

# STEM IN LIBRARIES | Facilitation Toolkit



# STEM LIBRARIES

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The *STEM in Libraries: Facilitation Toolkit* provides resources to help you offer relevant and sustainable science, technology, engineering, and math (STEM) programs to your community.

You will learn to:

- Understand the concept of free-choice learning and why this means your STEM programs must be relevant and compelling.
- Recognize the librarian's role in STEM learning and explore opportunities for related professional development.
- Plan purposefully, using a simple yet effective method for creating STEM program plans.
- Identify different approaches to STEM programing, and consider how you might start with a simple approach and build your library's STEM ecosystem over time.
- Learn from the experiences and best practices of libraries that have already developed STEM programs for their communities.

#### What's inside:

- Introducing STEM programs to your library
- Tips for facilitating STEM in libraries
- Library patrons and free-choice learning
- STEM facilitation training for librarians
- The library STEM ecosystem
- Passive and active STEM programs
- Additional resources

## Introducing STEM programs to your library

The STEM in Libraries: Facilitation Toolkit is the first in a series of toolkits that provide public libraries with strategies, resources, and pathways to integrating science, technology, engineering, and math into a library's daily operations—and to do so in ways that are appropriate for each library's capacity, staff, patrons, and community.

These toolkits will familiarize you with a number of great resources that you can easily introduce at your library. They will also offer examples from other libraries around the country. You are not alone in your efforts to introduce STEM programs! Librarians all across this nation—from small to large, from urban to suburban to rural—are integrating STEM programs.

### Benefits of STEM programming

#### STEM activities can bring to the library:

- *Adults, teens, and children.* STEM programs can draw patrons of all ages. You can start with toddlers and encourage lifelong learning for patrons of all ages.
- *New audiences that may have never come to the library before.* People may come because a STEM program relates to their interests, then come back when they discover what more the library has to offer.
- *A new awareness of the value of the library.* When STEM programs relate directly to local interests, then potential donors, community partners, local officials, and the general public will respond.

A new awareness of the library as a STEM resource can only be achieved if there is sustained public access to engaging and relevant STEM experiences. The *STEM in Libraries toolkits* are here to help you—public library directors, librarians, and staff—to successfully build sustainable STEM literacy programs that earn your library recognition as a local STEM hub.

### What is STEM literacy?

What do we mean by “STEM literacy”?

#### According to the Open Educational Resources (OER) Commons,

STEM literate individuals are able to use concepts from science, technology, engineering, and mathematics to understand complex problems and to innovate with others to solve them. A STEM literate person considers how STEM can improve the social, cultural, economic, and environmental conditions of their local and global communities. Building STEM literacy ensures that we have both the scientists and global citizens we need to thoughtfully build equitable and sustainable futures.

OER emphasizes that “STEM literacy is for everyone!” This doesn't mean that everyone can or should become a scientist or an engineer. But it does mean that every citizen can benefit from having a basic understanding of how their world works.

What does all this mean to you as a librarian? It doesn't mean that you need to become a STEM expert. But it does mean that you can draw on your skills and resources to find experts, facilitate programs, and help the citizens in your community become more STEM literate.

## Getting started

Where to start? Successful STEM integration starts with the library director, librarians, and staff determining the resources they'll need, the interests of their community, and the most practical starting points.

**Resources needed.** How many and what kind of library resources (e.g., staff time, financial) will be needed to achieve a high return on investment for *both* the library and the community? As librarians take on more complex STEM responsibilities and your library expands its sphere of influence in the STEM world, you may need to develop staff STEM knowledge and skills.

**Community interests.** What do my patrons *truly want*? This may not be what you think they want. Ask those who use the library a lot, and more importantly, ask those who do not use the library at all. Ask teens and parents, teachers and students. You may get some interesting input.

**Simple starting points.** *Start with what you are already doing in the library or what is already happening in the community.* This may be a birding guide and a pair of binoculars, a book or other resource that is repeatedly requested by your patrons, a summer reading program for children, or a community reading program for adults. Or it could be a school science fair or another event happening in the community, hosted by another organization, that the library can enhance by offering supplementary resources.

