



Full STEM Ahead: Afterschool Programs Step Up as Key Partners in STEM Education



Afterschool Alliance

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Cover Photo:

MathPOWER (Boston, MA)

Middle school students at the Dearborn STEM Academy spend five weeks in the summer honing their math and language arts abilities through dynamic experiential learning opportunities. Students participate in weekly field trips in which they build budgets to understand travel and admission costs, immediately applying the math skills they develop in the classroom. MathPOWER is a partner of Boston After School & Beyond. *Photo courtesy of Casey Atkins.*



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SECTION 1: INTRODUCTION

Why is STEM important?

The interconnected content areas of science, technology, engineering and mathematics (STEM) underpin much of modern society. Today's global citizens require a greater level of STEM literacy and fluency to not only effectively utilize what science and technology have to offer them, but also to better understand complex issues that affect them and their communities. Additionally, more and more jobs require proficiency in STEM. With reports that STEM jobs have been growing three times faster than non-STEM jobs,ⁱ there is great concern that without access to adequate educational experiences, large segments of the population will be unable to participate effectively in the modern workplace. For all of these reasons, no matter where children live, they should have opportunities to access quality STEM learning environments.



GSK Science in the Summer™ (National)
Taught by certified teachers, this free summer program introduces scientific concepts through hands-on activities to students entering grades 2 through 6. Created in Philadelphia 29 years ago to combat the “summer slide,” the program has expanded to Pittsburgh, Baltimore/D.C., Chapel Hill, and recently started a 12-site national pilot. Science in the Summer™ is sponsored by GSK and administered by The Franklin Institute in partnership with local public libraries and other community-based organizations. *Photo courtesy of The Franklin Institute.*

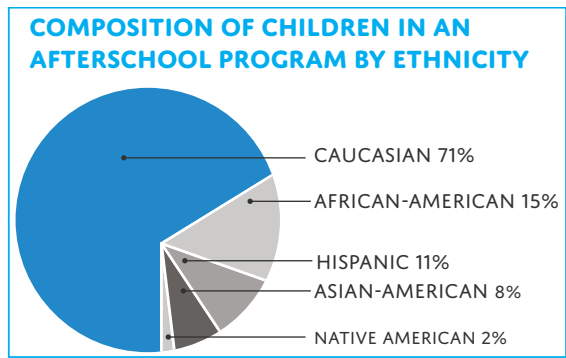
Improving the quality of and access to STEM education remains a high priority in the United States as well as across the globe. STEM learning hones relevant, real-life observation and analysis skills for young people. It cultivates experience with experimenting and checking assumptions against data, which helps make everyone better problem-solvers and citizens, qualities our country needs in a complex and changing world.

Research shows that what happens outside of school can be equally as important as what happens inside of school in setting a child's direction and activating interest in STEM or another subject. Thus, leaders in science education improvement efforts recognize that afterschool programs can play an important role in STEM learning—especially when it involves real science and engineering practices. These practices, such as running science experiments, analyzing data and developing explanations, or designing engineering solutions, have been found to be the best way to learn science and engineering.^{ii, iii}

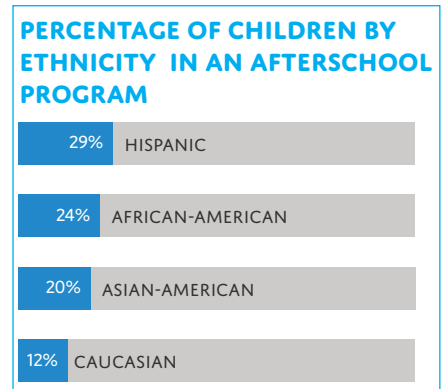
As afterschool programs have expanded their offerings, many providers and funders have seen STEM as a natural fit for the setting. The strong focus on youth development allows for youth-driven exploration that can provide students with opportunities to immerse themselves in STEM learning, which complements the school day with a different approach to teaching and learning. There is room for experimentation and failure, and time for children to develop strong relationships with mentors and peers—all while gaining knowledge and skills. These are all vital for future access and participation in STEM fields and careers.

While some youth-serving organizations, such as 4-H and Girls Inc., have a long history of offering afterschool STEM programs, the larger afterschool field has more recently come to enthusiastically embrace STEM. Four of the largest youth-serving organizations, 4-H, Boys & Girls Clubs of America, Girls Inc. and YMCA, have recently launched “Imagine Science,”¹ an initiative to reach millions

of underserved youth with STEM programming. Over the past decade, a robust infrastructure has also developed to support afterschool program providers. In addition to national associations and networks, many statewide² and citywide³ afterschool networks are supporting programs and advancing both practice and policy in their states and cities. There is also substantial ongoing work in the research community to establish appropriate frameworks for outcomes,^{iv,v} design relevant assessment and evaluation tools,⁴ and document evidence of impacts^{vi,vii} for afterschool STEM programs.



Afterschool programs also present an opportunity to engage young people from the very populations that are traditionally underrepresented in STEM. Women, African-Americans, and Hispanics⁵ are currently underrepresented, as the percentage of members of these groups who earn postsecondary STEM degrees and are employed in STEM fields is disproportionately less than their percentage of the U.S. population.^{viii} But girls attend afterschool programs at similar rates to boys, and African-American and Hispanic children are at least two times more likely to participate in an afterschool program than Caucasian children. Afterschool



STEM programs thus present a great opportunity to reach children from these populations.

Supporting quality STEM education for all children and youth is vital to our country’s prosperity, and policymakers are paying attention to the afterschool space—the President’s Council of Advisors on Science and Technology released a much-cited report^{ix} that included a recommendation to “create opportunities for inspiration through individual and group experiences outside the classroom;” the Department of Education has placed a priority on STEM in its 21st Century Community Learning Centers grants for afterschool and is forging new interagency collaborations that are aimed at making connections across various federal agencies to advance STEM in afterschool;⁶ and the National Research Council (NRC) has just released a consensus study report on productive practices in out-of-school-time (OST) STEM^x as a companion to its report on STEM education in K-12 schools.^{xi} Additionally, the National Science Foundation continues a long-standing commitment to informal science education and afterschool STEM programming, investing about \$60 million through grant programs such as Advancing Informal Science Learning (AISL) and Innovative Technology Experiences for Students and Teachers (I-TEST).

ExpandedED Schools (New York City, NY)
 The ExpandedED Schools initiative, led by The After-School Corporation (TASC), focuses on helping urban schools give kids more time, more ways and more opportunities to learn. A key part of the ExpandedED Schools model is daily, comprehensive afterschool programming operated by community organizations inside public schools to offer kids an inspiring variety of structured, hands-on experiences—including arts, science, movement and service-learning—and academic support and enrichment. In the photo, students participate in hands-on STEM learning.
Photo courtesy of TASC.

