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Afterschool: A Vital Partner in STEM Education

There is widespread recognition of the need for literacy and proficiency in Science, Technology, Engineering, and Mathematics (STEM) to navigate the modern world. Furthermore, there is an urgent national priority to transform STEM[a] learning and engagement in order to meet the nation's need for a STEM-skilled workforce. For students in grades K through 12, the formal school day and classroom teachers are at the forefront of the effort to not only increase the number of children and youth who have access to STEM learning opportunities but to do so in an equitable manner that will reach and equip a diverse group representative of the nation's population. But because children spend less than a quarter of their waking hours in school, out of school-time experiences such as afterschool[b] programs—and the institutions and people who provide them—need to be essential partners in this effort. We need both the additional time offered by afterschool programs and the opportunity to diversify the ways that students experience STEM learning.

The K-12 education community is increasingly aware of the benefits for their students of participation in afterschool programs. Numerous evaluations of afterschool programs have shown both academic and behavioral gains for students of all ages. A study of 21st Century Community Learning Centers (21CCLC), the only federal funding source exclusively dedicated to afterschool programs, showed that participating students had fewer absences and less tardiness, higher grades, higher rates of homework completion and increased rates of parental involvement in school.[i] Another comprehensive study of afterschool programs by Vandell et al. found that "regular participation in afterschool is linked to significantly

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[a] *We recognize that the term STEM education refers to a very broad set of fields and disciplines; children do not engage in "STEM" learning but learn about specific subject areas in science, engineering, technology, and mathematics. We use the term STEM here very broadly to refer to the individual programs and efforts that address this broad swath of topics.*

[b] *For the purposes of this document and the ensuing discussion, we define "afterschool" as programs which provide an array of safe, supervised, and structured activities for children and youth that are intentionally designed to encourage learning and social development outside of the typical school day. Programs generally operate during the hours immediately following school dismissal; however, they also include activities that occur before school, on weekends, over school breaks, and during the summer. They may be located at a school or off-site (but usually have a link to the school(s)). Programs provide a variety of activities, but an engaging, hands-on learning approach and less formal environment are common across all programs. These programs are different from individual activities, such as sports, special lessons, or hobby clubs. Programs may be delivered through partnerships between public and private entities and may employ credentialed teachers and/or qualified community educators. They may be supported by parent fees or subsidized by federal, state, and local governments, grants, or philanthropic gifts, or any combination of these resources.*

improved work habits, overall behavior and reduced behavior problems, thus facilitating academic improvements."[ii] Schools also benefit from the afterschool programs' abilities to bridge schools and communities while also engaging families in the students' learning and providing them and their children with more comprehensive supports than schools can do alone. One study found that by getting parents involved, schools benefit from better teacher morale and higher ratings of teachers by parents.[iii] Afterschool is a key venue to begin and sustain positive parent participation in their children's learning.

The impact of afterschool programs is a well-researched topic with a plethora of evaluations and research that show the positive impact of afterschool programs on participants' academic success as well as socio-emotional development.[iv] Afterschool programs are consequently strategic partners to engage in STEM education. Afterschool programs are structured yet flexible and provide an environment where children and youth can become engaged in and inspired about STEM fields and topics without fear of academic failure. Simultaneously they can be encouraged to appreciate the relevance of STEM topics and fields to their daily lives through hands-on, learner-driven projects.

The viability and importance of afterschool programs for STEM learning have been discussed by several researchers. For example, Schwartz and Noam[v] highlighted the potential of this setting stating that afterschool STEM programs can cut across the debate about academic outcomes and youth development outcomes by focusing on decreasing and dispelling the alienation and lack of interest of many American students in STEM topics by intentionally connecting science and technology to their lives. Friedman and James[vi] also make the case for "science by stealth," as afterschool programs offer an opportunity for kids to dig in and have fun with hands-on science and technology adventures while learning about the basic science and engineering principles behind those efforts.

The afterschool setting is well-placed to close the opportunity gap that many children and youth from under-served and under-represented communities face. Of some 8.4 million children in afterschool programs, ethnic minority children are more likely than others to participate.[vii] 25 percent of Asian, 24 percent of African-American, 21 percent of Hispanic and 16 percent of Native American children attend afterschool programs, compared to the national average of 15 percent. Girls attend afterschool programs in equal numbers to boys. The afterschool setting therefore presents an opportunity to reach the populations we need to bring into the STEM pipeline through experiences that supplement and complement the school day.

