



Out-of-School Time STEM Guidebook



**A Guide for Quality STEM
Programming**

THANK YOU TO OUR CONTRIBUTORS!

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In 2018, the Afterschool for Children and Teens Now (ACT Now) Coalition convened the first Illinois Afterschool Guiding Team to develop strategies to expand STEM in afterschool statewide. This team has expanded since its initial inception to include a broader STEM voice from around the state.

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INTRODUCTION

75 PERCENT OF NOBEL PRIZE WINNERS IN THE SCIENCES REPORT THAT THEIR PASSION FOR SCIENCE WAS FIRST SPARKED IN NON-SCHOOL ENVIRONMENTS ¹

THAT IS RIGHT!

Out-of-school time programming can ignite a passion in a child that results in accomplishments great and small. STEM (Science, Technology, Engineering and Mathematics) influences our daily lives. It is the responsibility of both formal school experiences and out-of-school time (OST) programs together to educate students in STEM if we expect youth to gain the deeper understanding needed in these areas to tackle the complex problems of our rapidly changing world.

School-aged children are expected to meet content and skill-based standards intended to promote proficiency and interest in STEM areas. Even as efforts to improve STEM education have been implemented in the classroom, OST providers play a vital role alongside educational institutions in establishing learning environments that promote inquiry and innovation skills needed to prepare all youth for a STEM dependent future.

This guide is designed to enumerate the benefits of out-of-school time programs, aid in justifying the implementation and funding of these programs, provide guidance in selecting and implementing quality STEM curriculum, suggest tools to evaluate STEM programming, indicate possible funding streams, and provide a list of reviewed STEM resources.



Is STEM education needed in out-of-school time?



The simple answer is, YES!!

The STEM workforce continues to be one of the fastest growing areas of job development. As a group, STEM occupations are projected to grow 10.5% between 2020 and 2030, faster than the average for all occupations (7.7%) according to the U.S. Department of Labor. Not only are there more jobs in the STEM fields, but these jobs are also higher paying with a median salary of \$89,780, compared to \$41,950 for all other fields.²

To fulfill the demand for STEM jobs and promote economic stability for all, exposing youth in out-of-school programs to STEM activities that provide opportunities to develop skills and interest in areas that formal educational may not be able to is an essential role out-of-school time programs have to fuel the STEM workforce pipeline.

10.5%

STEM occupation growth between 2020 and 2030

7.5%

Growth for all other occupations between 2020 and 2030

\$89,780

Median salary in the STEM field

\$41,950

Median salary in all other fields

Is out-of-school time the right place for STEM? YES!



Out-of-school time programming offers benefits to youth in STEM that the traditional school day cannot offer to all students. Programs that promote STEM also have been shown to enhance learning in other areas, encourage 21st century skills such as collaboration, problem solving and resilience, and foster a positive STEM identity. By including and enhancing STEM in your program, you are also strengthening other areas as well.

● Unique Setting:

OST programming offers a unique opportunity for youth to engage in hands-on, real world projects. These projects promote collaboration and greater exploration in an informal setting which allows for a unique perspective of the STEM topics presented to the youth. The informal setting may make STEM more accessible for some students without the pressure or expectation of a formal classroom. The unique OST setting can spark, sustain and deepen an interest in STEM that a classroom may never be able to do.

● Positive Attitude Toward STEM:

The activities students participate in during out-of-school hours affect their attitudes and perceptions. Through funding from the Charles Stewart Mott Foundation and the STEM Next Foundation, states across the country have developed networks that focus on quality STEM afterschool programming. Research in 2016, looking at 158 afterschool programs that are part of these afterschool networks found that 65% to 85% of students report significant gains in STEM attitudes, STEM identity, STEM career interest, and SEL/twenty-first-century skills across the 11 state afterschool networks.³

● Closing the Achievement Gap:

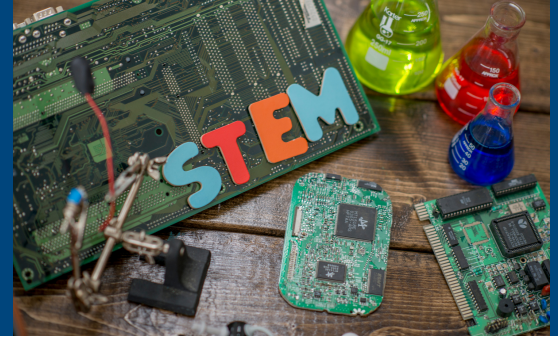
Afterschool and out-of-school time programs can close the achievement gap for underrepresented students. Families from higher income brackets spend a larger portion of money on experiential learning in the form of summer camps or other out-of-school experiences than those from lower socio-economic status. Research has found that the achievement gap, especially in math proficiency, which is often a gatekeeper for many STEM fields, is significantly lessened when lower-income students attend afterschool programs with greater frequency.⁴ Research has also shown that groups that have traditionally experienced academic failure in STEM areas, namely females that are economically disadvantaged or of color or low levels of English proficiency, have benefited from afterschool programming by demonstrating proficiency on standardized testing, enrolling in more science and math courses, and taking advanced level courses.⁵

● Parents Recognize Importance:

Parents know the importance of STEM for the future of their children and are seeking it in a quality STEM program to fill their children's afterschool hours. The America after 3PM report finds that "more than 7 in 10 parents (72 %) report that STEM and computer science learning opportunities were important in their selection of an afterschool program, up 19 percentage points from 2014 (53 %)."⁶



Which Curriculum to Choose?



The first step to implementation of STEM into a program is to choose a curriculum. BUT WHICH ONE?