¹ Information on this initiative is available on the website at <http://imaginesci.org/>
² Statewide afterschool networks (SANs) and partnerships are operating in all 50 states work to foster partnerships and promote policies to support and sustain high-quality afterschool programs in their state. Approximately half the SANs are deeply involved in building systems to support afterschool STEM programming in their state. Their efforts include developing partnerships with business and industry, higher education, science centers and other STEM-rich institutions; developing quality and outcome metrics; coordinating professional development opportunities and technical assistance; ensuring that afterschool programs are included in state-level STEM strategic plans and other policy initiatives; and looking for funding to sustain programming.
³ Every Hour Counts is a coalition of citywide organizations operating in nine cities across the country that coordinates the work of service providers, public agencies, funders and schools. They work to build effective afterschool systems in cities by convening stakeholders, developing communities of practice and disseminating information about best practices, developing metrics for impact, providing technical assistance to providers and advocating for policy change.
⁴ Information about the Common Instrument tool is available at <http://www.pearweb.org/tools/commoninstrument.html>
⁵ Native Americans and persons with disabilities are also underrepresented in STEM.

Why this survey?

Afterschool programs have emerged as a dynamic and vibrant setting for innovative STEM education and there has been rapid growth in this field over the past few years. Although many of the statewide afterschool networks are collecting data from afterschool providers in their states on afterschool STEM programming, this report offers the first national look at availability and access to afterschool STEM programs and parental attitudes and expectations for such programs. The *America After 3PM* survey is the most comprehensive study of how school-age children in the United States spend their after school hours.⁷ The data from this survey enable us to better understand parental expectations for programming and their perceptions of what is occurring in the programs; and examine differences in availability, satisfaction levels, and priority placed on STEM across various demographics.

The *America After 3PM* survey has been conducted in 2004, 2009, and 2014, revealing changes over a decade in availability and access to afterschool programs during the critical hours of 3 to 6 p.m.—the hours after school ends and before parents typically return from work.

Building on the 2004 and 2009 surveys and recognizing the growing emphasis on STEM learning in afterschool programs, the 2014 *America After 3PM* survey included several specific questions about afterschool STEM programming. In this survey, we defined the constituent topics in STEM as follows: (1) science learning opportunities; (2) technology and engineering learning opportunities (such as building robots, designing bridges or solving environmental problems); and (3) math learning opportunities (such as math games, puzzles or working with geometric shapes). Our goal was to probe for respondents' views on programs that went beyond homework help, especially in mathematics. However, we recognize that parents and providers may define STEM in subjective ways and it is difficult to enforce a rigorous and consistent definition of STEM in a household survey. Therefore, some of the findings about the nature of programming and the frequency might be not as cleanly demarcated from homework-related programs as we might wish.



Digital Harbor Foundation (Baltimore, MD)

In 2013, Digital Harbor Foundation transformed a closed-down rec center into a vibrant Tech Center to provide youth with a space to make and experience hands-on, real-world learning opportunities. Dedicated to fostering learning, creativity, productivity and community through education, Digital Harbor offers month-long elementary school programs, semester-long middle and high school programs, two-week summer camps, and school day field trips. Pictured are two students helping a fellow youth with his video game design, using a web-based software called Scratch. *Photo courtesy of Digital Harbor.*

⁶ Read more about this initiative at <http://www.ed.gov/news/press-releases/federal-agencies-collaborate-improve-after-school-science-technology-engineering-and-math-stem-education>

⁷ In the *America After 3PM* survey questionnaire, “afterschool program” was defined as “A program that a child regularly attends that provides a supervised, enriching environment in the hours after the school day ends, typically around 3 p.m. These programs are usually offered in schools or community centers and are different from individual activities such as sports, special lessons, or hobby clubs, and different from child care facilities that provide supervision but not enrichment.”

SECTION 2: FINDINGS

One of the most striking findings of the 2014 survey⁸ is just how great the demand is for afterschool programs. Over the past decade, the number of children in afterschool programs has grown from 6.5 million^{xii} to more than 10 million.^{xiii} Parents of an additional 19.4 million children would enroll their children in programs if one were available to them. And while parents of course speak to how these programs support their workforce engagement, they also appreciate that the programs offer a wide range of activities and enrichment for their children, from opportunities to be physically active to language literacy support to STEM learning opportunities.

In this section, we examine rates of participation in afterschool STEM programs, their importance to parents and variations in access and satisfaction across a number of demographic factors.

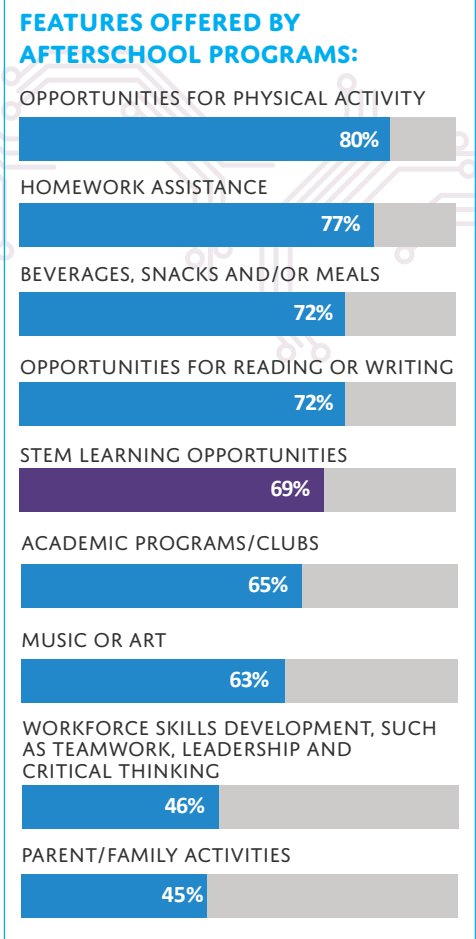
Availability and access

From observations of the afterschool field over the past decade, many people have concluded that STEM programming in afterschool has become increasingly prevalent and many afterschool providers are offering STEM activities as part of their overall portfolio of programming. The data from this survey confirm the observations.

A majority of children in afterschool programs are offered STEM learning opportunities. Seven in ten parents (69 percent) report that their child is offered STEM learning opportunities in their afterschool program, which equates to approximately seven million children who have access to afterschool STEM. The numbers are similar across elementary school, middle school, and high school grade levels. This is consistent with the observed rapid growth of such programming.

There are some striking differences when the STEM program activities are broken down into the components of science, mathematics, technology and engineering.