Research into the impact of STEM learning in afterschool programs is not as robust as that on the impact of participation in afterschool programs generally, but is growing rapidly. A study by Tai et al.[viii] found that a professed interest in STEM careers by eighth grade was a more accurate predictor of getting a science-related college degree than were the math or science test scores of those same eighth-grade students. This study provides compelling evidence that early encouragement of middle school students and elementary students to consider science careers can be very effective. Afterschool programs are well placed to help deliver on this promise. Additionally, the level of STEM exposure students receive has been shown to be extremely important to later pursuit of—and excellence in—STEM fields and careers (Wai et al.[ix]). Wai et al. found that students who had opportunities to participate in STEM

learning beyond the classroom were more likely to follow STEM career pathways and excel in them. Afterschool programs can provide some of this additional time for STEM learning.

Both these points are reflected in the recent National Assessment of Educational Progress (NAEP) science scores, which show the importance of hands-on science and out-of-school-time experiences as well as the frequency of such experiences. Students were asked to respond to questions about "I do hands-on science activities" in 4th grade, "I do science-related activities not for schoolwork" in 8th grade, and "I do science-related activities in my spare time" in 12th grade. In the midst of the generally dismal news about the NAEP science scores, the answers to these questions may hold a glimmer of hope. Students who answered positively to the above questions at all grades had higher NAEP scores than their peers who answered no. Furthermore, those who had a higher frequency of such experiences did better than those with fewer such experiences.[x]

The potential of afterschool programs for meaningful STEM learning to contribute to the current national discussion on STEM education has been increasingly recognized in policy contexts. The National Research Council released an influential report[xi] on this topic in 2009. Titled "Learning Science in Informal Environments," it calls attention to the 21CCLC program, pointing out its potential to provide enrichment experiences for under-served populations that do not typically obtain them from their families. The President's Council of Advisors on Science and Technology (PCAST) report, "Prepare and Inspire: K-12 Education in STEM for America's Future,"[xii] released in 2010, also notes the importance of providing children with opportunities to engage with STEM topics (regardless of their level of achievement in the formal learning environment) and showing its relevance to their daily lives. According to the report, providing these opportunities as well as connecting children with a diverse group of mentors, "…out-of-class activities can build interest and persistence in STEM subjects for girls and the members of minority groups."

What follows is a brief overview of the current state of STEM in afterschool as well as some examples of evaluations from afterschool STEM programs. While the infrastructure is now becoming available to integrate STEM into afterschool, policies need to be put in place to better equip and engage all of the stakeholders to help afterschool programs fully realize their potential for delivering high-quality STEM learning opportunities.

Supports for STEM in Afterschool

Afterschool programs are no strangers to STEM programming. National youth organizations such as 4-H, Girls Inc., Girl Scouts and other strong state and local afterschool providers have been offering STEM programs for many decades. Many are deepening their commitment to STEM programming in the current environment; for example, 4-H has embarked on a new initiative to engage one million new young people in science programs by 2013. To enable growth and support STEM in afterschool, infrastructure is being assembled at a rapid pace. System-level intermediaries are working to increase

quality and availability of afterschool and STEM in afterschool and the 39 Mott Foundation-funded Statewide Afterschool Networks are increasingly becoming the brokers to coordinate afterschool STEM learning efforts in their states. Below are a few examples of state or system-level efforts:

- The California AfterSchool Network is nearing completion of the planning stage of a multi-year, statewide initiative to advance informal STEM learning through California's system of out-of-school time (OST) programs. The initiative will increase OST program capacity to offer youth high-quality STEM learning experiences in order to increase their interest and engagement in STEM processes and subjects. The initiative seeks to facilitate local partnerships with community organizations such as museums, universities, professional associations and local businesses. The Network and these STEM partners will work with the state's existing technical assistance system for out-of-school-time programs to offer appropriate professional development opportunities and increase access to high-quality instructional materials for informal math and science learning.