There are numerous resources available and choosing the correct curriculum for your program may seem overwhelming. Some directors and facilitators who are experienced in STEM may choose to create their own curriculum. This requires a large time commitment to research and review individual activities to meet the age, academic level, and interests of their students. The use of a thematic curriculum is more advantageous for those with less STEM experience. When reviewing a premade curriculum consider the following:

Research Based

A reputable curriculum utilizes child development and educational research as a basis and incorporates best practices of instruction into the program.

Goal Focused

Activities and instruction should be aligned to specific goals and standards, specifically to NGSS standards. Information on the standards can be found in [A Primer and Resource Guide for Afterschool Educators](#).

Program Culture

Using a consistent curriculum highlights expectations of the overall program, emphasizes needs of the community being served, and differentiates the program from others.

World Connections

A well-developed curriculum will relate content topics and skills to real world situations. This connection brings STEM alive for the students and bring relevance to the activity.

Data Collection

Using a consistent, well-developed curriculum with standards and goals allows for the monitoring of data. This data can be used for securing funding in terms of grants and awards.

Time-saver

The use of a defined curriculum can be a confidence builder. This allows the provider to gain practice facilitating STEM activities that have been already developed without needing to spend the time to create them on their own.



What Does Quality STEM Programming Include?

Implementing a quality STEM program requires more than purchasing materials. **A quality program will engage youth's hands and minds.** Clear communication of expectations to staff begins with training. It is important to discuss and ensure each staff member has an understanding of each of the following:

Environment

You should ensure that you have space, materials, time, and background knowledge required for the activity. It is often helpful to do a practice run for your activity.

Participation

Program providers have the opportunity to unlock the scientist in all youth by identifying and fostering each of their strengths while also attending to their needs.

Objective

Your activity should be more than just fun. It should also call out specific STEM content and skills. NGSS Science and Engineering Practices should be considered in each activity.

Reflection

When designing and testing solutions, youth may "fail" to solve the problem. That's okay! They are expected to learn from what went wrong, and try again. Students should also learn how to question why things went wrong and discover solutions.

Hands-On

In STEM lessons, the path to learning is open-ended and decisions about solutions are youth-generated. Learning is "doing."

Careers

Youth should address real social, economic, and environmental problems and seek solutions. The most relevance comes from students seeing themselves in the role of scientist.

Relationships

Great STEM activities help youth learn how to work in teams and also help to build relationships with their instructor.

Connection

Youth must be interested in and understand the practical application of what they are learning. It is important that we purposefully bridge what youth find exciting outside of their school/program to what they're learning in their school/program.

STEM ACTIVITY FACILITATION

You do not need a STEM background to lead a STEM lesson.

STEM facilitators need to be curious, interested, and enthusiastic about the subject. Facilitators do need to understand the general concept, safety issues and the goal of the activity. In general, the facilitator needs to be prepared for the lesson. But the facilitator does not need to have all the answers. In fact, a sense of excitement and discovery that the facilitator shares with the youth could add to the overall environment. The look of a STEM activity is different from many others.

A STEM ACTIVITY LOOKS LIKE:

- Students working together to solve a problem.
- Inquiry-driven lessons that spark student curiosity.
- Less direct instruction from facilitator and more inquiry-based learning.
- Engaged students who are buzzing with excitement.
- Multiple solutions to a problem with students encouraged to understand that failure is a part of learning.





In the informal out-of-school setting, the facilitator leads the group through questioning rather than trying to transfer information through lecture. **Questions are used to encourage youths' thinking, check for understanding, stimulate the desire to seek more information, promote discussion and relate the topic to the activity's goal.** Typically, the facilitator will ask open-ended questions allowing the youth to demonstrate their thinking.

- What do you notice? What happened?**
- What do you think caused that?**
 - Tell me about your design.**
 - Why do you think that?**
- What evidence do you have?**
- Tell me why you are doing that?**
 - What would happen if...?**
- Does that remind you of anything you have seen before?**
 - How does that compare to....?**
- What did you learn from doing this?**

In STEM, everyone is a life-long learner. Adult facilitators model this for youth in the program. Under no circumstances should the facilitator ever fake an answer that is not known. If a facilitator does not know an answer or some information, one of the following strategies could be used:

- 1** **Redirect questions to the group to promote youth collaboration and input.**
- 2** **Make a plan as a group, including the facilitator, on how to find an answer to the question.**
- 3** **Find resources to answer the question. These resources may be in the form of written materials, another staff member or family member, or a community resource.**

NGSS: Science and Engineering Practices



Hands-on, experiential learning is characteristic of the active nature of STEM. The afterschool environment has the benefit of time to allow youth to explore and "do" science by delving deeper into concepts and gain a better understanding of the world around them. Learning STEM by "doing" includes developing skills such as asking questions and making predictions, experimenting, making observations and gathering data, making models, analyzing patterns and communicating results. These practices are skills that engage youth in the methods that real scientists and engineers use to experiment and solve problems and are also known as the NGSS Science and Engineering Practices. There is not one single activity that will utilize all these practices, but over time youth should be exposed to and using all of these practices. The NGSS Science and Engineering practices that facilitators should be familiar with, and youth should be using in every STEM program are:



