesses, and government agencies—have a lot to offer. All of these institutions in turn have keen interests, and sometimes a major stake, in K-12 STEM education. Partnerships leverage the STEM expertise and resources of the institution—and in combination with the youth development expertise of afterschool professionals, they open up the possibility for incredibly impactful STEM learning opportunities for youth.



This issue brief illustrates the power of strong, successful partnerships between afterschool programs and STEM-rich institutions. Additionally, the partnerships described offer promising and innovative models that can have a significant impact on both students and their instructors.



Read more about the afterschool programs mentioned in this issue brief in our Afterschool STEM Storybook.

Visit www.afterschoolalliance.org/STEM-STORYBOOK.CFM.

Find out what makes these programs successful, as well as details on outcomes, curriculum and other program features.

**America's
Afterschool Storybook**

Science centers, museums & cultural institutions

Science centers, museums and cultural institutions like zoos, aquaria, botanical gardens and nature centers often connect with youth through field trips, school outreach programs or as visitors with their families during evenings and weekends. For the vast majority of these institutions, their primary organizational mission, beyond conserving artifacts or organisms, is educational impact. Through partnerships with afterschool programs, these institutions gain a method of expanding and deepening their educational missions by providing a learning experience that has deeper impacts on youth. The James Irvine Foundation's evaluation of their museum-afterschool initiative confirms this as one of the main reasons for museums to get involved in afterschool.^{vi} The foundation also found that afterschool programs allowed museums to connect more substantively with their community and that involvement improved museum capacity and internal culture.

Science centers and museums offer a wealth of potential resources to afterschool programs—all have staff with expertise in STEM content, as well as expertise in teaching and learning in an out-of-school environment. They can provide access to exhibits and artifacts, animals and plants, tools, equipment, and other resources intended for hands-on learning. Science centers and museums often have experience developing activities and curriculum that are effective for use in the afterschool or out-of-school-time space. Many currently provide professional development to school-day teachers, which is an opportunity that could be expanded to include afterschool educators. Some institutions may have staff with evaluation expertise and capacity, which would help afterschool programs to document outcomes and improve quality.

Often, partnerships with science centers, museums and other cultural institutions utilize a mix of several resources, based on the needs of the afterschool program. The diverse set of models that emerge from this type of partnership allows for a great deal of customization based on the goals of the partnering organizations. The examples below demonstrate just some of the partnership possibilities that make the most of the strengths of science centers and museums.

Utilizing staff STEM expertise

Similar to many science centers and museums, the staff at the Woodland Park Zoo in Seattle, Washington, have diverse educational and professional backgrounds in STEM. The zoo employs zookeepers, veterinarians, conservation biologists, animal dietitians, science educators and more. As a STEM-rich institution that must regularly communicate messages about animal science and wildlife conservation to the public, staff also have significant expertise translating their knowledge to lay and youth audiences. The zoo leverages this resource through ZooCrew, their afterschool program that brings its staff together with middle school youth to teach ecological literacy, conservation action and problem-solving skills. The zoo partners with school-based afterschool programs and community organizations like the YMCA and the Parks & Recreation Department, allowing the zoo to more effectively reach underserved youth, a target demographic for the organization.

Each semester, a group of staff from all 25 of the zoo's departments volunteer to serve as Zoo Advisors to small groups of ZooCrew students. They propose a conservation project in a short video, which students watch to choose the project that most interests them. Students also consider the job role of the Zoo Advisors, selecting projects based on the career they'd like to learn more about. In addition to the zoo professionals that work directly with animals, Zoo Advisors also come from the communications, event planning and fundraising departments. Over the semester, students learn more about the project topic, develop a solution to the conservation problem, and then create a final project. Members of the ZooCorps, the zoo's teen volunteer program focused on science and conservation, also assist the middle school groups.



Read more about **ZooCrew** in the [Afterschool Storybook](#).

The Woodland Park Zoo and its afterschool partners have clearly designated roles—the program itself meets at the school sites and partners fulfill administrative duties, maintain day-to-day operations and provide basic classroom supplies. They also contribute to curriculum development and provide a teacher for classroom support. The zoo, in addition to providing and training Zoo Advisors and teen ZooCorps mentors, leads the development and delivery of the curriculum, provides any specialized

equipment and access to animals, and works with each site to complete a full program evaluation utilizing the zoo’s professional evaluator.