- The Collaborative for Building After-School Systems (CBASS) is a partnership of intermediary organizations dedicated to increasing the availability of high-quality afterschool programs by building citywide afterschool systems.[c] In an effort to prepare students for post-secondary success and a lifetime of STEM learning, with support from the Noyce Foundation, CBASS launched a national initiative to institutionalize engaging, inquiry-based science experiences in afterschool. Building on The After-School Corporation's Frontiers in Urban Science Exploration (FUSE) model, CBASS is working intensively in several cities and disseminating lessons learned to stimulate a culture shift among afterschool leaders and staff to increase the demand for- and delivery of high-quality STEM learning in afterschool. FUSE builds stronger systems of high-quality STEM and afterschool integration through several core strategies:
    - Brokering relationships with leaders and staff of schools and afterschool programs, government officials, science organizations, policy makers and funders to build enthusiasm and capacity for inquiry-based STEM learning afterschool
    - Strengthening the capacity of afterschool programs through ongoing professional development to deliver high-quality STEM content
    - Engaging in advocacy to promote the role that afterschool can play in fostering science engagement and reinforcing STEM learning
    - Utilizing a coordinating entity to build capacity, monitor quality and leverage resources
    - Identifying and implementing high-quality STEM curricula
    - Promoting co-inquiry to allow staff and students to explore and test assumptions side-by-side
    - Encouraging collaborative learning

[c] The CBASS partners include The After-School Institute, Baltimore; Baltimore's Safe and Sound Campaign; Partnership for Children and Youth, Bay Area; Boston After School & Beyond; After School Matters, Chicago; The After-School Corporation, New York City; Prime Time Palm Beach County; Providence After School Alliance; and DC Children and Youth Investment Trust Corporation.

- The Missouri State Afterschool Network is engaged in "Project LIFTOFF." This initiative, also funded by the Noyce Foundation, aims to develop a statewide system in support of afterschool STEM education in Missouri and surrounding Midwestern states. Components include disseminating excellent STEM curriculum materials, professional development, building a state afterschool web portal and conducting formative and summative evaluations.

- The National Girls Collaborative Project (NGCP) is a National Science Foundation (NSF)-funded project to bring together organizations throughout the United States that are committed to informing and encouraging girls to pursue careers in STEM. Many afterschool programs and networks are a part of this collaborative, drawing upon resources and supports that allow them to go much farther than they could do alone.

More and more, afterschool networks and providers are becoming increasingly sophisticated in their efforts to increase STEM learning opportunities and promote quality STEM learning. NSF has been a strong supporter of informal science education, including afterschool programs, for several decades. The field of informal science education was essentially born out of NSF funding and its investment has not only led to innovative programming, but also to many research and evaluation studies on learning in such environments. More recently, many private funders have become engaged in this space—both philanthropic foundations as well as corporations have recognized the potential of this setting for engaging learners in STEM topics. NSF and these funders are also driving the development of assessment tools and research studies to study the impact of STEM learning in afterschool programs. These efforts are crucial to help the afterschool community become effective partners in STEM learning.

Challenges

While the afterschool community has come a long way with STEM learning, there are challenges to be overcome. Several surveys conducted over the past few years get at "the state of STEM" in afterschool: The "Informal Learning and Science in Afterschool" (ILSA) study, begun in 2006, assessed informal science learning in *typical* afterschool programs (i.e. not specialized STEM-focused programs);[xiii] the Coalition for Science After School (CSAS) undertook a market survey[xiv] in 2008 to determine which afterschool programs are doing science, what they are doing and their needs; more recently, the Afterschool Alliance and the National Afterschool Association teamed up to conduct a survey of the field as part of their Noyce Foundation-funded effort to promote 2011 as the "Year of Science in afterschool."[xv] The details of this latest survey are discussed in Appendix A.

Overall, the survey results all point to some common factors. Afterschool program providers think it is extremely important to offer STEM in afterschool programs and offer a wide range of programming. Environmental science and engineering are some of the more common programs, while LEGO robotics clubs, rocketry and computers are also very popular. This highlights another positive aspect of the afterschool space in STEM learning: engineering and technology are very popular topics that do not

often receive much attention during the school day. But many programs struggle with issues relating to staff capacity and a lack of awareness about existing resources such as freely available high-quality curricula. The most recent survey participants identified insufficient funding, a lack of knowledge about existing curricula, lack of professional development in STEM content areas and partnerships as the most significant hurdles.