Asking questions and defining problems



Developing and using models



Planning and carrying out investigations



Analyzing and interpreting data



Using mathematics and computational thinking



Constructing explanations and designing solutions



Engaging in arguments from evidence



Obtaining, evaluating, and communicating information

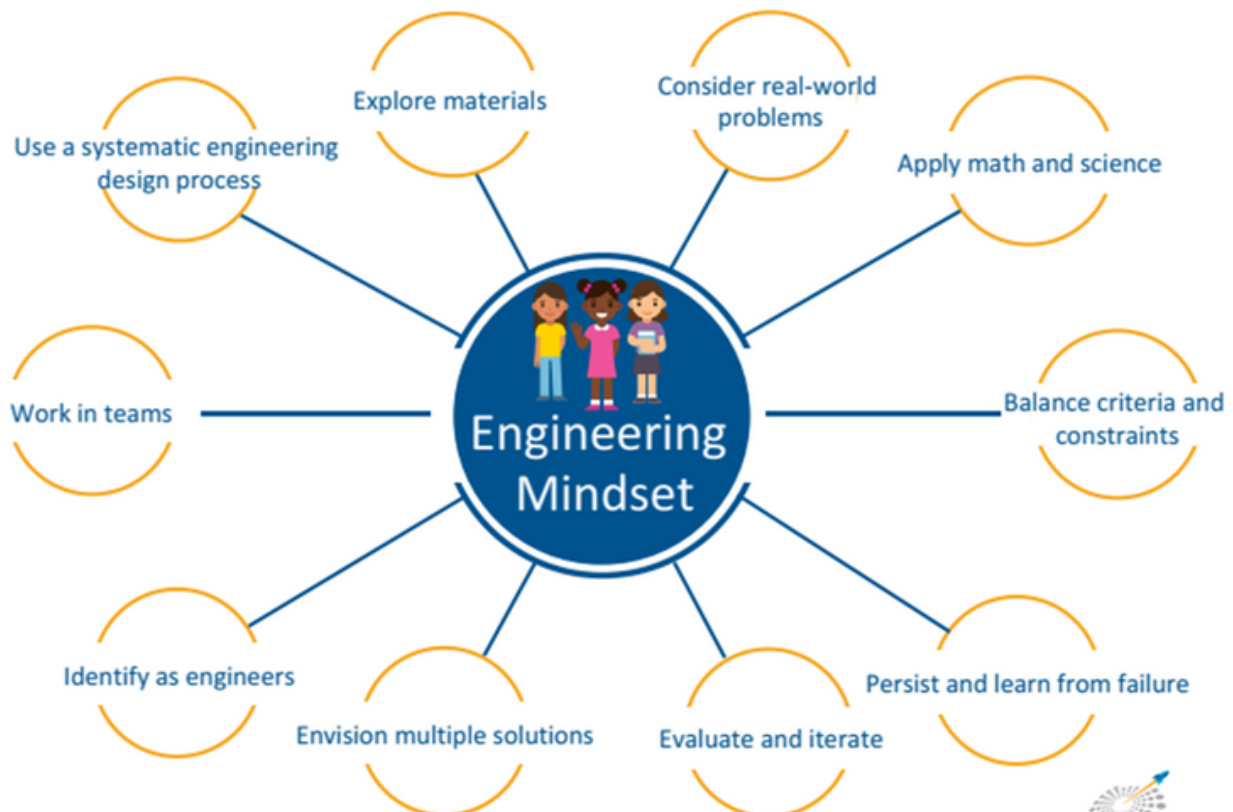


Engineering Design Process

STEM challenges are a hands-on approach to problem solving that allows for the incorporation of many content areas at once. STEM challenges range from simple 15-minute mind benders to multi-week projects depending on the age and interest of the youth involved. Many examples of successful challenges for all ages can be found searching the internet and some are provided in the [Resource section of this Guidebook](#). You may also allow the youth in the program to suggest areas that interest them or a need in the community that they feel needs to be addressed. **Challenges are one method used to illustrate the interconnectedness of the subjects of STEM (science, technology, engineering, and math) and the development of an engineering mindset.**

An engineering mindset refers to the values, attitudes, and thinking skills associated with engineering. Engineers use a systematic process to solve problems and develop solutions. The Engineering Design Process plays a key role in STEM challenges and other problem solving areas as a blueprint for youth to follow as they work toward solutions. Using the Engineering Design Process allows youth to develop not only technical skills in specific content areas, but also skills of persistence, collaboration, and creativity that will benefit them in the future.

10 Practices for an Engineering Mindset



Reference

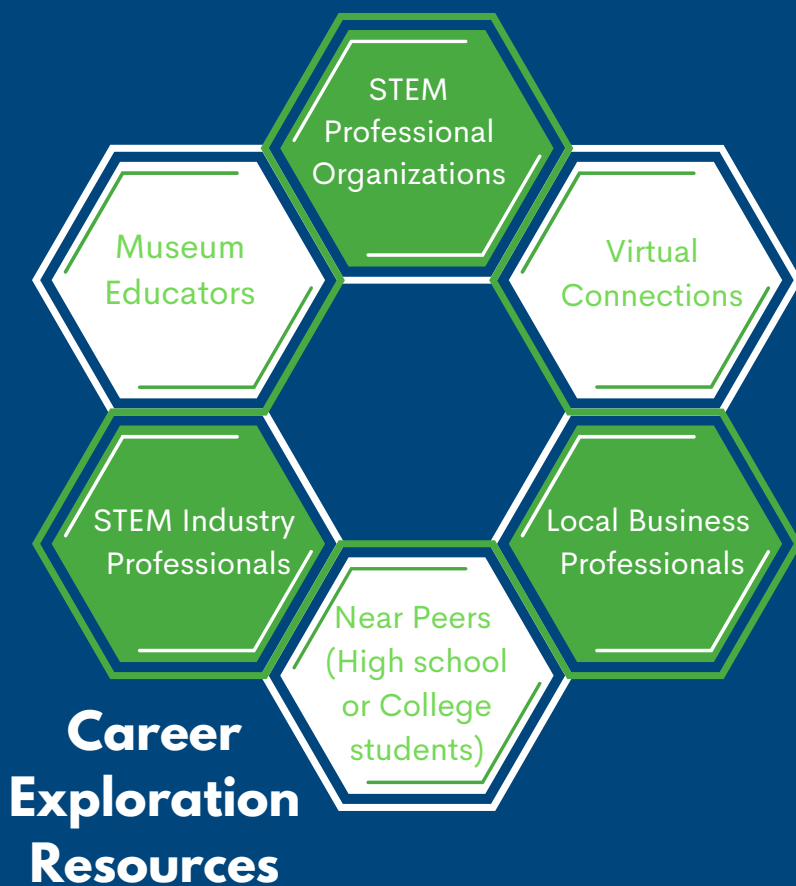
Cunningham, C.M. (2018). *Engineering in elementary STEM education: Curriculum design, instruction, learning, and assessment*. New York, NY: Teacher College Press.
Cunningham, C. M., & Kelly, G. K. (2017). Epistemic practices of engineering in education. *Science Education*, 101, 486-505.



