The impact of afterschool STEM:
Examples from the field

Afterschool programs are increasingly recognized as crucial components of the larger learning ecosystem for science, technology, engineering and math (STEM). Evidence shows that afterschool programs that provide high-quality STEM learning experiences are making an impact on participating youth. Participants not only become interested and engaged in STEM, but develop tangible STEM skills and proficiencies, come to value these fields and their contributions to society, and begin to see themselves as potential contributors to the STEM enterprise.

This paper summarizes evaluation data from a selection of strong afterschool STEM programs, providing a snapshot of the types of substantive impacts afterschool programs are having on youth. It is an update to the Afterschool Alliance's 2014 paper, "Examining the impact of afterschool STEM programs." We've added seven new afterschool programs, and included newer evaluation data for many. Consistent with our 2014 paper, new evaluation data continues to document afterschool programs' impact on participants' interest in STEM.

- In Philadelphia, Pennsylvania at STEM 3D, youth show statistically significant growth in science engagement through agreeing strongly to statements such as: "I like to participate in science projects" and "I get excited about learning about new discoveries or inventions."

- Youth choose to come back to East End House programs in Cambridge, Massachusetts year after year—95 percent of currently enrolled elementary students are returning, and 79 percent of currently enrolled middle school students are returning.

Photo courtesy of GirlStart

Youth also demonstrated gains in STEM competencies and 21st century skills:

- In the Texas program Girlstart After School, all participants engage weekly in iterative design and scientific inquiry to solve problems, and as a result Girlstart girls perform better on the state science and math tests compared to non-participants. In addition, girls demonstrate persistence—92 percent reported a willingness to redesign a project if it did not work on the first try and 92 percent agreed that, "if I try hard, I can be good at science."

- As a direct result of participation in EVOLUTIONS, an afterschool program at the Yale Peabody Museum of Natural History, 88 percent of graduating seniors reported an increase in communication skills, 82 percent increased their ability to work in teams, and 71 percent improved their writing skills. Among all students, 74 percent reported an increase in science literacy and 71 percent said they improved their field research skills.

December 2016

Afterschool Alliance

afterschoolalliance.org

- At the SHINE program in rural Pennsylvania, all elementary students in SHINE are referred to the program based on academic need, and as a result of their participation, students are highly successful in their school science classes—94 percent received passing grades, and 57 percent received an A or B. This is supported by parents, as 82 percent indicated their child improved in science after participation.

Finally, new evaluation data strongly demonstrated the lasting impact that afterschool STEM programs had on students' ability to connect the importance of STEM to their future success and their communities.

- Among alumni of The Clubhouse Network, 97 percent said that the Clubhouse was the most important source of support for setting high goals and expectations for themselves and 80 percent reported that the Clubhouse had been the most important source of support for pursuing a career.

- After participating in Explore the Bay, an environmental and marine science afterschool program, 89 percent of students surveyed reported that they wanted to take better care of their environment.

- The majority of participants in Science Action Club (86 percent) believe that learning about science can help them to better understand the natural world and 81 percent believe that the data they personally collect in the club is scientifically important.

Our process

In 2013, the Afterschool Alliance led a study of expert practitioners and stakeholders in the afterschool field to identify appropriate and feasible outcomes for youth participating in afterschool STEM programs. The results represent an expert consensus, and provide a framework describing the major outcomes, indicators and sub-indicators for how afterschool programs specifically impact youth participants and contribute to larger STEM education goals. Using this framework of youth outcomes, provided on the following page, we asked afterschool programs to map their existing evaluation data into the framework in order to clearly picture the common impacts of afterschool STEM programs.

Challenges to consistent evaluation

Through the process of pulling together evaluation data from multiple afterschool programs, we found that reporting on youth outcomes data is incredibly challenging for many. Several of the original programs included in the 2014 paper had difficulty providing updated evaluation data and new programs targeted as potential contributors to the 2016 paper were unable to do so as they were experiencing flux in funding for evaluation projects or staff capacity issues. All programs understood the importance of gathering this type of data, and had plans for upcoming years to re-start or expand evaluation efforts. This is an important reminder that the ability to document the impact of education programs requires sustained support.

Additional reading

- Read the full report, *Defining youth outcomes for STEM learning in afterschool*, to learn about the study informing the development of the youth outcomes framework, accessible here: www.afterschoolalliance.org/STEM_Outcomes_2013.pdf

- Publicly available evaluation reports and related research papers from the afterschool programs in this paper are listed on page 19.

- *Examining the impact of afterschool STEM programs* also included a summary of the research base on afterschool programs and the role of STEM learning in out-of-school time. Read it here: www.afterschoolalliance.org/ExaminingtheImpactofAfterschoolSTEMPrograms.pdf

- Learn more about the afterschool programs included in this paper in the Afterschool Alliance's STEM Program Profiles, which include fuller description of program structure and features, partnership models, and more: www.afterschoolalliance.org/STEMprofiles.cfm

Framework of youth outcomes

How did we arrive at these outcomes, indicators and sub-indicators? Read our report *Defining youth outcomes for STEM learning in afterschool*, accessible here: afterschoolalliance.org/STEM_Outcomes_2013.pdf