Despite these challenges, the impact of high-quality STEM afterschool programs shows tremendous promise for their ability to engage and inspire children and youth, as is shown in the next section. These examples, along with other research studies, demonstrate that we understand the key elements needed to achieve success in this setting: a commitment to providing high-quality STEM programming must be backed up by knowledge of existing curricula and programs, resources for staff professional development, partnerships with experts and leadership on the issue.

Examples of Afterschool STEM Evaluations

We are currently aggregating evaluation findings from a range of afterschool programs that offer STEM learning experiences all over the country. Preliminary analysis reveals that high-quality afterschool programs have a significant impact on student engagement and pursuit of STEM fields. Below we present a sampling of some of the evaluation findings obtained thus far.

- 4-H: 4-H has just undertaken an evaluation of its Science Initiative using a self-report questionnaire, the Youth Engagement, Attitudes and Knowledge (YEAK) survey.[xvi] While this is an ongoing study, a summary of findings thus far indicates:
    - More than eighty percent of respondents intend to finish college or continue to pursue more education after college.
    - Fifty percent of respondents want to pursue a science career.
    - Seventy-one percent of 4-H Science participants said science is one of their favorite subjects.
    - Sixty-eight percent do science-related activities that are not for school work.
    - Fifty-nine percent would like to have a job related to science when they graduate from school.

- *FIRST* Robotics: Brandeis University's Center for Youth and Communities conducted an independent survey[xvii] of *FIRST* Robotics Competition participants (ages 14-18) and compared them to peers who did not have this opportunity. They find that *FIRST* students are:
    - More than three times as likely to major specifically in engineering.
    - Roughly ten times as likely to have had an apprenticeship, internship, or co-op job in their first year of college.
    - Significantly more likely to expect to achieve a postgraduate degree.
    - More than twice as likely to expect to pursue a career in science and technology.

- Nearly four times as likely to expect to pursue a career in engineering.
- More than twice as likely to volunteer in their communities.

The Brandeis study of *FIRST* Lego League (for ages 9-14) also shows strong positive outcomes for participating youth and adults. Both the participating young people and their parents report an increased interest in engagement in science and technology. Additionally, studies report a better understanding of the role of science and technology in solving everyday problems, increased interest in school, improved life- and workplace-related skills and a more positive outlook about themselves and their futures.

- Girls Inc.: Girls who attended Operation SMART (Science, Math, and Relevant Technology) sessions offered by Girls Inc. demonstrated an increase in their confidence, competence and comfort in science, math, and technology. Participation also lessened girls' stereotyped views of scientists and whether men or women should have certain jobs. Girls Inc. of Greater Harrisburg Operation SMART participants were asked particular questions about their attitudes towards math, science and learning before and after their experiences in the program. They responded:

	Percent who answered YES	
Survey item	**Before**	**After**
I know what a scientist does	45%	99%
I am good in math	90%	100%
I am smart (intelligent)	91%	100%
I like to discover things (or invent things)	54%	97%
Not having science would be okay with me	40%	3%

- Miami Museum of Science and Planetarium: The museum's After-school Programs Exploring (APEX) Science program is aimed at children aged 5-10. A summative evaluation of this program found that the program yielded a positive shift in the activity leaders' comfort and confidence in teaching science and connecting it to everyday life. It also increased parents' interest, awareness and appreciation of science learning and led to increased engagement in family science activities.

- Project Exploration (based in Chicago, Ill.) recently released a 10-year retrospective study that surveyed 30 percent of an estimated 259 alumni in their database who were over the age of 18 (n=78). The study found that 95 percent of those surveyed have graduated high school or are on track to graduate—nearly double the overall rate of Chicago Public Schools. Sixty percent of those students enrolled in a four-year college are pursuing degrees in STEM-related fields and 60 percent of program alumni who graduated college did so with a degree in a STEM-related field.[xviii]

- SHINE 21st Century After-School Program: This program in rural Pennsylvania links schools and homes to build family involvement in student learning. Their five-week "Career Camp" pilot project in 2010 had a program emphasis on STEM and developing workforce skills. Data collected from the project shows students increased their knowledge of future job possibilities by 30 percent; increased their understanding of the importance of reading and mathematics for future careers by 10 percent; and gained insight into high priority fields. Students in three school districts also showed gains on academic performance (67 percent), science grades (62 percent) and classroom conduct (54 percent) from the 3rd to the 4th marking period on their report cards.