MILLION GIRLS MOONSHOT

Career Exploration

An important, yet often overlooked aspect of STEM programming is the opportunity for youth to explore careers. Out-of-school time programs have the unique opportunity to expose youth to STEM careers given the flexible schedule not provided in the school day. Exposure to a wide variety of STEM careers increases relevance of STEM and provides opportunities for youth to experience STEM in new and authentic ways. OST programs have the opportunity to also dispel the myth that all STEM positions require high levels of education. There are many well paying positions that are considered STEM yet require a certificate or two-year degree. Forming relationships with STEM professionals that are of similar racial or ethnic backgrounds as the program youth has been shown to have a positive effect on STEM career aspiration and strengthening of STEM identity of the youth.



You are not alone in educating youth about careers.

You have a variety of career exploration tools at your disposal. Utilize members of the local community to come speak at the program or take the students to see the individual at their place of work. Many virtual options exist to connect with STEM professionals as well. As you plan a unit or activity, also consider what STEM career connection may be made and reach out to a career resource to make STEM more relevant.

FAMILY ENGAGEMENT: THE SECRET SAUCE

Once a program has created an environment that promotes and encourages an authentic interest in STEM for the youth it serves, the next step is to grow and sustain that interest. The support of the family is the “secret sauce” in the future STEM aspirations, especially for girls and other underrepresented populations. Some parents lack confidence in their own STEM abilities, making it difficult to provide the needed support when their child expresses an interest in STEM. This is where out-of-school programming can assist families. STEM Next Opportunity Fund published a white paper highlighting strategies to support and engage families in STEM, [Changing the Game in STEM with Family Engagement](#), that provides guidance for family engagement.

The success of family engagement in STEM programming is very similar to any program with the inclusion and consideration of the following:

1

Authentic Family Relationships:

it is important to listen to families and make them feel comfortable and heard. Take time to get to know families during drop-off and pick-up time.

2

Honor Diverse Cultures:

When planning events, respect the community you are serving and direct STEM activities that may be relevant to their daily lives.

Use Relatable Language:

Some adults are intimidated by STEM due to a lack of exposure. Make topics relatable to adults by using everyday language to explain concepts. Keep heavy scientific vocabulary to a minimum.

3

Utilize Personal Interaction: In place of a flyer sent home about a family event, try sending a personal invitation, an e-mail or a phone call. When possible, speak to families in their native language and have information translated to increase their comfort level at an event.

4

5

Make Resources Available:

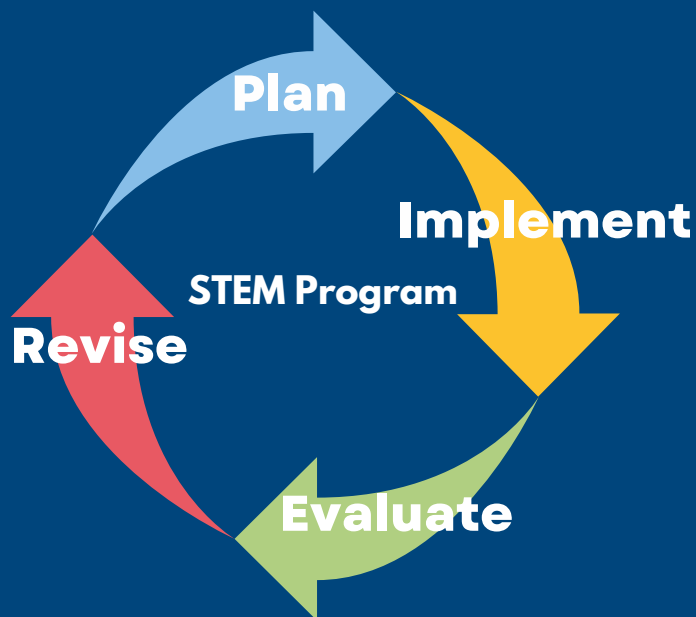
Share information about community STEM events, send home activities to be done at home with common household materials, and provide information sheets about STEM happenings in the program.

6

Educate Families: Share with families methods to encourage STEM at home and how to promote inquiry and questioning on a daily basis.

QUALITY PROGRAMS & EVALUATION

An overall quality OSP (Out of School Program) includes a quality STEM component. As a Program Director, utilizing planning and assessment tools allows you to create quality STEM programming and provide evidence of success. Planning tools are instruments to help guide action steps related to the implementation of STEM programming. You can use specifically designed assessment tools for STEM programming to assess the strengths and weaknesses by obtaining feedback and then adjust your programs accordingly. Through planning and assessment tools, you can build, sustain, measure, and improve upon the merit, worth, value, and effectiveness of your program. The following page provides some tools to use in the planning and evaluation of your program.



[Indiana Afterschool Specialty Standards](https://www.indianaafterschool.org/quality/standards/)

<https://www.indianaafterschool.org/quality/standards/>

The Indiana Afterschool Network created this tool to be used as a self-assessment for a program based on nationally accepted best practices and standards for out of school time programming. The self-evaluation indicates strengths and weaknesses in seven standards. Each standard is explained with indicators and common practices. The assessment tool can be used to drive decisions within the program.