Outcome Through participation in afterschool STEM programs, youth:	Indicator You know or can see that youth demonstrate:	Sub-Indicators If you had appropriate tools, you could document the following types of evidence:
 Develop an interest in STEM and STEM learning activities. **"I like to do this."**	**Active participation in STEM learning opportunities**	**Active engagement and focus in STEM learning activities** *Persisiting in a task or program; sharing knowledge and ideas; expressing enthusiasm, joy, etc.* **Pursuit of other out-of-school-time STEM learning opportunities** *Enrolling in programs; attending programs regularly; reporting performing STEM-related activities at home* **Pursuit of school STEM learning opportunities** *Participating more actively in school STEM activities; enrolling in courses; selecting special programs or schools; improving academic achievement*
	Curiosity about STEM topics, concepts or practices	**Active inquiries into STEM topics, concepts or practices** *Exploring ideas verbally or physically; questioning, hypothesizing, testing* **Active information-seeking about mechanical or natural phenomena or objects** *Conducting internet searches for more information; gettng books/journals about STEM; watching TV programs on science, etc.*
 Develop a capacity to productively engage in STEM learning activities. **"I can do this."**	**Ability to productively engage in STEM processes of investigation**	**Demonstration of STEM knowledge** *Demonstrating increase in knowledge in specific content areas; making connections with everyday world; using scientific terminology* **Demonstration of STEM skills** *Formulating questions; testing, exploring, predicting, observing, collecting and analyzing data* **Demonstration of an understanding of STEM methods of investigation** *Demonstrating understanding of the nature of science; using evidence-based reasoning and argumentation; demonstrating engineering design practices*
	Ability to exercise STEM-relevant life and career skills	**Demonstration of mastery of technologies and tools that can assist in STEM investigations** Developing capacity to use measurement and other scientific instruments; running computer programs for data analysis; developing effective methods to communicate findings **Demonstration of ability to work in teams to conduct STEM investigations** Communicating effectively with team members; collaborating effectively with team members; demonstrating leadership on the team **Demonstration of applied problem-solving abilities to conduct STEM investigations** Engaging in critical thinking; questioning, sequencing, reasoning
 Come to value the goals of STEM and STEM learning activities. **"This is important to me."**	**Understanding of value of STEM in society**	**Demonstration of an understanding of relevance of STEM to everyday life, including personal life** Referencing examples of STEM in everyday life: everyday problems **Demonstration of knowledge of important civic, global and local problems that can be addressed by STEM** Contributing to projects that address a community need; developing awareness of how STEM is implicated in larger societal issues **Demonstration of awareness of opportunities to contribute to society through STEM** Engaging in a service-learning project
	Awareness of STEM professions	**Development of an understanding of the variety of STEM careers related to different fields of study** Gaining knowledge about relevant professions; gaining knowledge of where such jobs and careers exist **Demonstration of knowledge of how to pursue STEM careers** Acquiring knowledge of what courses are needed to prepare for or pursue STEM degrees; declaring STEM interests or majors **Demonstration of awareness that STEM is accessible to all** Expressing a desire to meet role models; declaring STEM interests and majors; desiring to become a role model to pave the way for others

4-H Tech Wizards

Location
26 states

Reach
8,623 students

Age level
Ages 8-18; older youth mentors

Demographics
Open to all, but focus is on Hispanic and other under-served, high-need youth. Demographics vary based on the local community.

Evaluation methods
Outcome data is collected using formal skill assessment tools; surveys; service logs; observations; and interviews with youth, mentors, staff and family members.

Evaluation year
2012-2013

Evaluator
Not provided

4-H Tech Wizards is an evidence-based afterschool mentoring program that trains youth on various technologies within a bilingual, bicultural learning environment. The program is implemented through the 4-H National Mentoring Program, a partnership between the National 4-H Council and the Office of Juvenile Justice and Delinquency Prevention. Originating in Oregon, the program has been taken to scale nationwide.

Interest: I like to do this.

- Program attendance is high and consistent—on average, 95 percent of enrolled youth regularly attend 4-H Tech Wizard sessions and 95 percent of participants have stayed in the program for three years to complete all three skill levels.
- Youth report that they are drawn to 4-H Tech Wizards because of the opportunities to work with cutting edge technology and the mentors.

Capacity: I can do this.

- 95 percent of 4-H Tech Wizards participants demonstrate mastery of skills in website development, video and podcast productions, GIS and GPS technologies, and LEGO robotics.

Value: This is important to me.

- 85 percent of 4-H Tech Wizards participants completed 15 hours of community service learning by teaching technology to others.
- 70 percent of graduating 4-H Tech Wizards participants pursued post-high school education and careers in science, technology, engineering or math.

Build IT

Location
U.S. and Canada

Reach
3,500 students

Age level
Middle School

Demographics
95 percent girls, more than 80 percent of whom are African-American and Latina, and the majority of whom are from low-income households.

Evaluation methods
Staff collect ongoing outcomes data through performance tasks, concept surveys and attitude surveys. Evaluation data is collected during specific research projects and includes participant, facilitator, staff and parent surveys, as well as interviews and observations with youth and facilitators.

Evaluation year
2012-2013

Evaluator
Hatchuel Tabernik & Associates

Build IT is an afterschool and summer curriculum for middle school youth to develop fluency in information technology (IT), interest in mathematics and knowledge of IT careers. The program—co-developed by SRI International and the Girls Inc. of Alameda County—is designed to engage girls and African-American and Latino/a youth.

Interest: I like to do this.

- Retention was often 100 percent at sites that had girls and parents commit to girls' active participation in Build IT.
- Girls reported a statistically significant increase in their confidence in math, belief in its usefulness, and plans to take computer courses.

Capacity: I can do this.

- Girls showed statistically significant improvements in their understanding and use of the computer engineering design process, as it is embedded in every curriculum unit as a method of problem solving.
- Build IT motivates girls to use technology to strengthen and build their technology fluency, and participants achieved statistically significant improvements in frequency of computer use, computer skills and conceptual understanding of computing.