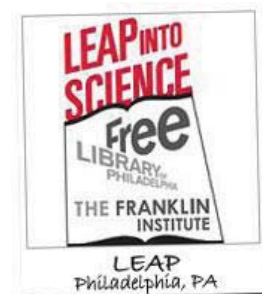
The ZooCrew partnership model pays off—at the end of the 2012-2013 year, more than 60 percent of participants were more interested in science. Of the students who completed the ZooCrew program, 91 percent demonstrated problem-solving skills by identifying, designing and implementing a solution to a conservation problem. ZooCrew participants are shown a pathway to remaining involved in STEM and 50 percent of participants become interested in volunteering with ZooCorps. Participants can visualize a future beyond secondary education in the STEM careers they are exposed to through their Zoo Advisor. Research has shown that early interest in STEM careers is a better indicator than academic achievement of who would actually pursue undergraduate degrees in science or engineering.^{vii}

Offering professional development and curriculum

The Franklin Institute, a science center in Philadelphia, Pennsylvania, has more than 50 years of experience providing professional development for school-day teachers. In partnership with the Free Library of Philadelphia, the science center developed *LEAP into Science* (Literacy Enrichment After-school Program), an afterschool and family engagement program in science and literacy that intentionally leverages the Franklin Institute’s expertise in professional development and science education. In combination with the library’s youth development expertise and familiarity with local communities, *LEAP into Science* effectively reaches underserved children in urban communities. By utilizing the Free Library’s existing citywide network of drop-in afterschool programs, *LEAP* has successfully expanded into more than 50 Philadelphia library branches. Most recently, *LEAP* has continued its expansion to 10 sites nationwide.

In each *LEAP into Science* session, library and afterschool staff engage students in kindergarten through fourth grade in hands-on activities that link science and children’s literature. An adult reads a story, asks the children questions—helping to model the scientific and inquiry process—and then facilitates the group in activities that reinforce the science concept highlighted in the book.

Librarians and afterschool staff may be experts at working with youth, but they often struggle with teaching STEM topics.^{viii} Professional development is therefore key to providing more STEM learning opportunities after school. The *LEAP* team at the Franklin Institute includes experts in science education, literacy, research, and teaching in an informal environment, who translate their experiences and knowledge into curriculum and training for the librarians and afterschool staff who lead the sessions.



Read more about *LEAP into Science* in the [Afterschool Storybook](#).

Training focuses on developing the capacity of the afterschool and library staff to facilitate STEM programs for youth, not just delivering a specific curriculum. The training specifically addresses the connections between science and literacy, teaching science through inquiry, and how to facilitate the curriculum activities. Staff become skilled at adapting and modifying activities, often adding more literacy to the lessons or connections to subjects like history and social studies. In a 2012 evaluation across the national sites, library and afterschool staff showed a statistically significant increase in their ability to teach science through inquiry methods, their science teaching efficacy beliefs, and their

enjoyment of science teaching through their participation in the Franklin Institute’s training program. National partners of *LEAP into Science* report positive outcomes for youth as well—including increased curiosity and interest, enjoyment and inspiration, understanding engagement, investigation skills, and creativity.

College connections and professional experiences for older youth

Science centers and museums offer several types of afterschool and out-of-school-time programming for older youth. EVOLUTIONS After School Program (Evoking Learning and Understanding through Investigations in the Natural Sciences) is a youth development program housed at the Yale Peabody Museum of Natural History. As the Peabody Museum is a university-affiliated museum, museum and university resources often overlap, allowing EVOLUTIONS to access faculty, graduate students, collections and research facilities. EVOLUTIONS is also part of a larger university outreach initiative, which links youth to a network of other STEM opportunities around campus.

