STAR*net* Science-Technology Activities & Resources For Libraries

STEM in Public Libraries

National Survey Results

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Spring 2016

This material is based upon work supported by the National Science Foundation under Grant No. DRL-10-10844. Any opinions, findings and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation (NSF).

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Section 1. Introduction

"A library outranks any other one thing a community can do to benefit its people."
~Andrew Carnegie

From climate change to threats to human health and access to clean water, the majority of challenges facing society today – and their solutions – are rooted in STEM (c.f. NAS, 2006; Climate Literacy, 2009; NSB, 2010; NAE, 2008). Successfully addressing these challenges requires highly competent STEM professionals; students who are engaged with and proficient in STEM content and processes; and a public that is sufficiently STEM literate to assess the choices before them. In the 21st century, a basic understanding of STEM is part of being an informed citizen. There is considerable research about the role that Out-of-School-Time (OST) experiences can play in student achievement (e.g., NRC, 2009; Afterschool Alliance, 2011; NRC, 2014).

As places that offer their services for free, libraries have become the "public square" by providing a place where members of a community can gather for information, education programming, and policy discussions (ALA, 2012; Crawford et al., 2012; Miller et al., 2013; Garmer, 2014). *Twenty-first century skills* include critical thinking, innovation, and creativity, and libraries serve as community leaders and focal points for 21st century learning (*Leadership Brief: Libraries Igniting Learning* 2014). Increasingly, libraries' missions, initiatives, and services reflect their role in improving scientific literacy and supporting STEM learning and education standards (IMLS 2009; Braun 2011; Anderton 2012; Bartolone et al. 2014; Vardell and Wong 2015) – especially for those underrepresented in STEM fields (Williams 2013; IMLS 2014).

1.1 Re-Envisioning Public Libraries

Libraries and bookmobiles serve 96% of the population (Brown et al., 2015), and their services are especially valued by individuals from lower-income households, Hispanics, and African Americans (Horrigan, 2015). In 2012, there were 1.5 billion visits to the nearly 17,000 public libraries in the U.S. (IMLS, 2016). The majority of Americans regard public libraries as important to their communities (91% of Americans ages 16 and older) and to themselves and their families (76%) (Zickuhr et al., 2013). Libraries are regarded as particularly important for African Americans, Hispanics, and individuals from lower-income households (Horrigan, 2015), and 78% of libraries prioritize reaching Spanish speakers with their programs and services (Koontz et al, 2008). (Baek, 2013) observed that "by creating an environment that welcomes newcomers to the community, libraries can become an on-ramp to STEM learning."

Libraries are no longer merely storehouses for books – a movement captured in the increase in public opinion that libraries should sacrifice space for print books and stacks to

community and tech spaces (30% of Americans ages 16+ "definitely" support this idea, up from 20% in 2012) (Horrigan, 2015). Librarians are interested in patrons in creating, rather than merely consuming, content through hands-on projects through makerspaces (Zickuhr et al, 2013). What started in libraries some years ago as independent experiments in STEM programming have become a national STEM movement (Dusenbery, 2014a). More and more libraries are responding to the need to increase science literacy and support 21st century skills, such as creativity and critical thinking, by adding to STEM programs for patrons of all ages, from pre-school to adults (c.f. Char, 2002, Kliman, 2013, LaConte et al., 2014). From Portland, Oregon, to Portland, Maine, libraries are hosting Science Saturdays, Robot Races, Maker Spaces (c.f. Good, 2012), and STEM exhibitions (Dusenbery, 2014a).