- Parents report that math activities in afterschool programs are offered at the highest rates of any of the “STEM” subjects. Almost 60 percent of children in afterschool programs are offered math and there is little variation across regions, grade levels or gender.
- 45 percent of children in afterschool programs are offered science learning opportunities. When looking across the grade levels, a little more than half of high school students have such activities, while elementary students have the least opportunities at 43 percent.
- Technology and engineering offerings in afterschool programs are much lower, with only 30 percent of parents on average reporting that their child attends an afterschool program that offers such programming. According to parents, the highest rate of technology and engineering programs is in middle school (36 percent), while elementary school has the smallest percentage (26 percent). Interestingly, high school programs, where we might expect more of such programming, fall in the middle at 31 percent.



⁸ The 2014 survey includes responses of 30,720 households. Parents in 13,709 households completed in-depth interviews through an online survey using a blend of national consumer panels.

AN IN-DEPTH LOOK AT AFTERSCHOOL PROGRAMS IN CALIFORNIA

SRI International conducted a multi-year study to investigate the nature of science offerings in California's After School Education and Safety (ASES) program.⁹ They found that, although the majority of sites reported that they offered science, only 18 percent offered it twice a week or more, 30 percent offered science once a week and 39 percent offered it less than once a week on average. A very small number of sites (4 percent out of 415) offered science on a daily basis. This study was conducted before California's big push to include STEM programming in afterschool and uses a different sample and methodology compared to the *America After 3PM* survey. The SRI study sample was all in California vs. national for *America After 3PM*; SRI studied programs directly while the *America After 3PM* survey studied parental perceptions; and the SRI study used a rigorous definition of STEM while the *America After 3PM* study allowed parents to determine what they considered to be STEM activities and programs. However, it does portray a detailed state of the field prior to a statewide push on STEM in after school and shows how focused state level studies might yield different findings.

The discrepancy between what parents report for frequency of STEM programming in *America After 3PM* and what researchers found in the ASES study deserves further exploration to understand how parents might be defining STEM activities.

While parents report that 69 percent of children in afterschool programs are offered some type of STEM learning opportunity, a much smaller number (45 percent) report that their child's program offers workforce skills development such as teamwork, leadership and critical thinking. It is not clear whether afterschool providers are failing to communicate that their STEM programs support these workforce skills or if the programs do not incorporate such skills.

STEM activities are offered with significant frequency in afterschool programs. For students whose afterschool programs offered STEM activities, parents report that the frequency of such offerings is significant. Three quarters (76 percent) were offered STEM programming at least once a week, while 13 percent of students were offered STEM programming once a month or less. There was a small difference by gender on frequency of participation, with 80 percent of boys and 73 percent of girls participating once or more a week.

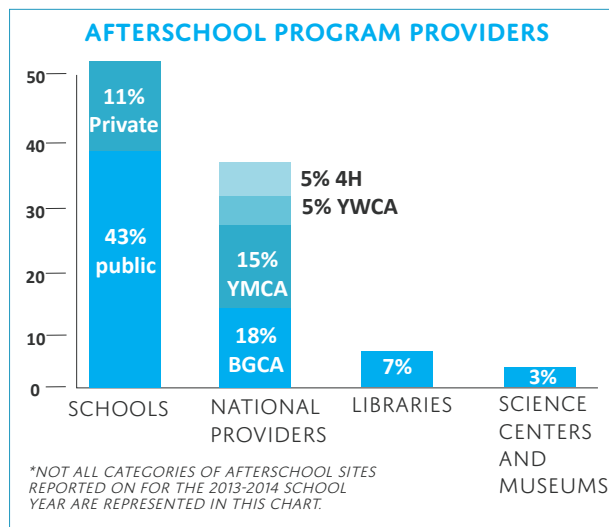
Research^{xiv, xv} has highlighted the importance of the amount and frequency of STEM programming in maintaining interest in STEM fields and encouraging young people to persist in these fields. Research also shows that the quality of programming (which includes frequent and purposefully-designed activities) is intimately linked to the outcomes and impacts.^{xvi} It is therefore encouraging to note that parents report that a majority of students who participate in afterschool STEM programs are doing so frequently.

There is a notable difference in access and participation in afterschool STEM programs between rural, urban, and suburban locations. Children in afterschool programs are being offered STEM programming more, and with greater frequency, in urban communities compared to rural and suburban communities. This finding may relate to the difference in parent satisfaction with their child's STEM programming and the weight an afterschool program offering STEM programming carries with parents. Parents of children in urban programs are more satisfied with their child's afterschool STEM offerings than parents in rural and suburban communities. Additionally, higher numbers of urban parents consider STEM to be an important factor in their decision when selecting an afterschool program and they also agree at higher rates that afterschool programs should be offering STEM and that such programs can help children gain STEM skills. This important issue will be discussed in more detail in an upcoming report from the Afterschool Alliance on rural afterschool programs.

Parents identify public schools, Boys & Girls Clubs, YMCAs, private schools and religious organizations as the most frequent providers of afterschool programs. The following chart shows where afterschool programs are offered most commonly. Only a very small percentage (3.3 percent) of students overall attend afterschool programs run by science centers and museums, which are likely to be STEM-specific programs (this number may not reflect partnerships between science centers and afterschool sites). Many factors are likely to influence this choice, such as convenience, transportation and affordability. However, these data highlight the need for STEM-rich venues such as science centers to partner more with afterschool program providers in their communities to reach children where they are after school ends. Such partnerships will reach more children than bringing them to the science center, which only a small fraction might be able to access and attend.

⁹ Read more about this study at <http://afterschoolsciencestudy.sri.com/about.html>