It's easiest to start by building on what is already occurring in the library and the community.

## Tips for facilitating STEM in libraries

Here are some tips for getting started with STEM programs in your library. Remember, you can start small and develop your programs over time as you develop your library's STEM capacity.

### Generate ideas

Don't know how to get started? The first step is to generate ideas.

- Draw on the interests, knowledge, and passion of your director, librarians, staff, and patrons. Ask them what their personal STEM interests are, and highlight these subjects within the library. It's a great way to deepen the connections between staff and patrons.
- Solicit ideas from other librarians in the region, state, or country.
- Look back at previous summer reading guides, such as those from the [Collaborative Summer Library Program](#) (CSLP), for many turnkey activities.
- Check in with your local preschools, K–12 schools, colleges, and universities. Teachers and teacher-librarians can be great resources and idea generators.

### Tap into your patrons' interest in STEM

Do ask your patrons what they would like to learn more about. You may be surprised to find that many people—particularly adults—are looking for a place where they can get more STEM information and engage in science experiences. You only have to ask! Try soliciting input at places where you might attract new patrons, such as farmers' markets or Parks and Recreation Department activities.

#### To get started with adults, you might:

- Host a community read and/or book club based on a fiction or nonfiction book with a STEM theme.
- Invite a STEM expert to provide a preliminary overview of the book's subject, or to facilitate a discussion of the book as the group reads.

#### To get started with teens, you might invite young people to:

- Advise you on youth STEM programming, based on their interests and schoolwork. Teens can help you brainstorm ways to bring the latest STEM books and resources to the public.
- Help develop stand-alone STEM stations.
- Create bulletin boards to increase public awareness of STEM. NASA, for example, has dramatic satellite photographs you can download and display as you ponder Mars voyages.

### **To get started with children, you might:**

- Talk to K–12 teachers, teacher-librarians, and preschool leaders and find out how library STEM programs might dovetail with the schools' science curricula.
- Reach out to parent-teacher associations and homeschooling parents to learn about their needs and interests.

### **Explore different types of STEM programs**

There are many easy, low-cost ways to highlight STEM programs and resources in your library. For example, you can:

- Build STEM book displays for children, teens, and adults, focusing on themes that are in the news, of interest to your community, and/or related to upcoming library programs.
- Assemble a loanable backpack or acquire science tools (like telescopes and microscopes) you can loan to families and youth.
- Create self-guided, stand-alone STEM stations. For ideas, see the Additional Resources section of this toolkit.
- Facilitate a STEM program using some of the ideas in the Additional Resources section of this toolkit.
- Promote STEM activities happening in your community and local schools as well as within your library.
- Think about how you can provide STEM programs outside of the library for those who can't come to your building. Could you offer programs on bookmobiles? In community spaces?

### **Engage the STEM providers in your community**

There are many STEM providers in your community and state who may be interested and willing to present—for free—on the subject they love. Think about the possibilities at your local schools and universities, local and state government offices, Audubon Society, 4-H/Cooperative Extension, astronomy club, Sierra Club, hospitals, etc.

To learn more about ways to develop relationships with formal and informal STEM providers, see the *STEM in Libraries: Community Partnerships Toolkit*. You'll find many ideas for potential STEM partners noted there.

## Library patrons and free-choice learning

Libraries, as venues, and librarians, as allies, are perfectly suited to support lifelong learning.

### Why are people motivated to learn? Some reasons include:

- To satisfy their personal curiosity or support a personal interest
- To complete a school assignment or prepare for a career
- To get job-related experience or training
- To enjoy a hobby
- To support the needs of others, such as children or other family members
- To satisfy a specific need or solve a problem (for example, they may want to learn about a disease, home repair, or recycling)

Most STEM learning in libraries is best described as *free-choice learning*. This is learning that people engage in when they have some control over how and with whom to spend their time. For library STEM programs to be successful, it is critical to recognize that participants will be engaging in free-choice learning. If your programming doesn't resonate with the needs and interests of your patrons and community, people will find other ways to spend their time.

