

# Building Upon the STEM Movement

## Programming Recommendations for Library Professionals

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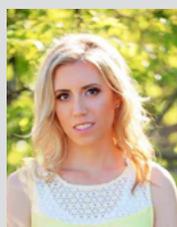
A growing body of evidence is showing that youth develop their interests in science, technology, engineering, and mathematics (STEM) through participation in activities across the informal and free-choice learning environments found in libraries.<sup>1</sup> Many libraries have joined a national movement in which libraries deliver STEM programming to youth.<sup>2</sup> Public libraries are a place for STEM learning,<sup>3</sup> and children's librarians are uniquely positioned to promote a love of STEM learning among youth through such programs. The benefits of STEM programming in public libraries are promising.<sup>4</sup> For

example, participating youth can become proficient in key STEM content and skills, such as critical thinking and engineering design processes.

It is critical to youth and community success that these existing STEM programs continue to grow and expand. Public libraries are an ideal location for these programs. They provide a familiar and trusted learning environment for diverse and underserved families.<sup>5</sup> Providing children's librarians with a "six strand" framework will help guide the successful expansion of these fun and engaging STEM programs.<sup>6</sup> This article provides specific recommendations and resources to help prepare and support librarians feel in adopting and implementing STEM in their programming.

### STEM as Part of Lifelong Learning and Community Engagement

Humans are natural scientists at birth, discovering and exploring their world and trying to make sense of it.<sup>7</sup> Yet research demonstrates that by the time youth reach fourth grade, a



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third of all students have lost interest in science; and by eighth grade nearly half of students have deemed science and technology as irrelevant to their future career plans.<sup>8</sup> Students from under-resourced communities face considerable barriers in developing STEM skills,<sup>9</sup> such as limited school resources and inadequately prepared teachers. Therefore STEM education needs to be promoted in public libraries.

In fact, public libraries are becoming a natural and promising place for all youth to actively engage in free-choice STEM learning.<sup>10</sup> John Baek observed that libraries can become “on-ramps” to STEM learning by creating environments that welcome newcomers to the community.<sup>11</sup> Increasingly, libraries’ missions, initiatives, and services reflect their role in improving scientific literacy and supporting STEM learning and education standards,<sup>12</sup> especially for those underrepresented in STEM fields.<sup>13</sup> Providing high-quality STEM community-learning programs with high participation can also increase community support and funding for the library itself. For instance, nearly all parents (96 percent) expect libraries to be important to their children’s learning, with major reasons being the availability of information, resources, and digital media not otherwise accessible at home, programs and classes available, and cultivating a love of learning in a safe environment.<sup>14</sup> Now is a great time for children’s librarians to create, implement, and improve informal STEM education programs, as there are significant funding resources available to support librarians in this pursuit (for example, the National Science Foundation, the Institute of Museum and Library Services, and private foundations).

## The STEM Learning Movement in Libraries

Results from a national survey conducted by the STAR Library Education Network (STAR\_Net) found that STEM programming is offered at least somewhat frequently in public libraries.<sup>15</sup> Of the 455 responding librarians, 29 percent offer STEM programming “frequently” (more than once per month) and 26 percent offer it monthly. When librarians in this study were asked what age groups they would like to reach with STEM programming, the following trends were observed: elementary students (396, 89 percent), middle school students (380, 85 percent), pre-kindergarten (328, 73 percent), and high school students (317, 71 percent).

Increasing numbers of librarians report that they want to see their patrons not just *consume* STEM information, but actively *create* projects via facilitated activities. The development of exciting and engaging STEM programs in public libraries aligns with the broader field of out-of-school-time STEM learning, which is not restricted to purely academic goals or subjective learning outcomes. The National Research Council developed a “six strand” framework to guide these informal STEM programs and describe what learners might experience:

**Strand 1: Interest in Science.** Experience excitement, interest, and motivation to learn about phenomena in the natural and physical world.

**Strand 2: Science Knowledge.** Generate, understand, remember, and use concepts, explanations, arguments, models, and facts related to science.