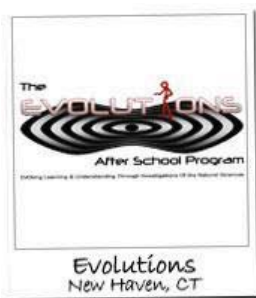
EVOLUTIONS bridges all four years of high school, immersing students in environmental and geological sciences through afterschool sessions, internship options, and a science career ladder program through which participants receive paid work experience at the Peabody Museum. EVOLUTIONS gradually introduces students to science careers and helps them prepare for college and develop workplace skills.

Students can enter the career ladder, SciCORPS (Science Career Orientation & Readiness Program for Students) in their second year of EVOLUTIONS. Beginning as volunteers, youth develop basic job and communication skills and shadow more experienced peers. They are then promoted to paid positions where they teach visitors the science of the exhibits through hands-on carts and activities. At the top of the career ladder, youth act as program leaders, supervisors and content developers.

Science Career Ladders
*Education, mentoring and employment
for older youth*

In recent years, the science center and museum field have shown a great deal of interest in science career ladders. Career ladders are an effective way to engage older youth and for museums to staff exhibits with energetic, engaging people. Paid positions are key to attracting older youth and especially beneficial to low-income populations.

Since 1986, the New York Hall of Science (NYSCI) has run a [noteworthy career ladder program](#). Its long-term impact on participants is documented in a 2009 retrospective study.^{ix} EVOLUTIONS is part of a 2006 scale up of NYSCI’s career ladder model.



Read more about **EVOLUTIONS** in the [Afterschool Storybook](#).

Self-reports from EVOLUTIONS’ 2013 evaluation indicate that students feel their participation in the program positively affects their skills, knowledge and understanding. Eighty-six percent say they increased their knowledge of science-related careers, and 80 percent increased their understanding of the connection between high school academics, college academics and careers. The majority of EVOLUTIONS’ students enter the program planning on going to college, but after participation, the percentage planning on entering a science field jumps from 36 to 54 percent. Almost 70 percent of students say EVOLUTIONS improved their communication skills, ability to manage long-term projects and ability to work in teams. More than half improved their laboratory, field research, and writing skills.

Learning Labs: Another model for older youth

Learning Labs are spaces and programs housed in science centers, museums and libraries in which middle- and high-school youth are able to learn and explore using digital and traditional media. Led by mentors, teens design their own activities and projects as they build skills in areas such as graphic design, video editing and creative writing. Youth primarily access the Labs in the hours after school.

Learning Labs rely on a partnership model for delivering programs—working with other cultural institutions, universities, youth-serving and community-based organizations. The national network of 24 Labs are able to offer lessons to the field about building strong, sustainable partnerships.

Learn more about the initiative at www.imls.gov/about/learning_labs.aspx.

Partnerships with Universities

Universities and colleges are natural partners in K-12 education. They share the mission of educating young people and have a vested interest in ensuring that students graduate high school prepared for college-level courses.^a Land-grant universities and colleges in each state often house cooperative extension programs that are intended to provide research-based information on a variety of topics to the community where they are located. 4-H programs offered through such extension services focus on youth development, and increasingly on STEM. In addition to any specific K-12 education and outreach programs universities may offer, they have a wealth of resources in the various academic departments that can be tapped. Faculty and researchers in these departments can provide content expertise and a human link to the latest exciting developments within that field. They can also provide access to tools, equipment, research labs or artifacts. Federal research grants awarded to faculty often require them to engage in broader outreach efforts, which is an opportunity for afterschool programs to partner with them. Some faculty may be experienced and effective in public outreach and informal education practice, and may even be able to participate directly. However, faculty members are often extremely busy with little spare time, and it is very important to keep their constraints in mind when approaching them about potential partnerships.

Universities and colleges have access to a vast pool of potential STEM mentors and role models—in their undergraduate and graduates students, as well as faculty and staff. Particular departments or student organizations like the Society of Women Engineers or the Society of Physics Students are possible partners who have a history of community outreach.