Use this tool when you want to implement or expand STEM programming, to self-assess your program quality, and for resources for improving STEM programming quality.

[California Afterschool Network: Assessment and Planning Tool for STEM](http://www.afterschoolnetwork.org/sites/main/files/file-attachments/stem_program_planning_tool_links.pdf)

http://www.afterschoolnetwork.org/sites/main/files/file-attachments/stem_program_planning_tool_links.pdf

The California Afterschool Network, in collaboration with the California STEM Learning Network, created an assessment and planning tool. The planning portion of the tool includes resources to get your program ready to implement STEM, a plan to implement STEM, and suggestions for expanding STEM programming. The tool also includes a program assessment portion where you are able to assess where your program is on the “STEM Program Pathway.”

Use this tool when you want to implement or expand STEM programming, to self-assess your program quality, and for resources for improving STEM programming quality.

[PEAR's Dimensions of Success and Planning Tool](https://www.thepearinstitute.org/stem)

<https://www.thepearinstitute.org/stem>

Harvard University's PEAR Institute (Partnerships in Education and Resilience) provides an observation and planning tool, Dimensions of Success (DoS), which defines quality STEM programming and allows afterschool providers to identify strengths and weaknesses in their own program. DoS defines twelve evidence-based dimensions rated on a four-point scale. The twelve dimensions are divided into four domains: Features of the Learning Environment, Activity Engagement, STEM Knowledge and Practice, and Youth Development in STEM.

As a part of its STEM initiative and aligned with DoS, the PEAR Institute also provides a planning tool which is free. The planning tool gives suggestions for how to modify and prepare teaching strategies and activities to align with the twelve dimensions of DoS.

Use this tool to learn more about the elements of quality STEM programming, to take a deep dive into how to plan high quality STEM lessons, or to obtain feedback on your STEM lessons.



Where to Find Funding



Implementing STEM into your program can be done with minimum cost.

Many STEM curricula and activities are available for free and most of the materials used are common household items. There is no need to invest in expensive equipment initially. Have your staff become comfortable with the science and engineering process first before moving to more complicated projects. The Resource section of this Guidebook provides a variety of free curricula and activities.

As time proceeds you will encounter more in-depth projects that require specialized materials or additional staff, and you may need additional funding. When seeking grants, first start with a complete budget that considers the scope of the project and the personnel involved. As you approach funders, be sure to refer to your program's mission, data collected during Quality Standards Evaluations and expected outcomes of the project. Having past successes to share with funders provides a sense of confidence that the donor is investing in a solid program with evidence-based outcomes. In the pages that follow are a sampling of the many funding resources available for STEM programming.

Know Your Funders: A Guide to STEM Funding for Afterschool

The Afterschool Alliance has a STEM funding guide that suggests sources of funding from federal, state and local governments, corporations and philanthropic groups. This guide also provides tips on obtaining grant money best suited for your program, creating meaningful, beneficial relationships, and writing an effective proposal.

<http://www.afterschoolalliance.org/STEM-funding-brief-10182012.pdf>

STEMfinity Grant Archive

Stemfinity lists federal, state, and corporate STEM grant opportunities. Funding listed may apply to schools and/or afterschool programs.

<https://stemfinity.com/pages/stem-grants>

Society for Science

STEM Action Grants are small grants up to \$5,000 awarded to innovative nonprofit organizations working to enhance the public's understanding of science and to increase participation of underrepresented populations in STEM fields.

<https://www.societyforscience.org/outreach-and-equity/stem-action-grants/>

BoostCafe

BOOST Cafe is a comprehensive online community for in and out-of-school time educators. The BOOST Cafe is an extension of BOOST Collaborative and provides no-cost resources, professional development information and funding opportunities.

<https://boostcafe.org/funding/>

Corporate & Robotics Funding

<p><u>Coca-Cola Foundation</u> https://www.coca-colacompany.com/social-impact/coca-cola-foundation</p>	<p>The Coca-Cola Foundation supports many community organizations large and small. They mainly look for large projects that have a broad impact on a diverse population. A project that is multi-year would benefit from applying to this organization.</p>
<p><u>General Motors Corporate Giving Grants</u> https://www.gm.com/commitments/communities#apply-for-funding</p>	<p>To receive funding from General Motors, an on-line application is required including demographic information about the program, a Letter of Inquiry and a full proposal. GM places an emphasis on funding programs working to advance STEM education to underserved communities targeting females and minorities.</p>
<p><u>Voya Foundation</u> https://www.voya.com/page/voya-foundation</p>	<p>The Voya Foundation is focused on promoting early interest in STEM for grades K-8 with emphasis on experiential learning. Applications are accepted all year round.</p>
<p><u>Costco</u> https://www.costco.com/charitable-giving.html</p>	<p>For nonprofit organizations focused on children, Costco can donate supplies to your program if you provide your local Costco Warehouse Manager with a copy of your tax letter and a completed Warehouse Donation Request Form. Costco also provides grant opportunities for nonprofit organizations that meet Costco's giving guidelines and focus areas.</p>
<p><u>First Robotics</u> https://www.firstinspires.org/robotics/team-grants</p>	<p>First Robotics lists Team Grant Opportunities. These grants are provided by individual sponsors, and each has their own individual requirements. Many will cover the full cost of the robotic materials needed to compete in First Robotics competitions. The grants change often, so it is recommended to check frequently for new and modified offerings.</p>
<p><u>REC Foundation</u> https://www.roboticseducation.org/team-resources/grants/</p>	<p>REC Foundation is committed to providing the necessary equipment to new teams interested in becoming involved in VEX Robotics. REC Foundation provides grants to newly formed competitive teams that will cover entry fees and equipment for teams that agree to compete for a minimum of two years.</p>

Federal & State Funding

The federal and state governments provide funding streams for out-of-school time programming. STEM is a required area in some and a possible area in others.