- Tech Corps: The Tech Corps program in Columbus, Ohio brings tech-savvy volunteers into K-12 schools and afterschool programs to help children increase their knowledge about career opportunities in technology-related fields and gain skills to help them succeed. Student pre- and post-surveys showed that they greatly enjoyed the opportunity to learn how to program, build robots, take apart computers, etc. The percentage of students who said "TECHie Club" helped them feel more:
    - confident knowing how computers work - 66.7%
    - aware of technology careers - 34%
    - excited about programming - 23%
    - excited about engineering - 17%

- The After School Corporation (TASC): "Evaluation Findings from the Frontiers in Urban Science Exploration (FUSE) 2.5 Program": This evaluation[xix] includes findings from 19 programs that participated in STEM trainings during the 2009-2010 school year and presents survey results for both youth workers (staff) and students in these programs. Major findings from this study include:
    - Students reported increased science motivation, confidence and knowledge as a result of participating in their afterschool science programs. Students from sites that were identified as high quality by the TASC STEM team scored significantly higher on all three measures than those from sites that were randomly selected to participate in this evaluation.
    - Youth workers scored highly on their personal science teaching efficacy scores, which indicates that they felt very confident in their abilities to teach science activities by the end of the school year. Focus groups revealed that staff felt comfortable implementing science activities after their training, despite the fact that most participants did not have any formal science background. The youth workers identified the hands-on nature of the training sessions as the reason for this comfort level. However, they rated lower on their outcome expectancy scores, which suggests that they feel their influence over their students' science learning is limited.

- Y of Central Maryland: The YMCA of Central Maryland conducted a two-week summer camp called "LET'S GO TO THE Y" in partnership with LET'S GO Boys and Girls Program. This was an interactive program for children aged 9-14 to learn basic building and programming skills using LEGO® tools. The evaluators conducted pre-camp and post-camp student and parent surveys and a focus group and survey among camp faculty and instructional assistants at the program's two sites. The surveys showed that the experience significantly increased children's interest in becoming scientists or engineers. (NOTE: Half of the students stated that they had no such interest before the camp despite asserting that science or math was their favorite subject and got "A" grades in the subjects in school.)

The above sampling of evaluation results highlights the potential of afterschool programs to positively engage and interest children and youth in STEM fields and careers. Many afterschool programs that have not conducted rigorous evaluation studies as yet also report increased student enthusiasm and interest in STEM topics as well as greater awareness of STEM career possibilities after participation in the program. We do not wish to overstate the case and profess that all afterschool programs are having this degree of impact; however, what these studies demonstrate is the ability of afterschool programs to engage students so that a larger percentage of them choose to enter the STEM pipeline.

These studies also underscore the challenge of assessing impact as each group utilized a different mechanism for evaluation, surveyed different groups of people (parents, teachers, children, afterschool staff), asked different questions and presented the results in a variety of ways. There is a need to define some common outcomes and indicators of success to be used to measure STEM engagement and interest developed through afterschool programs. While each program is unique and may have additional outcomes to report, having consistent data on a few common indicators will allow easier comparisons and aggregation of data to determine large-scale impacts of STEM learning in afterschool programs. In the meantime, we will continue our efforts to gather evaluation studies of STEM learning in afterschool and aggregate the data by type of impact to draw a clearer picture of the impacts as well as the challenges faced by such programs.

Conclusion

Afterschool programs have long been engaged in providing STEM learning opportunities. But there is now a growing awareness of the importance of STEM learning and a desire to offer such programs at most afterschool programs all over the country. Infrastructure is being assembled to help afterschool providers meet this interest and evaluation studies are beginning to provide information on the specific impacts such programs are having on children and youth. Data from several evaluation studies indicate that well-designed, science-rich afterschool programs can be successful in exciting and engaging children and youth about STEM fields and careers. Moreover, such programs reach many youth from populations who are often under-served by traditional schooling and under-represented in STEM higher education and careers. Combined with research studies indicating that early engagement and interest

in STEM careers is related to pursuit of such careers, these results support our claim that afterschool programs can contribute meaningfully to the strength and diversity of the nation's STEM workforce and must therefore be a key component of our Nation's STEM learning system.