Finally, schools of education within universities may also have faculty and students specifically interested in the afterschool and out-of-school-time environment. Students with such interests may want to partner with students from STEM departments and afterschool programs to teach STEM in afterschool programs. There may be students and faculty who are interested in undertaking research projects of interest to the afterschool community. They may even be able to provide evaluation

^a For more on the potential benefits of university-afterschool partnerships, see Johannes, E., Mullins, C., & Dvorak, M. (2013). Bringing Universities into the Mix: New Opportunities for Enhancing Afterschool and Summer Learning Programs. In *Expanding minds and opportunities: Leveraging the power of afterschool and summer learning for student success*. Retrieved from www.expandinglearning.org/expandingminds/article/bringing-universities-mix-new-opportunities-enhancing-afterschool-and-summer.

services. The following section describes a few examples of how afterschool STEM programs work with their local universities and colleges to deliver high-quality programming to youth, utilizing several of the benefits described above. All three programs described utilize different methods to prepare afterschool facilitators to successfully teach STEM.

Using university graduate students as mentors

Science Club is a partnership between Northwestern University and the Boys & Girls Club of Chicago, developed around the belief that long-term mentoring relationships are necessary to engage low-income urban youth in science. To achieve this goal, Northwestern graduate students serve as near-peer mentors who are relatable role models to middle school youth. Every week at the Boys & Girls Club, mentors lead small groups of students through designing and running hands-on science experiments. By providing a consistent relationship, they form a strong bond with youth and are able to cultivate a safe space for intellectual curiosity and scientific inquiry.

Northwestern University initially identified the Boys & Girls Club as an ideal partner as they also valued mentoring as a strategy to engage at-risk kids. As a community-based organization with deep youth development expertise and knowledge of the local community, the Boys & Girls Club greatly informs this aspect of the training and professional development for the Northwestern mentors. Chicago Public School teachers and administrators also play a key role in Science Club—they assist in curriculum development, providing feedback on appropriate learning outcomes and performance expectations, and actively bridge students' school-day learning with afterschool. Science Club staff is based at Northwestern University, operating through a university outreach program. They provide the central program administration, coordinate the mentors' participation and training, and lead evaluation efforts. In leveraging the STEM content and education expertise of university faculty and staff, Science Club develops its own hands-on science curriculum and professional development programs for mentors in order to train the graduate students in informal science methods.



Science Club's model demonstrates a clear impact on youth STEM skills. Through a focus on deepening youth understanding of the scientific method and developing scientific habits of mind, Science Club significantly improves participants' experiment design skills, understanding of experimental variables and ability to interpret data. Middle school students in the Chicago Public Schools participate in a fall science fair and work on their projects with Science Club mentors. As a result, they score an average of 41 percent better on their projects than their peers.

Youth are highly engaged in the club—on average, they participate for a year and a half, electing to return each quarter at a rate of 90 percent. Throughout the year, each student receives almost 50 hours of science instruction, which in many cases doubles the amount of classroom science instruction. This additional science time greatly effects a student population in which 97 percent qualify for federal free or reduced price lunch and 35 percent are limited English proficient. Of the most recent graduating class of 8th graders, 9 out of 20 succeeded in gaining admission into some of the most elite public

schools in Chicago. Long-term, Science Club is tracking participants' continued engagement in STEM learning through their elected science and AP courses in high school. Additionally, they will examine high school graduation rates and post-secondary paths.



Science Club
Chicago, IL

Read more about
Science Club in the
[Afterschool Storybook](#).

The mentors also benefit greatly from this experience. Since 2008, 65 Northwestern University graduate students and staff have volunteered as mentors with Science Club, staying on average for 1.4 years. Mentors receive intensive training on teaching skills, engagement strategies, curriculum design and evaluation techniques in informal science education. As a result of the training, more than 95 percent of mentors report feeling more confident as a teacher or science communicator. Mentors are also able to design stronger informal science programs and almost 60 percent of them report they know specific ways to evaluate outcomes. In interviews and focus groups, many Science Club mentors remarked that their interest in science had been reignited and that working closely with youth had opened their eyes to new career opportunities.