This is why it's essential to understand what your patrons are interested in, and to know the types of tools and resources they want or need to access. There is no need to guess their interests and hope they come to a program; you can find out what they want and then develop a program that meets their needs. For clues,

- Ask children, teens, and adults directly.
- Review current events in the news to see what's happening locally that might be STEM oriented.
- Learn what other community leaders are providing to the public and think about how you might build on the ideas of these sources.

A number of studies identify public libraries as community anchors and important venues for informal STEM learning. (For references to these studies and more information on libraries as STEM learning venues, see the Additional Resources section of this toolkit.) This means you have a tremendous opportunity to help fulfill your community's free-choice STEM learning needs.

## **STEM facilitation training for librarians**

Librarians hold a special place in the community as they are among the most trusted and respected public servants.

They provide connections to community resources, and have become the “go-to” people for questions and information on complex subjects such as resume development and health care. This means librarians have the potential and the opportunity to become effective STEM navigators and program leaders, providing patrons with access to STEM resources and experiences as well as connections to local experts who can help them learn about STEM-based community issues.

Some librarians will already have STEM facilitation skills, and others may benefit from related professional development opportunities. There are various online and face-to-face training opportunities to help librarians gain knowledge of STEM facilitation and confidence in their skills. The Additional Resources section of this toolkit lists some professional development tools and opportunities that may be useful to you and your team. In particular, [www.stemlibraries.org](http://www.stemlibraries.org) provides some of the most current training on how to build capacity for STEM within the library.



## The library STEM ecosystem

The constraints on a library—staff time, finances, space—are real, but they are not insurmountable. Taking a purposeful approach to STEM opportunities is essential to creating successful programs, services, and resources, whether you are just starting or you've already begun to integrate STEM literacy into your library.

It is important to understand that STEM in libraries is not just a matter of delivering STEM-based library programs. Your library is building and becoming part of a STEM ecosystem created through a network of activities, resources, and services provided by library staff and the community, alongside partners.

### This section highlights:

- The librarian's role in a STEM ecosystem—not necessarily as the subject expert, but as the catalyst who unleashes STEM expertise in the community
- A simple yet effective way to create a purposeful STEM program plan
- Four different approaches to STEM programming, and the characteristics of each approach

## The librarian's role in a STEM ecosystem

Library science educator [David Lankes has said](#), "Librarians ultimately must see their communities as their collections, not simply materials and activities in a building." He goes on to emphatically state that librarians should not be STEM educators—which is true. However, librarians do need to understand how STEM fits into our daily lives and affects our communities, and therefore *need to feel confident in their ability to create platforms that unleash STEM expertise within the communities they serve*.

Once librarians begin to view STEM as an essential literacy, it becomes possible to plan purposefully, to find ways to integrate STEM into the library's daily operations, and to develop a vision for the library as part of a larger STEM ecosystem. Librarians can facilitate connections between the scientific community and the public through strategic partnerships with formal STEM providers, such as science museums, and informal science providers, such as local astronomy clubs. These relationships are critical elements of the library's ability to expand the community's access to STEM experiences, resources, and services.

## Purposeful STEM programming

### Purpose, people, pieces, and parts

Integrating STEM in the daily operations of a library involves a continuous development of STEM activities in and around the library that, over time, provide greater value to the community. A quick and easy way to be purposeful in the development of a STEM initiative is to break out each component—purpose, people, pieces, and parts—so you can clearly see the alignment between the types of resources needed and the expected goals. This 4P approach has been adapted from the [work of Peter Wardrip](#).

- **Purpose.** What is the goal or anticipated outcome for the program, resource, or service? Defining your purpose is important because it helps you identify the resources required to achieve your desired goals and outcomes.

This step also helps you define what success will look like for each stakeholder. The return on investment for your program should include direct benefits to (in order of priority): library patrons, the general community, and the library itself. To help define your purpose, use worksheets #4 and #5 in the STEM Development Plan Workbook at [www.stemlibraries.org](http://www.stemlibraries.org).