While most afterschool program providers are convinced of the need to include more STEM-related offerings, federal policy makers do not yet fully acknowledge the value of including afterschool programs as integral partners in STEM education. Consequently, there is a two-pronged approach needed for pursuing a STEM agenda in afterschool. The first is to create formal pathways for including afterschool programs as partners in the national STEM education agenda by establishing policies that will allow them to be the most effective partners. The second is to build capacity within the afterschool community to facilitate high-quality STEM programs.

As awareness of the importance of this type of programming grows, additional funding and resources should follow. Afterschool programs are partners to help children across the country gain the skills to become the innovators, scientists, technologists and engineers of the future.

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[i] *Kane, T.J. (2004) The William T. Grant Foundation. The Impact of After-School Programs: Interpreting the Results of Four Recent Evaluations. University of California, Los Angeles.*

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[iii] *Henderson, A. T., & Mapp, K. L. (2002). A new wave of evidence: The impact of school, family, and community connections on student achievement. Austin, TX: National Center for Family & Community Connections With Schools.*

[iv] *http://www.afterschoolalliance.org/documents/EvaluationsBackgrounder2011.pdf*

[v] *Schwartz, S.E.O., & Noam, G.G. (2007). Informal science learning in afterschool settings: A natural fit? Commissioned paper for the National Academy of Sciences Committee on Learning in Informal Environments. Washington DC. (http://www7.nationalacademies.org/bose/Schwartz_abd_Noam_Commissioned_Paper.pdf)*

[vi] *http://afterschoolscience.org/pdf/coalition_publications/afterschool%20advantage.pdf*

[vii] *America After 3pm, Afterschool Alliance (http://www.afterschoolalliance.org/AA3PM.cfm)*

[viii] *Tai, R.H., Liu, C. Q., Maltese, A.V., & Fan, X. (2006, May 26). Planning early for careers in science. Science, 312, 1143-1144.*

[ix] *Wai, J., Lubinski, D., Benbow, C.P., & Steiger, J.H. Journal f Educational Psychology (2010, vol. 102, No. 4, 860-871).*

[x] http://www.afterschoolalliance.org/ost_role_naepscience2009.pdf

[xi] *Bell, P., Lewenstein, B., Shouse, A.W., & Feder, M.A. (2009). Learning Science in Informal Environments: People, Places, and Pursuits. National Research Council.*

[xii] *http://www.afterschoolalliance.org/documents/pcast-stemed-report.pdf*

[xiii] *Noam, G. et al., AERA 2010 Symposium*

[xiv] *http://www.scienceafterschool.org/pdfs/CSAS_Market_Study2008.pdf*

[xv] *http://www.afterschoolalliance.org/STEM_JointPositionPaper.pdf*

[xvi] *http://www.4-h.org/uploadedFiles/About_Folder/Research/Science/Final%20YEAK%20Report.pdf*

[xvii] *http://www.usfirst.org/aboutus/content.aspx?id=46*

[xviii] *http://www.projectexploration.org/10years/*

[xix] *http://www.tascorp.org/files/3181_file_FUSE_Public_Report.pdf*

Appendix A

The Afterschool Alliance teamed up with the National AfterSchool Association (NAA) in December 2010-January 2011 to conduct a survey to assess the national state of STEM in afterschool. The survey was distributed widely through a variety of listservs (NAA; Statewide Afterschool Networks; Coalition for Science After School; and policy coalitions the Alliance participates in which include youth serving-organizations such as the YMCA, Boys and Girls Clubs, Girls Inc., etc.) to capture a broad group of stakeholders who are engaged in this space. More than 1,000 afterschool program directors and staff from all over the country, spanning every state except Alaska, responded to the survey.

The survey results provide information on the level of interest within the afterschool community in offering STEM programming, how many children are benefitting from STEM learning after school and in the summer time; the types of STEM activities taking place in those programs and the resources respondents need to increase and improve STEM learning in this space. The results from this survey highlight the current state of STEM education in afterschool and offer a glimpse into how STEM learning in this setting can improve, evolve and become even more widespread and sustainable in coming years.