Training community volunteers as effective STEM educators

Adult Role Models in Science (ARMS) is a community outreach initiative of the University of Wisconsin-Madison's Institute for Biology Education. Like many college and university K-12 outreach programs, its mission is to improve science education locally, regionally and statewide. The Institute achieves its local goals by providing afterschool science clubs throughout the greater Madison area, using community volunteers and undergraduate students to serve as club leaders. Working with the Madison School District, its afterschool programs and several other local partners, ARMS reaches hundreds of kids each year. However, the focus of the program is on building the capacity of educators, which the Institute believes is key for building long-term sustainability of engaging science opportunities for youth.

ARMS is structured around the belief that all communities have people who are passionate about science and have a desire to share that knowledge with children—and demonstrates, through partnerships, a model of how to cultivate these community resources. The Institute for Biology Education leverages strong inter-university relationships to gain access to faculty, staff and students with expertise in science and science education who develop the volunteer training, university courses and afterschool curriculum.



Read more about **ARMS** in
the [Afterschool Storybook](#).

Coordinated by a university-provided staff member, ARMS facilitates several types of trainings for its club leaders. Community volunteers—who are working STEM professionals and retirees—are trained in science communication, teaching in an afterschool environment and techniques for engaging children. Student volunteers are enrolled in a university course that furthers their knowledge in developing and evaluating afterschool science programs. Retired science teachers are trained in evaluation techniques and regularly observe the afterschool clubs, providing feedback and assessment to club leaders to improve their teaching. ARMS also builds capacity for afterschool practitioners, who co-teach the clubs, by offering professional development in STEM.

ARMS is successful in developing community volunteers and university students into effective afterschool science educators. In 90-100 percent of observed club sessions, leaders demonstrated several behaviors of high-quality STEM teaching: they engaged students' prior knowledge, used age-appropriate questioning, gave clear directions, explained scientific terms, connected new concepts to things children were familiar with, elicited science process skills, and assessed student understanding and engagement. University students report significant improvements in their ability to work with diverse groups of students and to engage in community service. All afterschool practitioners who attended professional development and/or worked with a trained volunteer reported increased confidence and skills in leading science activities. More than 95 percent of afterschool site directors gave club leaders the highest rating possible in actively engaging children in science.

Afterschool as a site for pre-service teacher training

Girlstart is a well-known girl-serving out-of-school-time program operating for several years with proven effectiveness.^x In recent years, they have grown and formalized a staffing model that allows Girlstart to build a base of experienced and dedicated program leaders to lead its afterschool and summer programs. Through partnerships with local universities and colleges, Girlstart provides an intensive paid internship program for pre-service teachers enrolled in UTeach^b—an undergraduate program at several Texas universities^c that allows science and engineering majors to earn a teaching certification.

As a member of the STEM CREW (creative, resourceful, empowered women), interns are afforded significant teaching experience at an earlier point than typical pre-service teacher training programs, working at least 100 hours per semester. Throughout each semester, they teach hands-on STEM activities weekly, attend training sessions, and receive consistent coaching from Girlstart staff and veteran STEM CREW members.

The internship experience with Girlstart's afterschool programs directly complements and supplements pre-service teachers' training programs. One hundred percent of 2012-2013 STEM CREW members reported an increased confidence in their teaching skills. Every intern believed that their experiences would be helpful and relevant to their future jobs and that it made them better teachers. Every member of the 2012-2013 STEM CREW said their experiences in Girlstart helped them make a better decision in finding their first teaching job—by understanding the type of school environment and culture they'd like to work in and which grades they preferred to teach. STEM CREW alumni have a high placement rate in STEM teaching positions.



Read more about **Girlstart** in the [Afterschool Storybook](#).

^b UTeach began as a strategy to get more qualified K-12 math and science teachers. Model is described in: UTeach Institute. (2013, May). *The UTeach Secondary STEM Teacher Preparation Model and Current Standards Reform Initiatives*. Retrieved from www.uteach-institute.org/files/uploads/uteach-and-standards-reform.pdf.

^c UTeach originated at the University of Texas-Austin and has since scaled nationally. Expansion is described in: Beth, A., Hughes, K., Romero, P., Walker, M. & Dodson, M. (2011). *Replication as a Strategy for Expanding Educational Programs That Work: The UTeach Institute's Approach to Program Replication*. Presented at the annual meeting of the American Association of Colleges of Teacher Education, San Diego, CA. Retrieved from www.uteach-institute.org/files/uploads/AACTE2011.pdf.