Reimagine Public Safety Act

RPSA is a comprehensive approach to reducing firearm violence through targeted, integrated behavioral health services and economic opportunities. The grant recognizes the important problem solving and analytic skills that STEM offers to all youth and the impact STEM has on their future career paths. With STEM as a grant requirement funds may be used to enhance skills in science, math and technology, develop collaboration skills, explore careers and be ready to enter the workforce.

<https://www.dhs.state.il.us/page.aspx?item=93750>

The Teen REACH program is to expand the range of choices and opportunities that enable, empower and encourage youth to achieve positive growth and development, improve expectations and capacities for future success, and avoid and/or reduce risk-taking behavior. The STEM requirement recognizes the importance of the skills of problem solving and analysis in all areas of life. Funds from the grant may be used to facilitate and expand STEM programming.

<https://www.dhs.state.il.us/page.aspx?item=134565>

Teen Reach

21st Century Community Learning Centers

The 21st CCLC program is specifically aimed at students who attend high-need, high-poverty, and low-performing schools to provide extended learning opportunities outside of the regular school day to students in need of academic assistance. Successful programs assist students in meeting academic standards in core subjects (math, reading, science, social studies) so they can graduate from high school and be prepared for college and/or the workforce. Funds may be used for expanding learning activities or any area of enrichment and include technology.

<https://www2.ed.gov/programs/21stcclc/index.html>

The Perkins/CTE Act is the main federal funding source for high school and postsecondary career and technical education programs. The funds from this grant may be spent to more fully develop academic knowledge and technical and employability skills of secondary education students and postsecondary student who enroll in CTE programs. These areas of career and technical education include certification in STEM areas.

<https://www.isbe.net/perkins>

Perkins Career and Technical Act

PARTNERSHIPS

Partnerships are invaluable in the STEM out-of-school area. As a program leader, you are likely to seek and form partnerships with local museums, businesses, universities, or other local non-profit organizations. Any partnerships that you form should have mutual goals with shared outcomes between both organizations. As with any relationship, these partnerships need to be monitored and nurtured with clear and consistent communication between all involved.



WHAT COULD A PARTNERSHIP REGARDING STEM INVOLVE?

- Professional development for the afterschool staff
- Curriculum development
- Hands-on materials
- Tutoring for students
- Coaching for afterschool staff
- Field trip opportunities
- Career mentoring for students
- Financial support
- Program volunteers

When establishing a partnership with an organization always consider:

Needs of both organizations

Both organizations should be fulfilling a need and working toward the organization's goal. Focus on only entering partnerships that are mutually beneficial.



Long & short term goals

Both organizations should define their expectations and timeframe from the beginning. Ensure that both parties agree on an evaluation method and timeline.



Plan activities together

Work collaboratively to plan the activities and next steps. It is important that all involved are clear on what is going to happen. When is it going to occur? Who is responsible for what steps?



Clear communication

After the collaborative plan has been formed, ensure there is clear follow-up communicated through a central representative in each organization. This will prevent any unwanted changes or miscommunications.



Publicize success

Throughout the partnership, be sure to publicize success points as data is collected. This will create excitement for the partnership and more interest in possible future partnerships for both groups.



ADVICE ON INITIATING A STEM PROGRAM FROM PROFESSIONALS IN THE FIELD

Creating and expanding any STEM program takes a great deal of time to plan, execute, evaluate and revise. No matter if you are new to programming or have been working in the field for many years, everyone benefits from the experience of others. We have compiled some advice about initiating STEM programs and initiating partnerships from experts in STEM programming from Science Olympiad, Museum of Science and Industry, Chicago Public Library System, Small Bites and Garden Bites that might be helpful as you move your programs forward.

Listen to staff express their issues with programming and work together to support them by offering technical assistance
- MSI & Chicago Public Library

Develop a supportive relationship with program facilitators.
-Small Bites & Garden Bites

Schedule adequate time for initial contact and planning.
-MSI & Chicago Public Library

Provide training and professional development for new initiatives and materials.
-All

Promote program end results by making the goal be a final project, presentation or event
-Science Olympiad

Develop a robust network of partners to tap into for facilitation of programming, mentorship, college visits, curricula, etc.
- Science Olympiad

Collect data on the outcomes and challenges of programming in order to build out certain elements going forward and troubleshoot
-Small Bites & Garden Bites



Conclusion



Getting more young people engaged in STEM is not only an economic reality since the job growth in the STEM job sector out paces any other, but STEM engagement is also needed to understand our ever-dependent technology-based world. Afterschool and out-of-school programs play a unique and pivotal role in providing and supporting all students with quality STEM education, especially those from diverse backgrounds.

Research shows that what happens outside of school can be equally, if not more, influential than what happens in school in terms of student interest in STEM. Experiences that quality out-of-school time programs provide which engage students in hands-on learning can spark a sustained interest in STEM and may lead to a possible career pathway in turn increasing the numbers of underrepresented populations in the field. The myth that you need to be a STEM expert to instruct STEM is just that, A MYTH. Do not be afraid to work with the students in your program to develop their STEM identity and develop your own along the way. Resources are available, such as this guidebook, to assist in building a quality STEM program.

Throughout this Out-of-School Time STEM Guidebook, we hope you have gained valuable information to assist in your implementation and expansion of STEM in your program. Provided are the tools to examine and evaluate curricula, evidence of a quality program, funding sources, program evaluation tools, professional development aids, career resources, STEM and science suppliers and examples of lessons and activities.