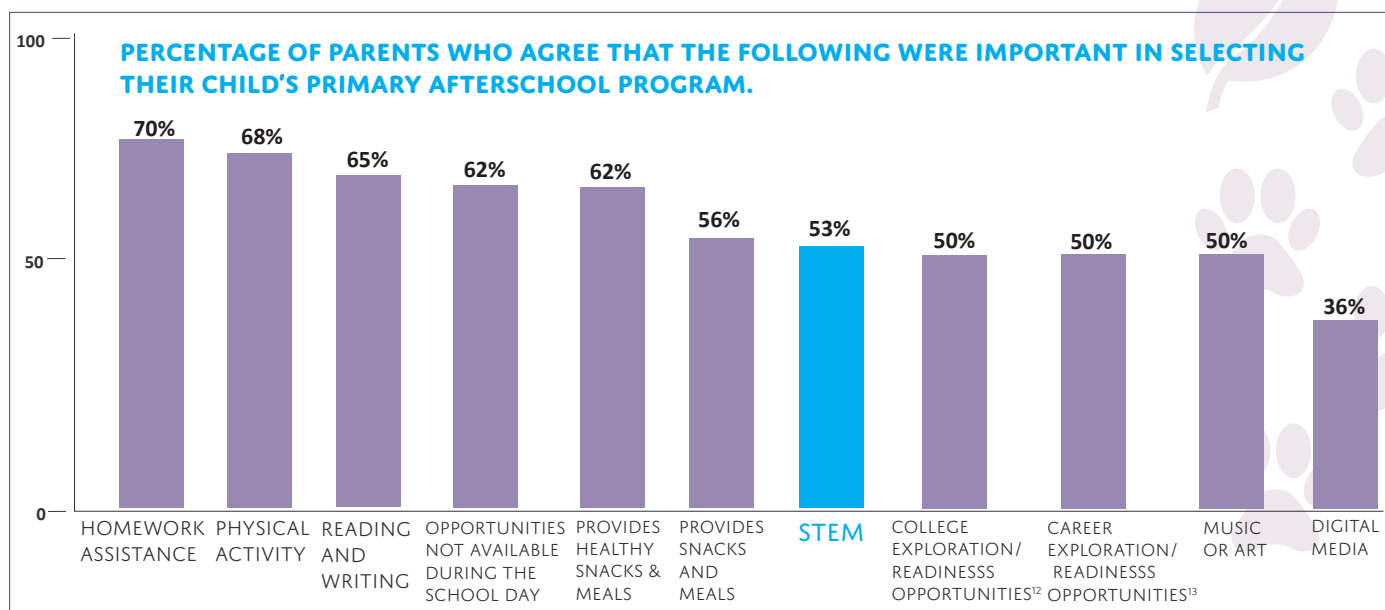
A majority of parents (69 percent or nearly 7 in 10) are satisfied with their child’s afterschool STEM learning opportunities. There are some regional variations in levels of satisfaction with the STEM programs offered. Parents in the West expressed the highest level of satisfaction (74 percent) while parents in the Northeast/Mid-Atlantic regions expressed the lowest (64 percent). There are variations between rural, urban and suburban populations as discussed earlier. There are also variations based on income as well as ethnicity, which are discussed in detail in a later section that focuses on these issues. Fewer than 10 percent express dissatisfaction across any type of demographic breakdown. Not surprisingly, parents who report their children have afterschool STEM learning opportunities are more satisfied, with 8 in 10 reporting satisfaction with STEM programming.



Parental perceptions of the value of STEM and other workforce-related activities in their child’s afterschool program

Parents are aware that afterschool programs are offering STEM activities and are supportive of such programming. While STEM is only one of many factors parents consider when choosing a program for their children, many parents state that they believe children can benefit from STEM learning opportunities in this setting and think that afterschool programs should be offering these opportunities.

Parents consider STEM as one of several other factors when selecting their child’s primary afterschool program. Roughly half of the parents surveyed said STEM programming was a factor in their decision. However, they ranked this lower than other factors that parents consider to be more fundamental to their selection of an afterschool program for their child. The vast majority of parents (80 percent) paid greatest heed to essential factors such as safety, quality of care, convenience of location, knowledgeable and well-trained staff, and child enjoyment of the program.



¹⁰ This question was asked for older students only.

¹¹ This question was asked for older students only.

¹² This question was asked for older students only.

¹³ This question was asked for older students only.



After School Matters (Chicago, IL)
 The “Music in STEM” program at After School Matters, delivered in partnership with Columbia College, presents teens the opportunity to design and craft musical instruments while exploring the science and mathematics behind sound. Teens learn some of the core principles behind music and apply their lessons by building their own instruments. This program provides an opportunity for teens to design and build two instruments, showcase their learning, and gain firsthand experience at a college campus. *Photo courtesy of After School Matters.*

Even when we narrow the focus to the content of the afterschool programs, STEM still does not emerge as a very important factor. This suggests that while about half of the parents are aware of STEM offerings, it is not a determining factor in their selection of a program for their children. The STEM rankings are similar to those for career¹⁰ and college¹¹ readiness and exploration opportunities. A plausible reason might be that most parents consider STEM subjects and college and career opportunities to be academic issues best addressed during the school day and therefore not essential for the afterschool hours. However, the data show that parents do take into account whether their children enjoy the program (80 percent) and whether the afterschool program provides learning opportunities that are not available during the school day (62 percent). This finding makes a strong case for educating parents about the nature of hands-on, innovative, high-quality STEM programming that can be available in afterschool settings to excite and engage their children in these fields, and to emphasize the importance of such experiences. It also suggests that parents can be activated to demand and support high-quality STEM learning opportunities in their child’s afterschool program.

Parents of afterschool participants and non-participants agree that children can benefit from afterschool programs by gaining interests and skills related to science, technology, engineering or mathematics. Overall, 65 percent of parents agreed that afterschool programs can provide opportunities for children to gain STEM-related interest and skills. Almost no one disagreed with this notion, although a large fraction (20 to 30 percent) was non-committal, neither agreeing nor disagreeing with this point. Parents of elementary school-age children were most likely to agree (69 percent) that afterschool programs could help children gain STEM skills, while parents of high schoolers had lower levels of agreement (59 percent). This could reflect parents’ recognition that high school students have different needs than children in elementary school and uncertainty as to whether the programs offer sophisticated and intensive programming at the right level for high schoolers.

Similarly, 67 percent of parents also believe that afterschool programs can benefit children by imparting workforce skills, such as teamwork, leadership and critical thinking, and 64 percent of parents agree that afterschool programs can impart excitement about learning. Parents are thus generally supportive of afterschool programs as venues to support their children’s learning and skill building.

When considering the various roles that afterschool programs can play for children and families, a majority of all parents (70 percent) think that afterschool programs should provide opportunities to explore and engage in hands-on science, math, engineering and technology learning. Very few parents disagreed with this idea, while 20 percent neither agreed nor disagreed. There were few variations in this sentiment across regions, grade levels, gender, income and employment status, but there were some variations by ethnicity that are discussed in a later section.

Gender differences

Given the salience of the issue, questions about participation by gender were explicitly included in this survey to examine if there were any differences in afterschool participation between boys and girls. In general, parents of boys and girls both report similar access to and satisfaction with their child's afterschool STEM programming. 69 percent of both boys and girls are offered STEM learning opportunities in their afterschool programs. But there was a small difference by gender in how frequently they participated in STEM programming, with 80 percent of boys and 73 percent of girls participating in a program once or more a week.

Thus it appears that there is little gender difference in access to and participation in afterschool STEM programs. This is extremely encouraging but this issue requires further attention and dissection—for example, do the increasing numbers of girls-only afterschool STEM programs skew the data? Do girls participate in all possible roles in co-ed programs or preferentially take on gendered roles such as design, marketing, or communications? We need to better understand how equal participation in afterschool STEM programs can be leveraged to address imbalances in girls' participation in high school STEM courses and college majors and careers (especially in the physical sciences and computer science), completing STEM degrees in college, and ultimately pursuing and thriving in STEM careers.