For Girlstart, the STEM CREW is a strategy to recruit and maintain qualified afterschool educators. There is currently a national priority placed on training STEM teachers^d and the Girlstart model offers a potential solution to train both school-day teachers and afterschool educators through partnerships with universities and colleges. Additionally, by employing female college students, Girlstart is able to provide strong role models for the elementary and middle school girls in their afterschool and summer programs—an effective practice to encourage girls’ interest in STEM.^{xi}

Business and Industry

Businesses and corporations are increasingly engaging in efforts to help address the STEM skills shortage, as it impacts their own ability to recruit qualified employees. As they look to become more engaged in their communities, afterschool programs often offer them easier access to K-12 students than schools. From the perspective of an afterschool program, STEM-related businesses are at the top of the list of possible funding support for afterschool STEM programs. However, businesses and their employees are also a source for enthusiastic volunteers and provide several opportunities to connect youth to careers.

Individuals working for STEM-related businesses, or STEM professionals, can be welcome volunteers in an afterschool program. From the occasional visit to talk about what they do, to a more sustained commitment to mentoring groups of students or hosting an intern in their company, STEM professionals can have an impact on students’ conceptions of STEM and STEM careers.

- **Role models** provide a realistic idea of what STEM professionals do every day, present the diverse array of careers options in STEM, and help students visualize themselves as scientists and engineers. Female and minority role models break down stereotypes about who practices STEM, which is particularly important for populations underrepresented in the STEM fields.^{xii} Role models can also offer career advice and clarify what the educational pathway to becoming a scientist or engineer looks like. [Techbridge](#) in Oakland, California, uses role models extensively in their programming, offering training on interacting with youth and assistance in making classroom visits successful.
- **Mentors** work more closely with students, developing a personal relationship with youth. Requiring a more sustained commitment, mentors might volunteer in the afterschool program every time it meets. In [Science Club for Girls](#), an afterschool program in Cambridge, Massachusetts, more than 100 women in academia and professional STEM fields lead the weekly clubs. Mentors also work with small groups of high school girls on challenging projects in advanced topics.

Businesses, as a whole, can coordinate site visits for afterschool programs to tour their facilities, allowing students to get a behind-the-scenes look at operations and meet several STEM professionals in one day. [ART2STEM](#), a girl-serving program in Nashville, Tennessee, has developed strong relationships with several local businesses that their afterschool clubs regularly visit and has built a network of committed STEM professional female mentors. Running an apprenticeship or internship program,

^d In 2009, Pres. Obama launched the Educate to Innovate initiative to improve American K-12 science and math achievement (www.whitehouse.gov/issues/education/k-12/educate-innovate). To meet this goal, a collaborative effort of education organizations, foundations and companies have formed 100K in 10, to add 100,000 effective STEM teachers to the workforce in the next decade (www.100kin10.org).

especially for teens, allows students to gain real workplace skills and learn how to apply their STEM knowledge in context.

Professionals interested in volunteering, but not directly working with students, can work with program and curriculum developers behind the scenes. Regardless of their interest and commitment level, STEM professionals and local companies are natural advocates—and ideally vocal champions—for the importance of afterschool STEM programs in their community.

An industry-wide commitment to afterschool STEM

The [ACE \(Architecture, Construction, Engineering\) Mentor Program](#) represents an industry-wide commitment to STEM education by increasing youth interest in the building design and construction industry. It is a national afterschool mentoring and apprenticeship program that reaches more than 8,000 high school students every year.

Individual companies commit to allowing their employees time to volunteer with students after school. Mentors lead students through the conceptualization and creation of a design project, while introducing them to various career options within the industry.

The ACE Mentor Program is successful at building career interests in youth—65 percent of alumni from the years 2002-2009 are currently majoring in architecture, engineering or construction as undergraduate or graduate students.^{xiii} ACE also provides a model for increasing industry diversity. African-American and Hispanic alumni enter civil, mechanical and electrical engineering programs at rates of three and four times that of their peers, respectively. Thirty percent of female alumni plan on majoring in these engineering fields, which is twice the national average.