Value: This is important to me.

- Interviews document that participation has made a noticeable difference in how girls view technology careers. Many who initially reported IT as solitary and boring later reported that they found IT to be collaborative, fun, intellectually stimulating and a possible career.
- Girls showed statistically significant improvements in knowing what classes to take in high school to prepare for an IT career.

The Clubhouse Network


Photo courtesy of Clubhouse Networks

Location
89 locations internationally, with 51 locations in the U.S.

Students Served
25,000 students across all sites: 700 in *Start Making!*

Age Level
Ages 10-18

Demographics
All Clubhouses focus on reaching under-served communities and youth. Demographics vary based on the local community.

Evaluation methods
A sign-in system collects data about participants and attendance. A biennial survey gathers demographic data; Clubhouse visiting patterns; and attitudes related to technological competence, academic engagement, social-emotional well-being, and aspirations for the future. Outcome data is collected through a variety of methods: facilitator progress reports on program implementation and youth outcomes; participant surveys describing their experiences before and during participation; discussions with Clubhouse facilitators; and archives of participant projects.

Evaluation year
Youth Survey 2015-2016; *Start Making!* Evaluation 2014-2015; Alumni Survey 2013

Evaluator
Inverness Research, Inc. and SRI International

The Clubhouse Network provides a creative and safe out-of-school learning environment in which youth from underserved communities work with adult mentors to explore their own ideas, develop new skills and build self-confidence through the use of technology. *Start Making!* is a new initiative by the Clubhouse, designed to serve as an introduction to an arts and engineering design cycle through STEM-rich making.

Interest: I like to do this.

- Participants actively choose to spend at their clubhouses—83 percent visited at least weekly, and 47 percent every day. And many spend considerable time there—37 percent of youth visited their clubhouse for more than three hours at a time, and 91 percent visited for at least one hour.

Capacity: I can do this.

- A majority of Clubhouse members report that they have learned to use more technology (91 percent), are more confident using technology (88 percent), and use technology more often (84 percent) as a result of their Clubhouse experience.
- Almost 90 percent of youth in the *Start Making!* program felt they were better at solving hard problems, and had more skills to design, make or create projects.
- Clubhouse youth who visit more frequently and stay longer show higher levels of collaboration. More than 80 percent of participants felt they were better at organizing a group to work on a project, and were more comfortable working on projects with groups.

Value: This is important to me.

- Among alumni, 97 percent said that the Clubhouse was the most important source of support for setting high goals and expectations for themselves and 80 percent reported that the Clubhouse had been the most important source of support for pursuing a career.
- 89 percent of *Start Making!* students were more interested in working on projects that help make the world a better place, and more than 80 percent said they are more interested in contributing to their local community.
- The Clubhouse has a positive impact on youth's attitudes about school and about furthering their education—a large majority care more about doing well in school (91 percent), try harder at school (90 percent), and feel like they are more successful in school (85 percent) because of the Clubhouse.

East End House


Photo courtesy of East End House

Location
Cambridge, Massachusetts

Reach
225 students

Age level
Ages 5-15; Grades K-10

Demographics
31 percent African American, 18 percent Hispanic, 15 percent white, 6 percent mixed race; 4 percent Asian, and 26 percent other. 86 percent are from low or low-moderate income families, 18 percent identify a language other than English as their primary language, and 29 percent have an Individualized Education Program at school.

Evaluation methods
East End House utilizes the Dimensions of Success tool from the Program in Education, Afterschool and Resiliency (PEAR) at Harvard University for evaluating program quality. Outcome data on students' confidence, knowledge and interest in STEM is collected using PEAR's research-based survey tools. The Changes in Attitudes about the Relevance of Science (CARS) survey is used to track change over time, and the Common Instrument includes items tied to a national testing system, allowing comparisons with normative data.

Evaluation year
2013-2014

Evaluator
Program in Education, Afterschool and Resiliency (PEAR) at Harvard University and internal evaluation by program directors in consultation with senior evaluation and administrative staff.

East End House uses a holistic approach to promote the well-being, academic achievement, and lifelong success of youth from under-resourced families. STEM is embedded into its elementary and middle school afterschool program, with the goal to increase excitement and confidence in STEM learning, as well as introduce STEM careers youth may not have known existed or thought possible for them to attain. The East End House STEM curriculum taps into the local, growing biotech sector by bringing in employees from local STEM companies to mentor and teach, and taking students on field trips to worksites.

Interest: I like to do this.

- Youth come back to East End programs year after year—95 percent of currently enrolled elementary students are returning, and 79 percent of currently enrolled middle school students are returning.
- Of middle school youth in GenoExplorers, a genetics and genomics curriculum, 62 percent reported their excitement about science either increased or stayed the same, and 70 percent rated their interest and confidence in science and technology higher than a 4 out of 7.
- Half of middle school students indicated they will take science classes in high school, even if they are optional.

Capacity: I can do this.

- 70 percent of middle school participants reported that they are interested in science and technology and are confident in their skills in these areas.

Value: This is important to me.

- 100 percent of participating middle school students in the Youth Ambassadors for Biodiversity, a service learning curriculum focused on ecology and biodiversity, feel it's important to use STEM concepts to help others and know how to apply STEM concepts to make the community a better place. And 75 percent of these students also feel they can use STEM concepts to make a difference in their community.
- Half of all middle school participants indicated that they wish to pursue a STEM career.