Low-income families have a more positive view of afterschool STEM programs

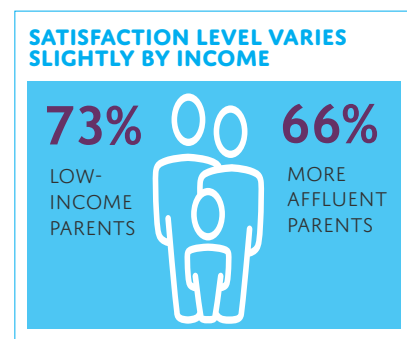
Parents of children from low-income families¹⁴ express higher support for afterschool STEM programs than more affluent parents. Low-income families place a higher emphasis on STEM when selecting their child's afterschool program and have a stronger belief that afterschool programs engage their children in STEM and help them gain skills in this area. They are also more satisfied with their children's afterschool STEM offerings.

The *America After 3PM* data show that:

- The net STEM offerings are higher for low-income children compared to more affluent children (73 percent to 65 percent). The rate of math offerings is also a little higher for low-income children (63 percent) compared to children from higher-income families (57 percent).
- Low-income parents are a little more inclined to say that they considered STEM as an important factor when choosing a program (57 percent) compared to more affluent parents (50 percent).
- Low-income parents also agreed more strongly that afterschool programs can help children gain interest and skills in STEM than more affluent parents (68 percent to 63 percent).
- Finally, 73 percent of low-income parents agree that afterschool programs should provide opportunities to explore and engage in hands-on STEM learning compared to 68 percent of more affluent parents.

One exception to this trend is that students from more affluent families had a higher frequency of STEM activities in their afterschool programs (81 percent) compared to those from low-income families (73 percent).

It is tempting to speculate that low-income children have a slightly higher access to afterschool STEM programs as public and private funding streams have targeted this population to address inequities. It is also tempting to speculate that low-income parents view afterschool programs as one of the primary opportunities for their children to access enrichment activities including STEM and make choices that maximize the access to such learning. However, the *America After 3PM* data do not yield information to support either hypothesis. This issue clearly deserves further exploration to better understand the underlying causes for the variations.



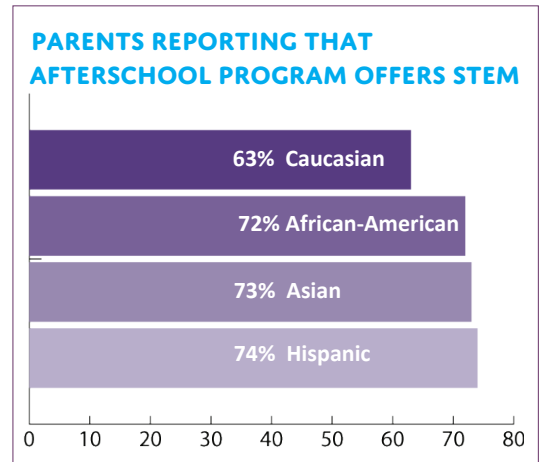
¹⁴ Children who are eligible for free and reduced-price lunches are defined as being from low-income families in this report.

Differences by ethnicity

African-American, Hispanic and Asian parents have a more positive opinion of and experience with afterschool STEM programs. There is a significant difference in attitudes, access and satisfaction levels between Caucasian parents and those from other ethnicities with regard to STEM.

Digging deeper to look at differences in specific disciplines, we find:

- **Math.** Caucasians have the lowest rate of math activities (54 percent) while the other populations are all at about 64 percent.
- **Science.** Parents of Caucasian children report the lowest rate of science offerings (40 percent) while Asians report the highest at 55 percent.
- **Technology.** Caucasian children have the lowest rate of technology offerings at 25 percent while the other populations are all at 33 percent.

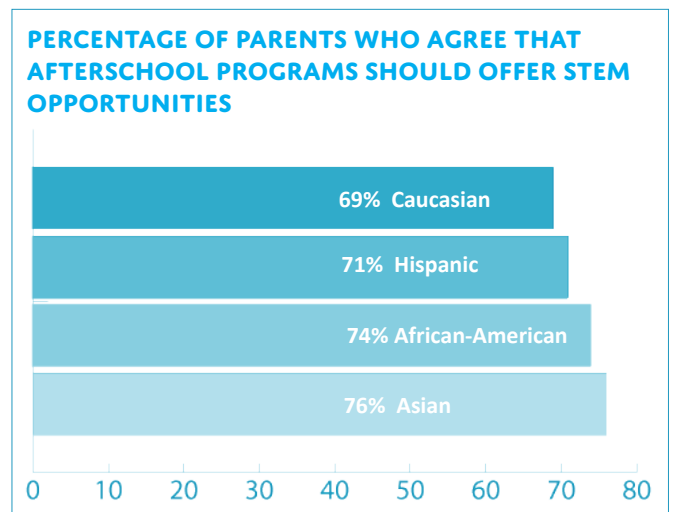


There is little difference in the frequency of STEM activities by ethnicity. Roughly 80 percent of children from African-American, Hispanic and Asian populations participated once a week or more while 77 percent of Caucasian children participated did so.

Satisfaction levels vary slightly by ethnicity. African-American and Hispanic parents report 70 percent and 68 percent satisfaction levels respectively, while Caucasian and Asian parents (whose children participate in these subjects at lower levels) have somewhat lower satisfaction levels at 63 percent and 64 percent respectively.

Caucasian parents were also less inclined than other ethnicities to view STEM as an important factor when selecting programs for their children and less inclined to believe that such programs benefited their child's STEM interest and skills.

- Forty-seven percent of Caucasian parents considered the availability of STEM programs as an important factor when choosing their child's afterschool program, compared to 60 percent for African-American and 57 percent for Hispanic and Asian parents.
- Caucasians had the lowest level of agreement that such programs can benefit children's STEM interest and skills. 62 percent of Caucasians agreed that children could benefit in this manner, compared to more than 70 percent of African-Americans, Hispanics and Asians.



These variations in access, satisfaction, and attitudes deserve further exploration to better understand the experiences that lead to such perceptions. For example, are Caucasian children genuinely having a different set of experiences than children from other populations, or are Caucasian parents more critical consumers of the available programming?

SECTION 3: CHALLENGES

The growth and spread of STEM programming in afterschool over the past decade demonstrates the potential of afterschool to be a strong partner in STEM education. But it is important to keep in mind that the afterschool STEM field is still relatively young and has room for growth. The *America After 3PM* survey finds that seven million children in afterschool programs have access to STEM learning and that there is a high level of satisfaction with the STEM offerings among parents. A majority of parents believe that children can benefit from afterschool programs by gaining interest and skills related to science, technology, engineering or mathematics. A majority of parents also believe that afterschool programs should offer opportunities for children to explore and engage in hands-on STEM learning. However, the data provoke several questions we must consider as the field enters its next phase of growth and refinement.