Government Agencies

Federal agencies that focus on STEM—such as the National Science Foundation, the National Oceanic and Atmospheric Administration, NASA, the Department of Defense and others—invest more than three billion dollars in STEM education every year for programs that target school-age students, college students as well as post-graduate fellows.^{xiv} Many of these agencies run grant programs that provide funding to develop, implement and evaluate afterschool programs. Some science mission agencies also develop innovative curricula and teaching resources and provide many opportunities for educator professional development.

NASA's Summer of Innovation

The [Summer of Innovation](#) project aims to support summer and afterschool programs to inspire and engage middle school students in STEM fields using NASA content and curricular support materials. This effort represents a systemic engagement by NASA to strengthen the capacity of in-school and out-of-school educators to engage students from under-represented and under-served populations in innovative and exciting STEM education programs^e. Beyond providing grant funding, NASA education representatives work with grantees to provide sustained professional development and involve NASA centers all across the country.

^e A study conducted on NASA's Summer of Innovation programs identified 50 best practices in summer and afterschool STEM programming for at-risk 4th-9th grade students. Booz Allen Hamilton Inc. (2012). *NASA Summer of Innovation: Excellence in Summer Learning Best Practices and Benchmarking Study*.

Additionally, like universities and corporations, they employ a diverse array of STEM professionals who are eager to engage with young people as mentors and role models. While some federal agencies explicitly have a commitment to K-12 education as part of their agency's mission, many of the STEM-focused agencies have a strong commitment to community outreach and provide access to their facilities for tours, education programs and internship programs.

Conclusion

The afterschool field is enthusiastic about providing youth with hands-on, innovative STEM learning opportunities and has clearly identified partnerships with STEM-rich institutions as essential supports in delivering these programs. Many afterschool programs are already deeply engaged in such partnerships, with participant outcomes clearly bolstered by the STEM expertise provided by partners. The opportunities and resources presented by STEM-rich partners help to increase the capacity of afterschool providers and educators to offer stronger STEM education programs that produce substantive outcomes for participants.

In particular, STEM-rich partners provide a rich source of knowledgeable and enthusiastic mentors to excite interest and provide guidance for the youth participants about STEM fields and possible career paths. It is important to note that adults require training to work with youth and to teach STEM topics appropriately in an afterschool setting. In return, the adults are rewarded with an increased ability to teach STEM topics and a rekindling of their own passion and interest in their field.

The afterschool programs detailed in this issue brief vary widely in their goals, structure, scale and focus. However, several common themes emerged about how the programs formed and maintained strong partnerships that proved to be essential for success:

- Established consistent and honest communication from the beginning, with clear expectations, goals and roles defined upfront;
- Allowed ownership of issues for each partner and maintain flexibility to make adjustments as needed;
- Ensured a good fit by matching the strength of each partner with a clearly identified need;
- Valued and respected all partners for their contribution and continually nurtured the partnerships and collaborations;
- Ensured coordination and communication with teachers and school administrators when needed.

As afterschool programs gain increasing recognition as essential partners in STEM education improvement, they will need to increase their capacity to offer such programming. In conjunction with professional development and training for afterschool educators, partnerships with organizations that have the desired STEM expertise can be an extremely powerful and cost-effective way to address this need. The afterschool programs described in this issue brief provide some models for how such partnerships could work to best serve young people and prepare them to navigate a STEM-rich economy and society.

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- ⁱ Afterschool Alliance. (2011). *Survey on Science, Technology, Engineering and Math (STEM) in Afterschool*. Retrieved from www.afterschoolalliance.org/SurveyBlog.pdf.
- ⁱⁱ Kauh, T. (2010). *Recruiting and Retaining Older African American and Hispanic Boys in After-School Programs: What We Know and What We Still Need to Learn*. Philadelphia, PA: Public/Private Ventures. Retrieved from www.sp2.upenn.edu/ostrc/doclibrary/documents/RecruitingandRetainingOlderAfricanAmericanandHispanicBoysinAfter-SchoolPrograms_000.pdf.
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