**Strand 3: Scientific Reasoning.** Manipulate, test, explore, predict, question, observe, and make sense of the natural and physical world.

**Strand 4: Reflection on Science.** Reflect on science as a way of knowing; on processes, concepts, and institutions of science; and on their own process of learning about phenomena.

**Strand 5: Scientific Practice.** Participate in scientific activities and learning practices with others, including using scientific language and tools.

**Strand 6: Identification with Science.** Think about themselves as science learners, and develop an identity as someone who knows about, uses, and sometimes contributes to science.<sup>16</sup>

Librarians can use this “strand” approach to cultivate STEM interest and skills in youth rather than simply being limited to more narrow academic standards or outcomes. Implementing these strands can help youth engage and practice their new-found skills with other youth. They also encourage librarians to mentor youth and build their STEM identities. This type of STEM-focused mentoring can help youth picture themselves as the purveyors of science knowledge and in real careers in STEM fields. Librarians getting started with the strand approach can be further supported by the following recommendations, which are intended to complement the strand model.

## Recommendations

1. **Get to Know Children and Mentor.** Develop and maintain strong, supportive relationships with children. Library professionals can act as mentors and be inspirational to children considering pursuing STEM education and careers. To learn more, use the Techbridge Role Models Matter Online Training Toolkit at <http://www.techbridgegirls.org/rolemodelsmatter/>.
2. **Encourage Diverse Participation.** Emphasize and facilitate participation by children from groups historically underrepresented in STEM. This includes girls, minorities, those with disabilities, and economically disadvantaged individuals. Libraries already provide a familiar and trusted environment for underserved audiences, so libraries are an ideal environment to help such children connect with STEM.
3. **Expand Access.** Go the extra mile whenever possible to ensure that programs offered are truly accessible to all children.<sup>17</sup> Are they welcoming? Are program promotional materials provided in the languages commonly spoken in the community? Can you work with others in the community to provide transportation to and from the library? Many library professionals note the value of meeting children

where the children are—it is worth the time and effort to go beyond library walls!

4. **Find Support and Get Inspired.** Seek out professional development and support around creating, implementing, and improving STEM education programs. Join STAR\_Net at <http://www.starnetlibraries.org/> to participate in free webinars, access hands-on activities, and interact with other library professionals who offer—or are interested in offering—STEM learning experiences to their patrons.<sup>18</sup>
5. **Collaborate.** Seek out and collaborate with STEM stakeholders in the community engaged in informal children's learning.<sup>19</sup> This can include community-based organizations such as the Girl Scouts or Boy Scouts, STEM professionals, leaders in the community, and other libraries with STEM programs.
6. **Network.** Reach out to organizations that serve children to establish mutually beneficial partnerships.<sup>20</sup> The extra support and resources are shown to increase the effectiveness of STEM programs.
7. **Get Help with Program Evaluation.** Evaluate and track STEM program outcomes, including how your program influences the educational outcomes of the children served. Program evaluators can help support this recommendation. Visit the evaluation section of STAR\_Net (<http://www.starnetlibraries.org/stem-in-libraries/evaluation/>) for information about how to get started and access resources from the Center for Advancement of Informal Science Education (<http://www.informalscience.org/center-advancement-informal-science-education-caise>).
8. **Share Your Program's Impact.** Share program evaluation results with child-focused community stakeholders to show how STEM programs positively affect your community. Also provide these results to other library professionals to help inspire their own STEM efforts. Your successes matter.

Children's librarians can support the movement by helping youth actively engage in STEM learning and programming. This engagement can help youth connect with STEM topics, develop STEM aspirations and interests, and consider STEM careers in the future. The "six strand" framework along with the eight recommendations described in this article provide children's librarians with useful information and resources to start or expand their STEM programs.

While more research is needed to understand the long-term effects of implementing STEM in children's libraries, this type of informal education institution provides a place that can capture the hearts and minds of today's youth in STEM learning. ☺

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