Need for educating parents

Despite the positive reactions to STEM when asked about it, parents do not consider the STEM opportunities available in a program as a major factor when choosing an afterschool program or provider for their child. This is not surprising given that the demand for afterschool programs far exceeds the availability of programs. Parents are more concerned about ensuring that there is a program they can send their children to and if they do find one, consider fundamental issues of safety, convenience, affordability and well-trained staff as their top priority.

However, other specific content areas like digital/media literacy and college and career readiness are also not rated highly as factors when choosing afterschool programs for older children. This leads to a concern that afterschool program providers are not communicating the power and potential of afterschool programs to ignite children's interest in STEM or other career-relevant fields and to build vital skills. There is a need to educate parents about the characteristics of high-quality afterschool STEM programs and increase their awareness of how important such programs are for engaging their children in STEM and building 21st century workforce skills. That may encourage parents to view access to STEM opportunities as one of the important factors to consider when selecting an afterschool program.

Need for deeper understanding of differences across data sources

There are some puzzling differences between the frequency and nature of STEM programming as reported by parents and other research studies. For example, parents report that three quarters (76 percent) of students were offered afterschool STEM programming at least once a week, while 13 percent of students were offered STEM programming once a month or less. However, other studies seem to indicate that the frequency of offerings is not as high. Also, parents report that math activities are offered at the highest rates (60 percent) in afterschool STEM programs while observations of the field and available afterschool math curricula would seem to indicate that math activities that are distinct from homework help are not offered very frequently.

In addition, the *America After 3PM* data reveal differences in access and attitudes towards afterschool STEM learning between Caucasians, African-Americans, and Hispanics. These issues deserve additional research to better understand parental perceptions of STEM programming in afterschool.



Thompson Island Outward Bound Education Center (Boston, MA)

As a Boston After School & Beyond partner, Thompson Island's Summer Expeditions program delivers exhilarating wilderness courses for middle-school youth. Set in the Boston Harbor Islands National Park area, these adventure-based sailing, sea kayaking and island expeditions employ physical and emotional challenges to build character, develop leadership and instill confidence. Students gain new friendships and a powerful sense of accomplishment, as they live outdoors, explore the natural world, learn camp craft, climb high ropes towers, investigate marine ecology, practice environmental stewardship, work with National Park Rangers and participate in team-based service projects. *Photo courtesy of Thompson Island*



Science Club (Chicago, IL)

Science Club is a mentor-based afterschool program at the McCormick Boys & Girls Club. Middle school students team up weekly with Northwestern scientists to work on fun and engaging science projects. Pictured are Science Club members exploring a Northwestern University medical simulation lab. The field trip was an extension of the Science Club Medical Mystery curriculum, which challenges youth to diagnose an illness in a fictional patient. Youth visited the Northwestern University medical school with their scientist mentors to learn more about how disease is diagnosed and treated. *Photo courtesy of Science Club.*

Need for more technology and engineering programming

Parents report that math and science programming far exceed the availability of technology and engineering programs offered in afterschool. This is a cause for concern as technology and engineering are among the most dynamic and fastest-growing fields nationally as well as globally. They are also extremely well-suited to the type of hands-on exploration and design that is possible in afterschool programs. Indeed, the afterschool field often states that it is ideally situated for technology and engineering programs and yet it appears that this potential is far from realized. We can speculate that a lack of expertise and equipment needed to offer these programs is one reason that more afterschool programs are not offering technology and engineering programs, but this deserves additional research to examine the specific factors and determine how to overcome obstacles and barriers.

Need for more afterschool STEM programs in rural areas

There is a marked scarcity of high-quality STEM programs for students in rural areas compared to urban and suburban areas. Rural students are generally less likely to have access to high-quality STEM learning opportunities either in or out of school. There are fewer qualified teachers in math and science, STEM role models, resources, or community partners such as STEM corporations or science museums.^{xvii} Lower availability of afterschool STEM programs only adds to the disparities faced by rural students. Hence, content-specific topics like STEM must be a part of any policy or funding initiative to expand afterschool into rural areas.

Need for STEM-rich institutions to partner more

The list of the most commonly attended afterschool programs makes it clear that most children attend afterschool programs in schools or youth-serving organizations like the Boys & Girls Clubs and the YMCA. It is vital that leaders in STEM-rich institutions, such as museums, science centers, universities and industry, recognize the importance of partnering with community-based organizations to offer STEM programs. This will extend the reach of the STEM-rich institutions as they can provide STEM opportunities at sites where the children already attend afterschool programs rather than creating new programs at their locations. It will also benefit afterschool program providers as robust partnerships will strengthen their STEM programming. Studies have shown the importance of partnering to increase and improve the quality of STEM programming in afterschool.^{xviii}



GirlStart (Austin, TX)

Dedicated to empowering and equipping girls in STEM through year-round STEM educational programming, Girlstart provides school-based afterschool programs, professional development for teachers, summer camps, STEM career conferences and expos, large-scale science events for families, and community STEM education outreach programs. Girlstart is focused on serving girls of minority backgrounds, girls who live in low-income or nonurban environments, and/or are considered at risk. In the photo, Girlstart After School participants work in teams to see how density affects buoyancy in a 'sink or float' experiment. *Photo courtesy of GirlStart.*

Need for new impact measures

Finally, the increased recognition and visibility of afterschool programs as partners to schools in STEM education has raised the bar significantly for the quality of programming that must be offered and for demonstrating the impact of such programs. However, standard academic measures are insufficient and do not capture the richness of the experience and the impact of afterschool STEM programs.

Work is ongoing to establish quality standards and appropriate outcomes for afterschool STEM programs. For example, a 2013 study^{xix} obtained consensus from afterschool experts on appropriate and feasible youth outcomes for STEM learning in afterschool. It presented a set of developmental outcomes, indicators of progress toward these outcomes and types of evidence that could be collected to demonstrate the impact of STEM programming in afterschool. The outcomes included STEM-specific items such as gaining and demonstrating STEM skills and an understanding of STEM careers, but they also included broader skills such as learning how to think critically to solve problems in the context of STEM investigations and working in teams to collaborate on solving a problem.

SECTION 4: RECOMMENDATIONS

Afterschool programs have demonstrated that they can be strong partners in STEM education improvement efforts, yet there is much more work to be done to increase the number of afterschool STEM opportunities and to improve their quality. To help all students access high-quality STEM programs in their afterschool setting, afterschool program providers, parents, community partners, the broader STEM education community and policy makers will have to work together. The following key recommendations will help greatly to fully realize the potential of the afterschool space as an integral partner in STEM education.