- **People.** Who will be involved, and how will they be involved in the development and implementation of the activity? Who will be participating in the program or using the resource or service? Your list might include the library director, librarians, and staff; community leaders and partners; volunteers and patrons. Make it a team effort. Build partnerships with outside groups and across library departments.
- **Pieces.** Identify logistical resources and efforts required for successful STEM work, such as funding, communications, places, and hands-on helpers.
- **Parts.** Note the programmatic resources involved, such as science tools, toys, activities, books, and other materials. Don't forget the speakers and other subject matter experts.

If you gather your director and staff to discuss the program and outline the plan together, you'll be able to identify the key components more clearly and thoroughly. The following table gives an example of a quick-and-easy 4P outline, showing the critical elements required to deliver a library telescope program that will benefit library patrons, the general community, and the library itself.

Sample outline for library telescope program	
<p style="text-align: center;"><b>Purpose</b></p> <p style="text-align: center;"><i>What's the program and why are we doing it?</i></p> <p><b>Goal:</b> To introduce the library telescope program, increasing the community's awareness and understanding of the beauty and importance of the night skies.</p> <p><b>Activities:</b></p> <ul style="list-style-type: none"> <li>◦ Circulation of telescope</li> <li>◦ Library-hosted star party</li> <li>◦ Displays and presentations on astronomy and the effects of light pollution on humans and animals</li> </ul>	<p style="text-align: center;"><b>People</b></p> <p style="text-align: center;"><i>Who will develop, deliver, and participate in the program?</i></p> <ul style="list-style-type: none"> <li>◦ <b>Library staff and STEM providers</b> responsible for development, communication, and implementation</li> <li>◦ <b>Partners:</b> Astronomy club, solar system ambassadors, academic informal and formal STEM providers, city Parks and Recreation Department</li> <li>◦ <b>Audiences:</b> Library patrons and general community</li> </ul>
<p style="text-align: center;"><b>Pieces</b></p> <p style="text-align: center;"><i>What logistical resources will be required?</i></p> <ul style="list-style-type: none"> <li>◦ <b>Finances:</b> Grants, sponsorships, budget allocations</li> <li>◦ <b>Marketing communications:</b> Website promotions, newsletters, partner marketing</li> <li>◦ <b>Places:</b> In the library, within the community (e.g., land trust, parks, parking lot)</li> <li>◦ <b>Hands-on helpers:</b> Staff and volunteers to make the program run smoothly</li> </ul>	<p style="text-align: center;"><b>Parts</b></p> <p style="text-align: center;"><i>What programmatic resources will be required?</i></p> <ul style="list-style-type: none"> <li>◦ <b>Telescopes and telescope circulation process</b></li> <li>◦ <b>Night sky maps:</b> <a href="http://skymaps.com">http://skymaps.com</a></li> <li>◦ <b>Books:</b> <i>Find the Constellations</i>, by H.A. Rey; <i>Nightwatch</i>, by Terence Dickinson</li> <li>◦ <b>Displays:</b> <a href="#">Free NASA materials</a></li> <li>◦ <b>Subject expertise:</b> Speakers from partner organizations</li> </ul>

## Approaches to STEM programming

There are four general approaches to STEM programming:

- The fortuitous approach
- The presentational approach
- The facilitation approach
- The development approach

These approaches move from more simple and opportunistic (the fortuitous approach) to more complex and purposeful (the development approach). The fortuitous approach requires the least planning and commitment of resources, while the development approach requires the most commitment—and holds the most potential for the long-term impact. The presentational and facilitation approaches fall in between.

No approach is right or wrong, and each may be useful in different libraries, at different times, under different circumstances. Though librarians often employ multiple approaches with different programs over time, usually one approach is used more often than others. The most-used approach within a library usually represents the approach the key librarian or director is most comfortable with. The library director can be especially influential in determining a library's approach to STEM programming. The director's understanding of the value of STEM and the opportunities it creates for libraries, and the director's commitment to integrating STEM with the library's operations, will influence the library's approach and the role the library can play in a larger STEM ecosystem.