EVOLUTIONS Afterschool Program


Photo courtesy of EVOLUTIONS

Location
New Haven, Connecticut

Reach
120 students

Age level
Ages 14-18; Grades 9-12

Demographics
60 percent girls. 80 percent racial or ethnic minorities and 70 percent eligible for free/reduced meals at school. Approximately 25 percent speak a language other than English at home, and half are first-generation college aspirants.

Evaluation methods
Outcome data is collected annually using pre- and post-tests, focus groups, and parent surveys. Longitudinal data is currently being collected to understand where students go after graduating high school.

Evaluation year
2014-2015

Evaluator
SageFox Consulting Group

EVOLUTIONS (Evoking Learning and Understanding Through Investigations of the Natural Sciences) is a multi-year afterschool program for high school students at the Yale Peabody Museum of Natural History. Students increase their scientific knowledge, learn about current research, grow their science communications skills, and participate in opportunities for college preparation and career awareness.

Interest: I like to do this.

- Youth found EVOLUTIONS highly valuabl:, 100 percent of freshmen, as well as 81 percent of students in grades 10 and 11, planned on re-enrolling the following year. Students cited the knowledge gained on college and careers, paid job opportunities, access to science learning, and having fun as the top benefits of participation.

Capacity: I can do this.

- As a direct result of participation, 88 percent of graduating seniors reported an increase in communication skills, 82 percent increased their ability to work in team and 71 percent improved their writing skills.
- Among all students, 74 percent reported an increase in science literacy and 71 percent said they improved their field research skills.

Value: This is important to me.

- Participation in EVOLUTIONS was especially impactful for freshman—almost half now believe they will go into a science field after graduation (33 percent to 47 percent) and 94 percent gained a better understanding of the connection between high school academics, college academics and careers.
- More than three-quarters of parents said that the program had helped their children prepare for college and 63 percent said that participation had increased their child's performance in school (22 percent were unsure).

Explore the Bay

Photo courtesy of Explore the Bay

Location
Rhode Island

Reach
350 Students

Age level
Grades K-8

Demographics
The program focuses on reaching under-served communities and youth.

Evaluation methods
Data is collected by through student pre- and post-program surveys of knowledge and interests as well as staff observations of youth.

Evaluation year
2013-2014

Evaluator
Save The Bay staff

Save The Bay's mission is to protect and improve the Narragansett Bay, and its afterschool program, Explore The Bay, is one of its education initiatives designed to create young environmental stewards. The program offers meaningful hands-on experiences in a wide range of environmental and marine science topics, which educate students on the bay, its role in their community and the threats it is facing.

Interest: I like to do this.

- 80 percent of students who had the opportunity to participate chose to enroll in the Save the Bay programming.
- After participating, 89 percent of students surveyed reported that they wanted to take better care of their environment and 81 percent of students said that they were really interested in learning about plants and animals.

Capacity: I can do this.

- After weekly inquiry-based marine science activities that often include formulating testable questions, investigating scientific concepts, collecting data and recording observations, students demonstrate the ability to communicate scientifically with their peers.

Value: This important to me.

- At the conclusion of each session, students may participate in presenting their knowledge to their peers and families in order to educate others about Narragansett Bay's ecological and economical importance and value.

Frontiers in Urban Science Exploration


Photo courtesy of FUSE

Location
New York, New York; Providence, Rhode Island; Oakland, California; Baltimore, Maryland; Boston, Massachusetts; Chicago, Illinois; and Palm Beach County, Florida

Reach
32,000 student

Age level
Grades K-12

Demographics
Demographics vary based on the local community.

Evaluation methods
Evaluators conduct interviews with stakeholders; collect surveys from staff, students and intermediaries' partners; and observe science activities using the STEM Program Quality Assessment (PQA). Staff confidence is examined using the Science Teaching Efficacy Belief Instrument (STEBI), and youth science attitudes with the Science Attitude Change Tool and Common Instrument.

Evaluation year
2012-2013

Evaluator
ExpandED Schools (Formerly TASC)

Frontiers in Urban Science Exploration (FUSE) is a strategy to institutionalize engaging, inquiry-based, informal STEM education nationally. The goal is to stimulate a culture shift among afterschool leaders and staff to increase the demand for and capacity to deliver high-quality informal STEM education.

Interest: I like to do this.

- FUSE students participated in additional science related opportunities—43.6 percent played a math or science game at home; 42 percent participated in discussions about science topics with friends; 55 percent watched TV, movies or online videos related to science topics; and 30 percent read a book about a science topic.

- Student attitudes toward science increased significantly in terms of agreement with the following statements: "I get excited to find out that I will be doing a science activity;" "Science is something I get excited about;" "I like to work on science activities;" "I like to participate in science projects;" and "I am curious to learn more about science, computers, or technology."

Capacity: I can do this.

- Youth saw gains in science knowledge, motivation and confidence across all FUSE sites participating in the evaluation. At least 85 percent of youth reported that participating in their afterschool science program: "Improved my understanding of science;" "Helped me learn things that I need to answer science questions;" and "Gave me experience that will help me in the future with science projects and activities."

- FUSE received a top score (5/5) on an observation based evaluation for providing opportunities to practice group process skills, which includes actively listening, contributing ideas or actions to a group, doing a task with others, or taking responsibility for a part of a project.

Come to value the goals of STEM and STEM learning activities

- After participating in FUSE, student attitudes increased significantly in terms of agreement with the statement: "I pay attention when people talk about recycling to protect our environment."

- 79.5 percent of youth reported that participating in FUSE "made the idea of a job in science when I am older seem more possible;" 73 percent reported that it "made me more interested in a science job when I am older;" and 69 percent reported that it "made me feel more sure that I want a job in science when I am older." 88.6 percent reported that participating in FUSE "made me more confident that I could do well in science classes in college."