PROFESSIONAL DEVELOPMENT RESOURCES

Resource	Description
<p><u>Afterschool Coaching for Reflective Educators in STEM (ACRES)</u> https://mmsa.org/projects/acres/</p>	<p>ACRES is a free, nationally acclaimed coaching program of the Maine Mathematics and Science Alliance that is available to afterschool providers everywhere. Trained coaches provided guidance, training, and resources around a specific STEM skill to staff in the program. Educators work together in cohorts to learn skills, go back and practice the taught skills in their program on camera and then receives feedback from the coach and the small group in order to improve their instruction.</p>
<p><u>Afterschool Tech Toolkit</u> https://naaweb.org/toolkit-trainings</p>	<p>The Afterschool Tech Toolkit provides free webinar trainings conducted by skilled, qualified professional presenting on various topics about implementing technology in your program, digital learning implementation and digital learning equity. In order to be notified of new modules, you are able to register for free. If you are unable to take part in the scheduled webinar, you are also able to listen to the webinar recordings later.</p>
<p><u>Click2ComputerScience</u> https://click2computerscience.org/teaching-computer-science/building-stem-excitement/</p>	<p>Click2 is a free web-based professional development opportunity to learn about computer science and coding. The lessons include how to engage youth in computer science and computer science basics. The site also has lessons and activities that can be implemented into your program.</p>
<p><u>Click2Engineering</u> https://click2engineering.org/training-staff/</p>	<p>Click2 is a free web-based professional development opportunity to learn about the engineering mindset and engineering practices. The lessons include using each of the practices of an engineering mindset as well as how to train your staff to use engineering. The site also has lessons and activities that can be implemented into your program.</p>

CURRICULUM RESOURCES

Resource	Grade	Cost	Topic	Description
<u>4-H Curriculum</u> https://4-h.org/parents/curriculum/	K-12	Yes	STEM	The topics vary to include all STEM areas from butterflies to autonomous cars.
<u>Afterschool Math Plus</u> https://www.fhi360.org/resource/afterschool-math-plus	3-8	Yes	Math	After-School Math PLUS is an evidence-based program that provides fun, real-world mathematics activities for students in grades 3 through 8. Materials include an implementation guide and activity guides designed around four thematic units (Jump Rope Math, Built Environment, ArtMath, MusicMath). Each unit emphasizes identity development, careers, role models, strategies for family involvement and inclusion of students with disabilities.
<u>Apex Science Curriculum</u> https://www.frostscience.org/stem-professionals/apex-science/apex-science-curriculum/	3-8	Yes	Various	APEX is an 8-unit curriculum with each unit containing 4 hands-on lessons covering life science, nature of science, energy, processes that shape the Earth, nature of matter, environmental science, forces of motion, and Earth/space science. Each unit includes a facilitators guide, instructions for lesson delivery, student instruction cards, and data collection sheets. Units may be purchased in either English or Spanish.

CURRICULUM RESOURCES

Resource	Grade	Cost	Topic	Description
<p><u>Code.org</u> https://code.org/</p>	K-12	No	Computer Science /Coding	Code.org is a non-profit that provides free open-sourced computer science curriculum and tutorials for grades K-12. The site contains developed curricula for all ability levels and thousands of individual activities to practices computer skills.
<p><u>Creative Computing Curriculum</u> http://scratched.gse.harvard.edu/guide/curriculum.html</p>	K-12	No	Computer Science /Coding	The Creative Computing Curriculum is a collection of ideas, strategies, and activities for an introductory creative computing experience using the Scratch programming language. The activities are designed to support familiarity and increasing fluency with computational creativity and computational thinking.
<p><u>CS First</u> https://csfirst.withgoogle.com/c/cs-first/en/curriculum.html</p>	K-12	No	Computer Science/ Coding	The CS First team at Google has developed curricula and corresponding videos for youth to do in order to learn about Computer Science principles and more. There are also opportunities for participants to learn graphic design and animation skills.
<p><u>EIE Engineering</u> https://www.eie.org/stem-curricula/engineering-grades-prek-8</p>	PreK-8	Yes	Engineering	EIE provides engineering curricula from pre-K to grade 8 to develop create thinkers and problem solvers. Digital and paper resources are available as well as the option to purchase materials for all activities.

CURRICULUM RESOURCES

Resource	Grade	Cost	Topic	Description
<p><u>Girlstart</u> http://girlstart.org/our-programs/for-educators/free-curriculum/</p>	K-12	No	Engineering	Girlstart is a NGSS aligned STEM program designed to enhanced classroom learning through hands-on, engaging activities that allows students to investigate real world problems and careers.
<p><u>Hess Truck STEM Curriculum</u> https://hesstoytruck.com/stem/#stem-curriculum</p>	3-8	No	Engineering /Physics/ Math	Free STEM curriculum that demonstrates how toys can be used to learn. Each year (6 years of curriculum) different Hess toy trucks are featured, but any toy trucks can be used in their place. Hands-on with common materials utilized in activities.
<p><u>Mizzen by Mott App</u> https://www.mizzen.org/</p>	K-12	No	Various	Mizzen is an application developed by the MOTT Foundation to foster STEM learning in youth of all ages. The app hosts activities and modules on engaging STEM topics and is designed for the afterschool professional.
<p><u>STEM Sports</u> https://stemsports.com/</p>	3-8	Yes	Various	STEM Sports is a curriculum that combines STEM content and sports. Complete K through 8 supplemental curricula are for purchase that include materials and assessments. An emphasis is placed on real-life application, hands-on learning, and career information.