- Afterschool and summer program providers view STEM as a vital component of their programming; however, STEM is not the major focus of the majority of programs.
    - Nearly all (99 percent) survey respondents stated that they believe it is important to offer STEM programs afterschool and during the summer.
    - Only 33 percent of respondents consider STEM to be the primary focus of their afterschool program (with six percent responding that they do not run an afterschool program), and only 29 percent of respondents consider STEM the primary focus of their summer learning program (with 19 percent responding that they do not run a summer learning program).

- STEM learning takes place in a variety of arenas and is being offered to all age groups, but even more children could get involved.
    - The majority of practitioners responding (81 percent) stated that they offered STEM learning opportunities afterschool, while 53 percent and eight percent stated they offered STEM in the summer and before school respectively.
    - An analysis of the survey data found that 47 percent of all reported afterschool participants and 57 percent of all summer participants from the survey were engaged in their program's STEM offerings.
    - As is the case with most learning after school and in the summer time, the majority of children benefitting from STEM offerings are in elementary school, yet many programs do serve middle- and high-schoolers as well.
    - The findings revealed a wide range in the average time programs spent on STEM activities; however the median number of hours spent per week on STEM activities provided a more manageable picture with medians of four hours for afterschool programs and six hours for summer learning programs. The most common was two hours per week during the school year and four hours per week during the summer.

- Programs have a variety of goals for their STEM offerings but the measurements of success do not always reflect those goals.
    - The majority of program providers (84 percent) claim that a main goal of their STEM program is to "offer kids programming they enjoy," while 75 percent say the goal is to

help kids improve their school work. A large number of respondents also say that they aim to get kids excited about STEM so they will pursue careers in these fields (69 percent) and get kids to be scientifically literate (66 percent).
    - However, impact assessment appears to be done primarily through tracking attendance (i.e. do they keep coming back) and tracking test scores and grades in school. Fewer track participants' interest in STEM and participation in other STEM-related activities such as science fairs or pursuing additional science courses.

- The meaning of STEM learning varies from program to program with a wide swath of STEM activities appearing among the programs surveyed. It is difficult to easily categorize the types of STEM offerings in the afterschool space.
    - Programs spend a lot of their STEM learning time focusing on homework help, specifically in mathematics and to a lesser degree in science. But it is unclear whether this support is merely providing the time to do homework or if it involves making the connections to bring these topics alive. Programs also offer activities such as robotics, rocketry, engineering, computer science and some cooking and gardening.
    - A majority of program providers (85 percent) responded that their program addresses Math, with Geology/Earth Science (63 percent), Engineering (53 percent) and Biology (51 percent) appearing as other popular STEM fields which are addressed after school and in the summer. Chemistry and Physics (both 43 percent) were less popular with program providers.

- While additional funding for STEM activities is a common request, survey respondents also noted other needs that would help them offer STEM programming.
    - The STEM practitioners surveyed cite a number of funding sources for their programs, but by far the most prevalent funding source is the federal 21st Century Community Learning Centers program (52 percent). Other significant funding includes parent fees (31 percent), state or city funding (32 percent), private donors (28 percent) and businesses/corporations (27 percent). Only a small percentage of respondents report accessing funds from the National Science Foundation.
    - Eighty-seven percent of providers surveyed cited increased funding as a resource that would help them provide higher-quality STEM offerings, while nearly equal percentages of providers stated that curriculum materials (68 percent), professional development opportunities (67 percent) and expanded partnerships (71 percent) would help improve program quality.

- Improving access to professional development opportunities and engaging additional STEM partners are two clear needs.
    - Nearly a quarter of the programs surveyed offer no STEM content professional development for staff and nearly half offer less than one hour per month of staff professional development. However, 68 percent of programs acknowledge that providing more professional development is a major way to improve their STEM programming for 2011.
    - Programs currently engage a variety of partners to offer their STEM programming—school teachers (48 percent) and colleges (40 percent) are the top two, while science centers and businesses come in next (30 percent). Only a small minority (14 percent) partner with a federal lab or agency, and almost a quarter have no external partners for their STEM programs.