Girlstart


Photo courtesy of Girlstart

Location
Texas

Reach
1,441 students

Age level
Ages 8-13; Grades 4-8

Demographics
100 percent girls; 64 percent Latina, 13 percent Caucasian, 11 percent African American, 4 percent Asian American and 8 percent identified as multiethnic; 74 percent low socio-economic status; 35 percent speak another language at home.

Evaluation methods
Pre- and post-surveys are used to assess girls' STEM skills and knowledge, attitudes toward Girlstart and interest, and confidence in undertaking future STEM activities, courses, majors, and careers. Long-term impact is collected using a framework for tracking alumnae's academic progress.

Evaluation year
2015-2016

Evaluator
Girlstart research staff (prior support from SEDL, now part of the American Institutes for Research)

Girlstart After School is a free, weekly STEM afterschool program designed to increase girls' interest and engagement in STEM through innovative, informal STEM education programs. This intensive intervention involves sequential, informal, hands-on and inquiry-based activities in topics across the STEM acronym, designed to build girls' skills in collaboration, creative problem solving, and critical thinking, as well as their STEM knowledge and their interest and confidence in STEM activities, studies, and careers.

Interest: I like to do this.

- 85 percent of girls agreed with the statement, "I like science!" and 92 percent reported that they enjoyed building things in order to solve problems at Girlstart After School.
- Interest in STEM extends past participation—Girlstart girls enroll in advanced 6th and 7th grade science and math courses at significantly higher rates than non-participants and 89 percent want to return to Girlstart After School next school year.

Capacity: I can do this.

- Girlstart girls perform better on the Texas state science and math tests compared to non-participants.
- All participants engage weekly in iterative design and scientific inquiry to solve problems, resulting in 82 percent of participants correctly identifying all the steps of the engineering design process.
- Girls demonstrate persistence—92 percent reported a willingness to redesign their activity if it did not work on the first try and 92 percent agreed that, "if I try hard, I can be good at science."

Value: This is important to me.

- Almost all participants (94 percent) understand that doing well in STEM in school means that they are more likely to get into college and 94 percent understand that doing well in STEM in college can lead to a better job.
- 73 percent of girls report a strong desire to pursue a STEM career, and 95 percent report at least a moderate desire.

Project GUTS


Photo courtesy of Project GUTS

Location
Santa Fe, New Mexico

Reach
2,000 students

Age level
Ages 11-13; Grades 6-8

Demographics
58 percent Hispanic/Latino, 24 percent Caucasian, 2 percent Asian-American, 2 percent Native-American, 1 percent African-American, 13 percent other; 35 percent qualify for federal free or reduced price lunch; 7 percent are Limited English Proficient; 5 percent have special needs or disabilities.

Evaluation methods
Outcomes are measured using student demographic and attendance data, pre- and post-surveys of knowledge, skills and self-efficacy. Additionally, information is collected on teacher participation in professional development, growth and self-efficacy of teachers, and partnerships developed.

Evaluation year
2010-2011

Evaluator
Kaminsky Consulting

Project GUTS (Growing Up Thinking Scientifically) is an afterschool program in which middle school students learn cutting-edge computing methods to solve modern-day problems. Participants design, create and test computer models to simulate "what if" scenarios for real-world questions of community and societal concern.

Interest: I like to do this.

- Among participants, 65 percent strongly believed that Project GUTS made them more excited to do and learn science and technology in school.

Capacity: I can do this.

- The majority of youth (82 percent) persist through the challenging program to successfully complete a working computer model.
- Using computer models to conduct scientific investigations is a skill that requires following an iterative problem solving process to design, implement, test and debug computer models, and 64 percent of youth agreed they had learned how to successfully do this.
- Youth reported feeling that they had developed specific programming skills with 46 and 63 percent of youth agreeing or strongly agreeing.

Value: This is important to me.

- Project GUTS participants demonstrate their understanding that STEM relates to everyday life and can be used to study and potentially solve local community problems. When asked how they would investigate a new community issue, 80 percent of Project GUTS participants suggested using computer modeling and simulation.

Science Action Club


Photo courtesy of Science Action Club

Location
San Francisco, California

Reach
1100 students

Age level
Ages 10-14, Grades 6-8

Demographics
40 percent girls; 41 percent Asian, 32 percent Hispanic/Latino, 9 percent multi- or bi-racial, 6 percent white, 4 percent African American, 7 percent other. SAC partners exclusively with afterschool programs in communities where at least 40 percent of youth qualify for free and reduced price lunch.

Evaluation methods
Science Action Club works with evaluators to design and administer surveys, and interview youth and activity leaders, conduct site visits and hold focus groups. Activity leaders submit ongoing feedback on the SAC activities, which we use to inform program revisions.

Evaluation year
2014-2015

Evaluator
Gibson & Associates (2010-2012); Public Profit (2012-present)

Science Action Club is a science and nature education afterschool program for middle school youth at the California Academy of Sciences. The Academy partners with afterschool programs to provide training, curriculum, and other resources. In Science Action Club, students explore the local environment and document their discoveries to better understand and protect our planet.

Interest: I like to do this.

- Despite competition from many other afterschool options, clubs maintain an average attendance of 15 youth per club per semester.
- 78 percent of participants agreed with the statements, "I get excited to find out that I will be doing a science activity in afterschool" and "Being in Science Action Club makes me want to learn more about science outside of school."
- In reflecting on the completed session, 93 percent of program staff agreed that "Most youth were actively engaged in the Science Action Club activities" and 86 percent supported the statement that "Youth said they enjoyed the activities in Science Action Club."