ACTIVITY RESOURCES

Resource	Grade	Cost	Topic	Description
<p><u>American Chemical Society</u> https://www.acs.org/content/acs/en/education/resources.html</p>	K-12	No	Chemistry	ACS Resources provides access to lesson plans, activities, textbooks, multimedia and other resources centered around bringing chemistry to your students. This site is arranged by education level or topic.
<p><u>Boeing</u> https://www.boeing.com/principles/education.page</p>	K-12	No	Engineering /Physics	Aviation and aerospace are highlighted in these activities. Numerous design challenges are included as well as multimedia resources and career information.
<p><u>NASA Activities</u> https://www.jpl.nasa.gov/edu/teach/ https://www.nasa.gov/stem/foreducators/k-12/index.html</p>	K-12	No	Various	These two sites include searchable individual activities, curriculum, videos, family engagement and so much more.
<p><u>Nova Labs</u> https://www.pbs.org/wgbh/nova/labs/about/</p>	6-12	No	Various/ Energy	This is a digital platform where "citizen scientists" actively participate in the scientific process by visualizing, analyzing and sharing the same data that scientist use. Each lab is unique and focusses on a different area of active research.
<p><u>Science Buddies</u> https://www.sciencebuddies.org/stem-activities</p>	K-12	No	Various	Science Buddies is a database of searchable activities that utilize easy to find materials and can be done in less than an hour. Searches can be done by grade level, subject area, or type of activity.

ACTIVITY RESOURCES

Resource	Grade	Cost	Topic	Description
<p><u>Science Snacks</u> https://www.exploration.edu/snacks</p>	K-12	No	Various	Science Snacks are hands-on activities that bring explorations of natural phenomena into the classroom and home. Each activity uses inexpensive, easily available materials, offers detailed instructions and images, and provides a clear explanation of science content.
<p><u>Teach Engineering</u> https://www.teachengineering.org/curriculum/browse</p>	K-12	No	Engineering	Teach Engineering is a compilation of individual activities and unit lessons on all engineering topics. You can search by any topic, grade level or time interval desired.
<p><u>You for Youth</u> https://y4y.ed.gov/stemchallenge/overview</p>	6-12	No	Engineering/ Environmental/ General Science Physics	The U.S. Department of Education is collaborating with other federal agencies to provide exciting learning opportunities for students in 21st Century Community Learning Centers (21st CCLC) programs. Check out the Institute of Museum and Library Services (IMLS), NASA, National Oceanic and Atmospheric Administration (NOAA), and National Park Service (NPS) portals, where you'll find hands-on project ideas and resources your program can use to bring science, technology, engineering and mathematics (STEM) to life.

STEM CHALLENGES RESOURCES

Resource	Grade	Cost	Topic	Description
<p>Little Bins for Little Hands <u>STEM CHALLENGES Archives - Little Bins for Little Hands</u></p>	K-6	No	Engineering	7-pages of various STEM design challenges using common household materials. These are geared toward younger students, but middle school aged students will also enjoy but may find them less challenging. These challenges are shorter in length ranging from 15 minutes to 1 hour.
<p>Kesler Science STEM Challenges (keslerscience.com)</p>	4-8	Yes	Engineering	Kesler Science offers multi-lesson, real world challenges. The challenges may be purchased individually or as a 12 challenge package. Everything the facilitator needs to lead the group is included including introduction and reflection questions.
<p>Nasa STEM Challenges You For Youth // NASA STEM Challenge - (ed.gov)</p>	5-8	No	Engineering	NASA challenges are specific to middle school and focus around space exploration. Each challenge uses real mission data and experience. The challenge comes with a facilitators guide, introductory video, and resources to help conduct the challenge.

CAREER AWARENESS RESOURCES

Resource	Grade	Cost	Topic	Description
<p><u>FabFems</u> https://www.fabfems.org/about</p>	K-12	No	Careers	FabFems is a database of women in STEM. This directory of positive role models from a wide range of careers have contact information that can be used to arrange in-person or virtual connections to highlight personal stories and career pathways.
<p><u>If/Then Ambassadors</u> https://www.ifthen.shecan.org/ambassadors/</p>	5-12	No	Careers	The If/Then Ambassadors are 125 innovative STEM professionals that serve as high profile role models for girls in STEM. The personal and career stories of the ambassadors are shared here. Activities are provided in the Educator Hub to assist in career discussion and exploration.
<p><u>Skype-a-scientist</u> https://www.skypeascientist.com/</p>	K-adult	No	Careers	Skype-a-scientist is a free, virtual platform that matches you with a scientist with your area of interest for a session. They can match scientist in many languages and flexible times. The goal is to make science accessible and fun.
<p><u>Society for Women Engineers (SWE)</u> https://swe.org/k-12-outreach/stem-pathways/</p>	K-12	No	Careers	SWE is a professional organization of engineers that provides careers information. They also have information on how to begin engineering clubs, competitions and scholarship opportunities.

CAREER AWARENESS RESOURCES

Resource	Grade	Cost	Topic	Description
<u>NGCP- Resources for Underserved Youth</u> https://ngcproject.org/resources/resources-underserved-youth	K-12	No	Careers, scholarship, mentors	NGCP curated this listing of high-quality resources to help your programs and communities support underserved youth.

SUPPLIERS

Resource	Grade	Description
<u>Educational Innovations</u> https://www.teachersource.com/category/stem	K-12	Educational Innovations carries many kits and toys. Many are not classroom size but are good demonstrations and attention grabbers.
<u>Flinn Scientific</u> https://www.flinnsci.com	K-12	Specializes in educational materials. Flinn carries a wide range of chemicals and dissecting materials as well as safety materials.
<u>Hand2Mind</u> https://www.hand2mind.com/products/stem	K-6	Hand2Mind specializes in younger grades. They have more STEM kits and STEM bins than individual materials.
<u>STEM Supplies</u> https://www.stem-supplies.com	K-12	Sells supplies for all your needs including makerspaces.
<u>Stemfinity</u> https://stemfinity.com	K-12	Sells supplies for all of your needs. Good selection of robotics and tech supplies.

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