Engage and educate parents about the important role that afterschool programs can play in supporting STEM learning.

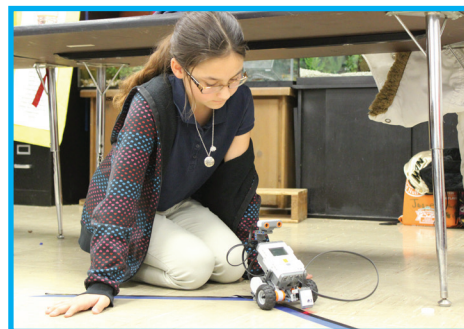
It is important to educate all parents about the role of STEM knowledge and skills to prepare their children for the future. It is equally important to then describe the proven importance of STEM learning in a variety of settings and frequent exposure to such learning for children to become fluent in these subjects. While it is extremely encouraging that a majority of parents are aware of the STEM opportunities in their children's afterschool programs and are supportive of these programs, it is still very much a secondary factor when choosing an afterschool program. Afterschool program providers should highlight that hands-on, inquiry-driven afterschool STEM programs can make afterschool enjoyable for children and should offer learning that looks and feels different from the school day. Afterschool program providers should also make the explicit connection for parents between such programs igniting children's curiosity and interest in STEM and developing social and workforce skills such as team work, collaboration and critical thinking.

If parents are more aware of the positive impacts of afterschool STEM programs for their children as well as for other children in their community, it may be possible to activate them to become supporters and champions of quality afterschool STEM programs. Parents are a crucial force for change in education practice as well as policy and can become strong advocates for afterschool STEM programming.

Further explore parent perceptions of STEM learning in afterschool.

The findings in this report point to some differences between parent reports of the frequency and nature of STEM programming in afterschool and research findings from other studies that examined afterschool programs directly. It will be important to dig into these differences to better understand the roots of these differences. For example, do certain perceptions arise because of the way programs describe their offerings? Or are parents including homework help activities as part of the STEM enrichment efforts that are intended to be distinct from homework? The report also reveals differences in parental perceptions of afterschool STEM among Caucasians, African-Americans, and Hispanics.

Focus groups of parents could shed light on this issue. A greater understanding of parent perceptions will help afterschool stakeholders get a better picture of the nature of STEM offerings in afterschool programs, any gaps in STEM programming that need to be addressed, and also if programs need to communicate more with parents to describe their STEM offerings.



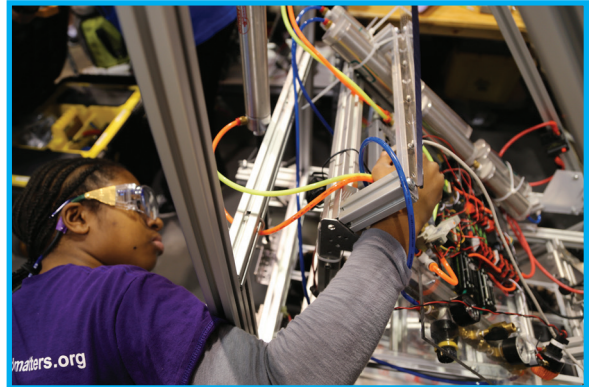
Tech Reach (Austin, TX)

The Thinkery, a children's science center, helps student learn how to create their own technology by teaching computer programming fundamentals through their technology outreach program, Tech Reach. Tech Reach provides innovative and creative technology-based learning experiences, primarily to low-income students, that equip and inspire the next generation of creative problem solvers. Pictured, a student tests her LEGO robot to see if it correctly follows the code she programmed. *Photo courtesy of the Thinkery.*

Increase the technology and engineering programming available in afterschool.

This *America After 3PM* report indicates that there is a paucity of technology and engineering programming in afterschool. Yet afterschool programs provide an ideal environment to engage in hands-on design, building, coding and programming by providing a venue where students can apply science and math principles to design and implement solutions to real world problems. Indeed, there are many examples of high-quality engineering and computing programs in afterschool,¹⁵ but they are relatively few and far between. The popularity of “making and tinkering” programs is a testament to the demand for project-based learning and construction.¹⁵

Understandably, many engineering and technology education advocacy organizations are focused on schools as a means to increase and improve students’ technical and engineering literacy and skills. But afterschool programs provide a ready and immediately available opportunity to tackle this issue and begin engaging a diverse group of young people in computing and engineering education. Increasing the number of high-quality curricula and programs designed for the afterschool setting and providing the training, resources and partnerships to implement such programs will yield benefits that go beyond simply increasing the number of such programs. Afterschool programs are a promising opportunity to address inequities in access to and participation in these fields as girls and children from African-American and Hispanic populations, who are traditionally underrepresented in engineering and technology fields, participate in large numbers.



After School Matters (Chicago, IL)

The CHOICES Robotics program at After School Matters exposes teens to the vast world of engineering sciences through active participation in a competitive robotics team during the school year and exposure to career opportunities in the field. Teens learn how to create robots through teamwork, project building and problem solving. The program gives teens a chance to create, build, operate and introduce their final project, a robot, at the FIRST Robotics Competition at the University of Illinois at Chicago. *Photo courtesy of After School Matters.*



STEM 3D (Philadelphia, PA)

STEM 3D is a three-dimensional approach to engaging underserved youth and families in science through multiple access points of afterschool, home and community. The NSF-funded program offers year-round science programming experiences and support structures to those facilitating children’s science. *Photo courtesy of Darryl Moran.*

The Next Generation Science Standards (NGSS) also provide an impetus for partnerships between schools and afterschool program providers around engineering education. The important conceptual shift within the standards is that students learn science and engineering through the same practices that professional scientists and engineers do—through scientific inquiry and engineering design. In recent science education standards documents, engineering is regarded with the same importance as scientific inquiry and is recommended to be taught in kindergarten through 12th grade.¹⁶ It will be difficult for schools and teachers to do this on their own and afterschool programs are well-situated to be partners in the design and implementation of such projects.

¹⁵ Projects or curricula that incorporate “making” focus on invention and prototyping. While incorporating aspects of art and craft, “making” often uses technology as a primary component. Popular projects utilize electronics, robotics, 3D printers or CNC machines. When K-12 students engage in maker-style activities, they learn practical skills in these technologies but repurpose them in creative ways.

¹⁶ A detailed description of how engineering practices are incorporated into NGSS can be found in Appendix F -- Science and Engineering Practices in the NGSS. See www.nextgenscience.org.

Increase partnerships between the larger STEM education community and afterschool programs to advance practice and policy.