Capacity: I can do this.

- 100 percent of participants contribute directly to a national citizen science project by making observations, collecting data and thinking critically about the implications of their findings.
- 90 percent of youth report feeling confident using technology (like computers or iPads) to do science activities in Science Action Club.

Value: This is important to me.

- The majority of participants (86 percent) believe that learning about science can help them to better understand the natural world.
- 81 percent of youth believe that the data they personally collect in Science Action Club is scientifically important.

Science Club


Photo courtesy of Science Club

Location
Chicago, Illinois

Reach
100 students

Age level
Ages 8-12

Demographics
40 percent Asian-American/Pacific Islander, 33 percent African-American, 22 percent Hispanic/Latino; 5 percent Caucasian; 97 percent qualify for federal free or reduced price lunch; 35 percent are Limited English Proficient; 15 percent have special needs or disabilities.

Evaluation methods
Using a case-control methodology, Science Club measures changes in youth skills with a scenario-based skills interview and science fair scores. Youth attendance, interviews and surveys are also collected. Mentors participate in focus groups and self-report on changes in communication and teaching skills as well as attitudes toward science outreach.

Evaluation year
2013-2014

Evaluator
Rockman et al and the Garibay Group

Science Club is a partnership between Northwestern University and the Boys & Girls Club of Chicago, utilizing long-term mentoring relationships to engage low-income urban youth in science. Every week, Northwestern graduate students lead small groups of students through designing and running hands-on science experiments.

Interest: I like to do this.

- Youth choose to go to Science Club among an array of options at a Boys & Girls Club—84 percent of participants attend weekly, participating for 1.5 years on average, with a 92 percent retention rate.
- 94 percent of youth prefer learning hands-on science with Science Club over school-based science classes.
- 82 percent of youth express a desire to continue in the program as a high school mentor.

Capacity: I can do this.

- The Science Club curriculum emphasizes the scientific method and the engineering design process. Science Club youth significantly outperform their aptitude-matched peers in two independent, well-controlled oral assessments of science skills. These assessments include constructs of experimental design, use of variables, and data analysis. Science Club youth are also more confident conducting experiments than non-participating youth (56 percent vs. 32 percent).
- Twice as many Science Club students described experiments as a way to help them learn and find out new things compared to youth not in the program (64 percent vs. 33 percent).
- 81 percent of Science Club youth described using science outside of school compared to the control group.

Value: This is important to me.

- Science Club youth are better able to describe how science is used in everyday life in comparison to their non-participating peers.
- 100 percent of students felt science was relevant to their careers after participation in Science Club, up from 70 percent at the start of the program. Students could also more specifically describe science careers.

Science Minors Club

Location
Chicago, Illinois

Reach
6,370 students

Age level
Ages 8-12

Demographics
48 percent African-American, 36 percent Hispanic/Latino, 8 percent Caucasian, 6 percent Asian-American/ Pacific Islander; 87 percent qualify for federal free or reduced price lunch.

Evaluation methods
The museum's in-house research and evaluation team collects data sources using student intake forms, weekly attendance reporting, surveys, facilitator reflections and site observations. Program implementation, effectiveness and usability of the curriculum and pedagogical approaches, impact of the professional development trainings, and community perceptions of the museum have also been evaluated.

Evaluation year
2013-2013

Evaluator
Museum of Science and Industry in-house evaluation team

Science Minors Clubs is an outreach initiative of the Museum of Science and Industry aimed at increasing interest in science in underserved neighborhoods by engaging students in places where they already spend their time after school, such as community-based organizations and schools. Participants work together on STEM projects and activities that build curiosity and encourage teamwork

Interest: I like to do this.

- 87 percent of youth indicated that they enjoy science and 92 percent expressed interest in doing more science activities.
- Participants demand more STEM—85 percent of site facilitators reported adding additional STEM topics and 57 percent accessed additional curriculum kits to expand offerings for their club participants.

Capacity: I can do this.

- Site observations revealed that 80 percent of facilitators encouraged youth to formulate testable questions and 93 percent fostered the collection of data and recording of observations.
- Participants use real STEM tools—93 percent of observed sites provided opportunities for youth to use tools such as a hand lens, calorimeter and rulers to make observations, take measurements or collect data.
- Observations indicated that 80 percent of sites observed provided opportunities for youth to report out their findings and communicate their ideas to the broader group.

Value: This is important to me.

- In site observations, 86 percent of facilitators supported youth in making connections to their everyday lives and 78 percent of participating youth indicated that they use science in their everyday lives. Of the sites implementing the "Green Energy" curriculum, 100 percent of facilitators reported participation in a recycling program.
- An average of 1,350 youth and family members participate in the museum's STEM career fairs. 100 percent of youth attending the fairs completed a STEM career journal, which guided their interviews of STEM professionals and encouraged them to describe STEM careers of personal interest.

SHINE After School Program

Photo courtesy of SHINE After School

Location
Carbon & Schuylkill Counties, Pennsylvania

Reach
360 elementary students

Age level
Grades K-12 (data is for K-5 only)

Demographics
87 percent of elementary students qualify for free or reduced price lunch; 23 percent are English Language Learners; 31 percent have special needs or disabilities; 10 percent African American, 23 percent Hispanic and 67 percent Caucasian.

Evaluation methods
Outcomes are measured using several data sources, including surveys of staff, school day teachers, and parents; pre- and post- surveys of participants; the Common Instrument from the Program in Education, Afterschool and Resiliency (PEAR) at Harvard University; report cards; and state assessment results. To assess program quality, site observations are conducted.