The following table shows the characteristics of the four different approaches to STEM programming. As you develop purposeful programs, it's important to understand which approach you're working with now, and which approach you may want to work toward.

	Fortuitous approach	Presentational approach	Facilitation approach	Development approach
<b>Type of program</b>	The librarian takes advantage of a situation or opportunity that comes along. Programs may take a variety of forms.	The librarian focuses on STEM presentations: usually an external presenter talks to the audience and allows Q&A time at the end.	The librarian leads or coordinates hands-on activities that have already been developed, or the librarian collaborates with a community partner to facilitate or lead STEM activities.	The librarian focuses on a STEM-based community issue and develops activities from the ground up or from model activities they have seen or researched.
<b>Effort and forethought required to prepare and deliver program</b>	Programs develop as opportunities arise. The focus is on the opportunity and not necessarily on a community need or want. Requires no preplanning, minimal effort, and no training for the librarian.	Some research may be needed to find local presenters who are willing to come and give a talk. The program delivery usually requires minimal effort, including room preparation, an introduction of the speaker, and shutdown of the room when presentation is over.	Moderate effort is required to find activities, stakeholders, and community members, as well as to plan and coordinate the program. The librarian may act as a cofacilitator with an expert, or may present activities alone after researching the science and practicing the activity.	Significant effort is required. After much research and understanding of a community need, the librarian outlines the program, defines the resources required, and gains stakeholder buy-in. Then the librarian builds a program or set of activities and develops ways to present the science.
<b>Sustainability of program; long-term effort required</b>	Once the program is over, no further action is taken. The librarian may be quick to take advantage of the next opportunity that comes along.	Once the presentation is over, no further action is usually taken except to file the presenter's name and contact information for a possible similar presentation in the future.	The program is one element of an effort to meet a broader community need, part of a broader STEM effort for the library, and/or one of multiple activities that support a greater purpose. (This is true of the Development approach as well.)	The program can be adjusted and given multiple times, possibly to different age groups. Regular programs can lead to regular attendance by patrons and become something they look forward to, fostering community interest. The program is one element of an effort to meet a broader community need, part of a broader STEM focus for the library, and/or one of multiple activities that support a greater purpose. There is a desire or need to develop new and relevant activities, either from the ground up or from facilitated activities the librarian has seen or researched.
<b>Examples</b>	<i>A STEM provider comes to you stating they are willing to give programs free of charge.</i>	<i>Your library is interested in focusing on a STEM theme, so you invite a scientist from a local university who is an engaging, reputable speaker.</i>	<i>Your library borrows a science kit from the state library or science provider, like 4-H/Cooperative Extension, and the partner leads or cofacilitates the activity.</i>	<i>Your library creates a loanable backpack of family health resources, brings in health providers, and uses the backpack activities during storytime.</i>

## Passive and active STEM programs

Libraries do not always have to provide active, structured STEM programs. Unstructured exploration is equally important as it sparks curiosity, the foundation of lifelong learning, without significant staff time commitments.

Passive STEM programs can be offered in a designated area of the library, where they can be completed by kids, families, or adults, on their own time, whenever they happen to visit the library. They can be enjoyed by groups or families, and they also work well to engage individuals with the library and its materials. By setting up a small space, providing a few materials, and checking in daily to see how the resources are being used, you can increase and sustain public access to engaging and relevant STEM experiences. Passive programs can and should occur in any part of the library: floors, walls, ceiling, and outside. Surprising patrons with changing library spaces also encourages people to return more frequently.

Active STEM programs do require more preparation and management by library staff; however, they can provide the public with deeper experiences. Many librarians are more confident providing STEM activities to children, but it is important that adults don't miss out on the learning. The impact of STEM programs on adults can be just as great as the impact on children, particularly when the programs involve relevant community issues. In these instances, library staff plays a critical role in reaching out to STEM providers to facilitate connections between STEM experts and adults in the community.