Stronger partnerships between the afterschool field and STEM-rich institutions, STEM-based corporations and the larger STEM education community are vital to advance not only afterschool STEM practice and implementation but also to affect policy initiatives.

- Partnerships are a cornerstone of afterschool programs and providers are always looking to access community resources. Many afterschool providers have strong partnerships with universities, science centers and corporations in their communities. But to increase and improve the quality of afterschool STEM programming, it is vital that STEM-rich institutions are more open to partnering with community-based afterschool providers rather than creating and providing their own programming. As shown in this report, the majority of children attend afterschool programs run by schools and youth-serving organizations. Partnerships can therefore extend the reach and impact of the STEM-rich institutions, while strengthening the programming offered by the youth-serving organizations. The resources and STEM expertise available in such institutions combined with the youth development expertise of afterschool providers will help to make afterschool STEM programming more robust and extensive.
- At the next level, such partnerships also hold the key to the challenge of professional development and technical assistance for afterschool educators. STEM-rich institutions can serve as local or regional professional development providers and offer technical assistance to program providers in their communities working in concert with the statewide afterschool network that often coordinates such resources. These partnerships will also help create a stronger, more cohesive afterschool science education community in cities and states that can make a compelling case for the value of such programs. Together, they can change the conversation about outcomes and impacts that can be different from school-based measures and highlight the unique and necessary role of afterschool programs.
- Finally, it is vital that STEM education advocates understand the importance of afterschool programs in improving STEM education for all students. Stronger partnerships between afterschool advocates and STEM education advocates would be extremely beneficial not only to afterschool providers but also to advance the larger goal of truly bringing all hands on deck to improve access to innovative STEM education opportunities and careers. There is a lot of information now available about such programs, including easily digestible research notes and communications materials that can be incorporated into the larger conversation. If the broader STEM education advocacy community were to partner with the afterschool community to advocate for inclusion of afterschool and afterschool programs in policy and funding initiatives, it would send a very powerful signal to policy makers and funders.



Southside Garden Club (Providence, RI)
Through the Providence After School Alliance (PASA) AfterZone Summer Scholars program, middle school students join the Southside Garden Club to learn all about growing food in the city. They explore other urban gardens and farms; learn how to plant seeds and seedlings so they can grow tomatoes, peppers, and eggplants; and learn about how to take care of city chickens. By the end of the program, they will harvest and cook the food they grow. The Garden Club partners with the Southside Community Land Trust at their City Farm property. *Photo courtesy Sarah Summers, PASA.*

Improve assessment measures.

STEM serves as an excellent vehicle to support social-emotional learning and 21st century skills in addition to developing STEM-specific knowledge and skills in afterschool programs. It is therefore vital that the impacts of afterschool STEM programs are measured by their contribution to a broad set of skills, rather than focusing narrowly on school achievement data. New assessment instruments must reflect the current research on measuring the range of impacts of afterschool STEM programs. The dialogue with funders, school districts and afterschool providers needs to continue to ensure that the unique strengths of afterschool programs to excite and engage young people in STEM are not lost in the rush to judge programs by immediately tangible measures such as test scores. The recent NRC report on productive practices in afterschool STEM programs highlighted the characteristics of high-quality afterschool STEM programs. The findings and recommendations in the report can also serve as a guide for designing STEM experiences in afterschool as well as how to assess quality.

Increase investment in afterschool programs.

While the number of children in afterschool programs has grown over the past decade, the demand for programs has also grown. For every child in a program, two more are waiting to get in. To increase and improve STEM programming in afterschool, parents need to have a choice of afterschool programs where they can send their children to access these learning opportunities. Public-private partnerships and investments at the national, state, and local levels are needed more than ever to inspire learning while supporting working families and keeping kids safe.



Techbridge (Bay Area, CA)

Techbridge is engineering a revolution for girls to change the world through science, technology and engineering. Through its own afterschool programs and partnerships with organizations like Girl Scouts and YMCA, Techbridge gives girls across the country a chance to discover a passion for science, technology and engineering. In addition to fun hands-on activities, girls explore careers by meeting role models and visiting local employers like Google, Facebook, Lockheed Martin, eBay and Pixar. Throughout their participation, girls build confidence and critical 21st century skills like public speaking, teamwork and perseverance that will serve them in any career. *Photo courtesy of Techbridge.*

There are many resources available to parents and afterschool programs interested in accessing STEM opportunities.

- [Click2Science PD](http://click2sciencepd.org) – Click2Science is an interactive professional development site for trainers, coaches, site directors and frontline staff/volunteers working in out-of-school-time STEM programs serving children and youth. click2sciencepd.org
- [Connectory](http://theconnectory.org) – A comprehensive collection of STEM opportunities and programs, The Connectory is the go-to place for families to discover local STEM opportunities for the children in their lives and for afterschool program providers to find partners for collaboration. theconnectory.org
- [InformalScience.org](http://informalscience.org) – A central portal for project, research and evaluation resources designed to support and connect the informal STEM education community in museums, media, public programs and a growing variety of learning environments. informalscience.org
- [Lights On Afterschool](http://afterschoolalliance.org/loa.cfm) – An annual nationwide event celebrating afterschool programs and their important role in the lives of children, families and communities. Get involved to showcase your program or visit an event in your community to see what programs can offer you. afterschoolalliance.org/loa.cfm
- [National Girls Collaborative Project](http://ngcproject.org) – A national network that brings together organizations throughout the United States that are committed to informing and encouraging girls to pursue careers in STEM. ngcproject.org
- [Statewide Afterschool Networks](http://statewidafterschoolnetworks.net/about-national-network/statewide-networks) – Statewide afterschool networks foster partnerships and policies to develop, support and sustain high-quality afterschool and expanded learning opportunities for children and youth. statewidafterschoolnetworks.net/about-national-network/statewide-networks
- [STEM Afterschool Storybook](http://afterschoolalliance.org/STEM-STORYBOOK.cfm?TYPE=PROGRAM) – See examples and models of exemplary afterschool STEM programs and dig into what makes them work so well. afterschoolalliance.org/STEM-STORYBOOK.cfm?TYPE=PROGRAM

Finally, a note about funding. In addition to the Department of Education’s 21st Century Community Learning Centers program, many federal science agencies offer resources that can support afterschool program providers interested in offering STEM programming, modifying their STEM programming or adding to their STEM programming. Federal agencies like NASA, National Science Foundation (NSF), National Oceanic and Atmospheric Administration (NOAA) and National Institutes of Health (NIH) invest in K-12 STEM education, including afterschool programs. There are grant programs, curricular support materials and professional development workshops available from these agencies that afterschool providers or their STEM-related partners can access. The Afterschool Alliance maintains an afterschool STEM funding database that we encourage you to check out.



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