Evaluation year
2013-2014

Evaluator
SHINE staff

SHINE (Schools & Homes in Education) is a comprehensive afterschool program that provides academic and social support to youth in a primarily rural region of Pennsylvania. SHINE offers STEM throughout the grades, with the intention of building a STEM pipeline from kindergarten to career.

Interest: I like to do this.

- Almost three-quarters of SHINE students like science (73 percent) of SHINE and get excited to find out that they will be doing a science activity (76 percent).
- Participants exhibit a strong curiosity about science—88 percent agree that they like to see how things are made, 72 percent want to learn more about STEM, and 74 percent want to understand science (for example, to know how computers work, how rain forms or how airplanes fly).

Capacity: I can do this.

- All elementary students in SHINE are referred to the program based on academic need, and as a result of participation, students are highly successful in their school science classes—94 percent received passing grades, and 57 percent received an A or B. This is supported by parents, as 82 percent indicated their child improved in science after participation.
- Additionally, 82 percent of students received passing grades math, with 46 percent receiving an A or B.

Value: This is important to me.

- Youth could picture a future in STEM—91 percent said that science and math will be used in their future career and 52 percent would like to have a science or computer job in the future.
- Participants gained an understanding of the specifics of STEM careers—80 percent reported that they know what an engineer does and 94 percent understood that engineers need to know both math and science.

STEM 3D: Integrating Science Afterschool

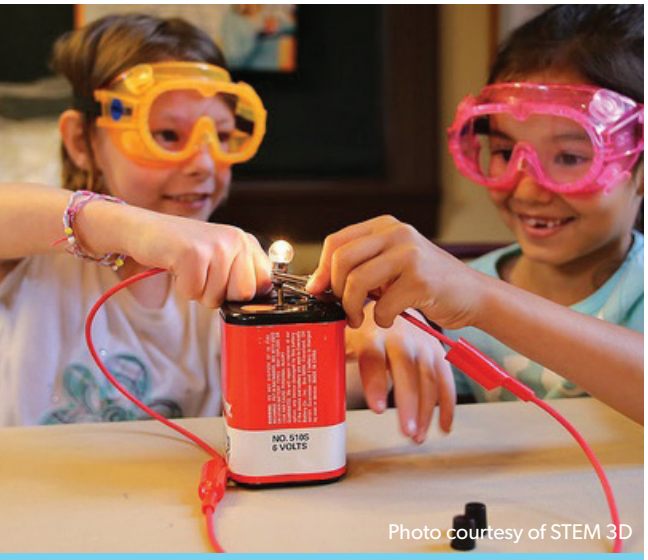
Photo courtesy of STEM 3D

Location
Philadelphia, Pennsylvania

Reach
400 students

Age level
Grades 3-5

Demographics
50 percent girls, 41 percent Asian / Pacific Islander, 40 percent African American, 15 percent Latino, 4 percent Caucasian, 35 percent speak a language other than English at home.

Evaluation methods
Evaluation data are collected through structured site visits, facilitator interviews and surveys. STEM 3D uses the Program in Education, Afterschool and Resiliency (PEAR) at Harvard University's Common Instrument to measure STEM interest and engagement, and the Holistic Student Assessment to assess 21st century skills.

Evaluation year
2014-2015

Evaluator
Creative Research & Evaluation, LLC

The goal of STEM 3D, a project of The Franklin Institute, is to engage underserved youth and families in year-round STEM learning and career awareness through a combination of afterschool, home and community activities. In partnership with city-funded out-of-school time programs, The Franklin Institute supports afterschool facilitators in order to impact children's sense of identity in STEM and to identify ways in which underrepresented groups come to understand, value and promote STEM content and careers.

Interest: I like to do this.

- Youth show statistically significant growth in science engagement through agreeing strongly to statements such as: "I like to participate in science projects" and "I get excited about learning about new discoveries or inventions."
- Participants reported feeling significantly more interested in STEM content and skills in response to prompts such as "I am curious to learn more about science, computers, or technology" and " I want to understand science (for example, to know how computers work, how rain forms or how airplanes fly)."

Capacity: I can do this.

- Participants reported statistically significant gains in perseverance and critical thinking, as well as gains in their relationships with adults and other youth (only two out of three program sites administered this assessment).
- In all three sites, there was a significant correlation for individual students between gains in 21st century learning skills and gains in STEM interest and engagement.

Value: This is important to me.

- STEM 3D project-based learning units incorporate real-world problems, such as creating models for flood-proof buildings or identifying how humans can help rebuild habitats for endangered species. After participation, youth reported being more interested in the statement "I pay attention when people talk about recycling to protect our environment."
- Participation led to an increased understanding and awareness of STEM careers. The units emphasize careers by allowing students to investigate and embody science careers throughout explorations of science concepts.

Techbridge After-School

Location
Bay Area, CA; Seattle, WA; and Washington, DC (evaluation data represents CA only)

Reach
600 students

Age level
Grades 4-12

Demographics
100 percent girls, 42 percent Hispanic/Latino, 30 percent Asian-American/Pacific Islander, 10 percent African-American, 8 percent Caucasian, 2 percent Native American, 8 percent other. 94 percent of school partners receive Title I funding; 75 percent of students are eligible for free or reduced price lunch; 40 percent limited English proficient.

Evaluation methods
Evaluation methods include pre- and post-surveys, focus groups with girls, teachers, and families, and program observations and coaching. Surveys examine technical and scientific ability, career awareness, aspirations, teamwork and adult influence. Comparison groups are utilized to evaluate outcomes with groups not participating in Techbridge. In addition, an observation rubric is used to ensure fidelity of implementation and identify areas for program improvement.