The following table shows some examples of passive and active STEM activities that libraries can use to engage patrons throughout the year.

Examples of program types	
Passive STEM programs	Active STEM programs
STEM signage or bookmarks Online STEM resources, links to online citizen science opportunities, such as <a href="#">SciStarter</a> STEM bulletin boards or kiosks Gardens, bird feeders, sundials, miniature solar systems Self-guided STEM activities, such as shadow reflections or color mixing	Librarian-facilitated STEM programs, such as storytimes with science activities Presentations by informal or formal STEM providers
STEM book displays	Community reads or book clubs with STEM providers leading discussions of chapters or presenting an overview of the book's topic STEM author readings and appearances
Loanable science tools, such as telescopes	Family science day or stargazing party with a local astronomy club

## Additional resources

### Libraries as STEM learning venues

Over the past decade, public libraries have been recognized as important community anchors and venues for bringing STEM experiences and resources to the public. Here are a few studies, collections, and convenings that highlight the role libraries play in informal STEM learning.

[\*How to STEM: Science, Technology, Engineering, and Math Education in Libraries\*](#), edited by Vera Gubnitskaia and Carol Smallwood (2014). Scarecrow Press: Lanham, MD.

[\*\*IMLS Focus Conference: STEM Learning in Libraries\*\*](#). A convening of the Institute of Museum and Library Services, Chicago, Illinois, June 5, 2014.

[\*“Initiating STEM Learning in Libraries,”\*](#) by Jennifer Hopwood (2012). *Children and Libraries*, 10:2, 53–55.

[\*Library Services in the Digital Age\*](#), from the Pew Research Center, 2013.

[\*Public Libraries at Places for STEM Learning: An Exploratory Interview Study with Eight Librarians\*](#) (pp. 10–14), by John Y. Baek for the Space Science Institute, 2013.

[\*Pushing the Limits: Making Sense of Science Summative Evaluation\*](#), by the Goodman Research Group for the National Science Foundation, 2014.

[\*STEM in Public Libraries: National Survey Results\*](#) (pp. 1–21), by Jim S. Hakala, et al, for the National Science Foundation, 2016.

[\*“The STEM Education Movement in Public Libraries,”\*](#) by PB Dusenbery, P.B. (2014). *Informal Learning Review*, 124:14–19.

### Examples of STEM in libraries

There many great STEM activities taking place in libraries—you are not alone! These links showcase a variety of STEM projects currently under way in public libraries, and show you a number of youth, adult, and family programs, connect you with scientists, and generate a host of ideas.

[\*“STEM in Libraries: Resources for Library Leadership,”\*](#) from STAR Net. Science and Technology Activities & Resources for Libraries (STAR Net) offers a range of resources on STEM programs, partnership opportunities, evaluation, and more.

[\*“STEM Learning in Libraries,”\*](#) from Informal Science. This resource includes links to many STEM learning resources and a detailed repository of STEM projects in libraries.

[\*The Connector\*](#) “makes the connections that inspire young people to explore, discover, and create.” Check out their information on youth STEM opportunities.

The [Acton \[Massachusetts\] Memorial Library](#) offers math and science kits that patrons can check out.

## **STEM exhibits, materials, and toolkits you can use in your library**

**Cornerstones of Science** provides libraries with telescopes and science trunks: <http://www.cornerstonesof-science.org>.

The **NASA Space Place** offers a variety of activities related to space science and technology: <https://spaceplace.nasa.gov/menu/do/>.

You can **book a traveling exhibition from the U.S. National Library of Medicine**: <https://www.nlm.nih.gov/hmd/about/exhibition/booktraveling.html>.

The **Smithsonian Institution Traveling Exhibition Service** also offers some STEM-related traveling exhibits: <https://www.sites.si.edu/s/>.

**Science and Technology Activities & Resources for Libraries (STAR Net)** offers earth and space science exhibits, materials, events, and more: <https://www.starnetlibraries.org>.