Evaluation year
2012-2013

Evaluator
Rebecca Ancheta, City College of San Francisco

Techbridge offers afterschool and summer programs with hands-on projects and career exploration to inspire girls in STEM. Curricula are developed with girls in mind, and designed to spark and sustain an interest in these fields as well as to make a connection with STEM careers. Career exploration is facilitated through visits from STEM role models and field trips to local engineering and technology companies.

Interest: I like to do this.

- After participation in Techbridge, 80 percent of girls planned to pursue additional STEM learning opportunities by taking advanced math and/or science classes.
- 85 percent of girls reported they find engineering more interesting and 83 percent said they find science more interesting after participating.

Capacity: I can do this.

- Girls gain real STEM skills—93.5 percent said they know more about how things work, like circuits and simple machines and 92 percent said they feel more confident using technology.
- Participants demonstrate persistence in addressing challenges—95 percent of girls say they understand it can take many tries to solve a problem and 81 percent said they are better at problem-solving.
- Girls build STEM-relevant life skills—70 percent said they are more comfortable speaking in front of a group of people and 97 percent believe teamwork is good for solving problems.

Value: This is important to me.

- Techbridge provides extensive opportunities to engage in career exploration. As a result, 94 percent of participants knew more about different kinds of jobs and 81 percent said they can see themselves working in technology, science or engineering.

Evaluation Reports and Research Papers

Build IT

Koch, M. and Gorges, T. (2012). Inspiring girls and their female after school educators to pursue computer science and other STEM careers. *International Journal of Gender, Science and Technology, (4)3*, pp. 294–312. Retrieved from http://genderandset.open.ac.uk/index.php/genderandset/article/viewArticle/229

Koch, M., Gorges, T., & Penuel, W. (2012). Build IT: Scaling and sustaining an afterschool computer science program for girls. *Afterschool Matters*, Fall 2012. Retrieved from www.niost.org/pdf/afterschoolmatters/asm_2012_16_fall/ASM_2012_16_fall_7.pdf

The Clubhouse Network

Inverness Research. (2016). *Developing Youth: Highlights of the International Clubhouse Youth Impact Survey*. Inverness, CA: Inverness Research. Retrieved from http://www.computerclubhouse.org/sites/default/files/Clubhouse%20Youth%20Impact%202016.pdf

Gallagher, L., Pinkerton, L., Dominguez, X., Michalchik, V., & Llorente, C. (2013). *Computer Clubhouse Network: Alumni Survey Report*. Menlo Park, CA: SRI International. Retrieved from http://www.computerclubhouse.org/sites/default/files/SRI%20Alumni%20Survey%20Report%20March%202013.pdf

Remold, J. (2015). *Start Making! @ Clubhouses Final Evaluation Report*. Menlo Park, CA: SRI International. Retrieved from www.sri.com/sites/default/files/publications/start_making_40_clubhouses_oct_2015_evaluation.pdf

Frontiers in Urban Science Exploration

Agrawal, N. and Kanter, J. (2013) Expanding high-quality informal STEM education: Findings from a national demonstration. *After School Today*, Spring 2013. Retrieved from www.mydigipub.com/publication/?i=152965

Donner, J. and Wang, Y. (2013). Shifting Expectations: Bringing STEM to Scale through Expanded Learning Systems. *Afterschool Matters*, Spring 2013. Retrieved from www.niost.org/images/pdf/afterschoolmatters/asm_2013_17_spring/ASM_2013_spring_2.pdf

Girlstart After School

Girlstart. (2016). *Girlstart Program Impact Statement: 2015-16*. Austin, TX: Author. Retrieved from https://issuu.com/girlstart/docs/girlstart_may_2016_program_report

Harris, S. (2016). *Strong Promise: Moving from Interest and Engagement in STEM to Real Academic Results: Evaluating Girlstart After School Participants' Academic Performance*. Austin, TX: Girlstart. Retrieved from https://issuu.com/girlstart/docs/strong_promise_girlstart_after_scho_863a7961051441

Project GUTS

Lee, I. (2011, April 9). Assessing youth's computational thinking in the context of modeling and simulation. Paper presented at the 2011 annual meeting of the American Educational Research Association Retrieved from http://hub.mspnet.org/index.cfm/28279

Lee, I., Martin, F. Denner, J., Coulter, B., Allan, W., Erickson, J., Malyn-Smith, J., and Werner, L. (2011). Computational Thinking for Youth in Practice. *ACM Inroads*, 2(1), pp. 32-37. Retrieved from http://dl.acm.org/citation.cfm?id=1929902

Science Club

Kennedy, M., Daugherty, R., Garibay, C., Sanford, C., Braun, R., Koerner, J., and Lewin, J. (2016). Science Club: Bridging In-School and Out-of-School STEM Learning Through a Collaborative, Community-Based After-School Program. *Connected Science Learning*, 1(1). Retrieved from http://csl.nsta.org/2016/03/science-club/

SHINE After School Program

SHINE 2008-2014 Trend Data - Return on Investment. (2014). Retrieved from http://shineafterschool.com/shinewordpress/supporting-data/

Techbridge After-School

Mosatche, H. S., Matloff-Nieves, S., Kekelis, L., & Lawner, E.K. (2013). Effective STEM Programs for Adolescent Girls: Two Approaches and Many Lessons Learned. *Afterschool Matters*, Spring 2013. Retrieved from http://niost.org/images/pdf/afterschoolmatters/asm_2013_17_spring/ASM_2013_spring_6.pdf