1.2 The STAR Library Education Network

The Space Science Institute's National Center for Interactive Learning (NCIL) provides interactive STEM exhibits, programming, and training to public libraries nationwide through its ***S****cience-****T****echnology* ***A****ctivities and* ***R****esources Library Education Network* (***STAR****_Net*) (Dusenbery, 2014b). In partnership with American Library Association, Lunar and Planetary Institute, and the Afterschool Alliance, NCIL received funding from NSF in 2014 to build upon previous work and provide:

- Large hands-on library exhibits, which are on national tours: *Discover Space*, *Discover Earth*, and *Discover Tech*
- A small exhibits program (*Explore Earth*, *Explore Tech*, and *Explore Space*), which includes six double-sided graphic panels, a computer kiosk, and activities for a Discover Station
- Resources to implement hands-on activities for different age groups in the library setting
- Online and in-person training for library staff, which introduces them to the STEM content of the exhibits, and guides them in developing complementary programming
- A comprehensive outreach program (led by the *Afterschool Alliance*)
- A growing community of practice (CoP) that includes a resource clearinghouse, blogs, a monthly newsletter, special events, and funding opportunities (www.starnetlibraries.org)

The project's evaluation and research are conducted by Education Development Center, University of Colorado, and Datum. The project explores how public libraries and library staff can develop the capacity to offer standards-based STEM programs through collaborations with outreach providers and STEM. The *STAR_Net* team is investigating whether or not libraries are well suited to deliver STEM experiences to patrons from undeserved and underrepresented populations. This national survey report was funded by STAR_Net 2.0 as part of its front-end evaluation conducted by Jim Hakala and his team at

the University of Colorado. The findings of the survey were presented at the recent *2015 Public Libraries and STEM Conference* in Denver, Colorado.

Over 1.2 million patrons have visited *STAR_Net's* Discover exhibits, over 85,000 have participated in hundreds of programs conducted by host libraries, and over 1,600 librarians and STEM professionals are part of the *STAR_Net Online Community*. Other funders and sponsors of *STAR_Net* programs, including the *Public Libraries & STEM Conference*, are the National Institutes of Health, FIRST and the LEGO Foundation, Institute of Museum and Library Services, NASA, and Keva Education. See www.STARnetlibraries.org for more information.

Section 2. Purpose, Methodology, Surveys and Administration

2.1 Purpose

The purpose of this national survey was to connect with librarians to determine:

1. What STEM programming is currently in place? How do libraries approach and implement these programs?
2. What obstacles prevent libraries from incorporating more STEM programming?
3. What kind of training and resources would be most helpful to librarians?

Additionally, we sought the following information from STEM professionals, for the purpose of establishing and maintaining a Community of Practice:

4. What factors influence and enhance the success of Communities of Practice?

2.2 Methodology

Jim Hakala (Senior Educator, University of Colorado Museum) and Keelin MacCarthy (Graduate Student, University of Colorado Museum and Field Studies Program) conducted the *STEM in Libraries National Survey*. With guidance and input of the STAR_Net 2.0 project team and consultant Marcella Wells, the evaluators developed:

- One self-administered survey and one telephone interview instrument for Library professionals
- One self-administered survey for STEM professionals.

The evaluators employed a mixed-method approach of quantitative and qualitative questions and utilized the University of Colorado's on-line survey system (Qualtrics) to administer them. The survey instruments were finalized and distributed in late February and closed April 1, 2014, giving respondents approximately 5 weeks to access and complete

them. The telephone interviews were conducted during this same period, with respondents who provided their contact information on the surveys.

2.3 Surveys and Administration

The surveys were posted on-line with an email invitation describing the STAR_Net project and providing a link to the survey. The surveys were sent to listservs in the library professional community and to listservs for STEM professionals. For the library survey, the survey link was distributed via the STAR_Net Community of Practice, the Afterschool Alliance, the American Library Association, the Association for Rural and Small Libraries, the Colorado State Library system, the Public Library Association, the Young Adult Services Library Association, Explore! (through the Lunar and Planetary Institute), and the Chief Officers of State Library Agencies.

The STEM professionals survey was distributed via the *National Center for Interactive Learning* newsletter, the Association of Academic Museums and Galleries, Museum-L, Museum-Ed, Museum Junction (of the American Alliance of Museums), the Colorado Science Educators Network, the Lunar and Planetary Institute, the Universities Space Research Association, the Association of Universities for Research in Astronomy, the Association of Science and Technology Centers and the Learning Lab community, the Mountain Plains Museum Association, and the Afterschool Alliance. It was also featured in the Center for the Advancement of Informal Science Education (CAISE) newsletter, distributed to their listserv, and featured on their website.

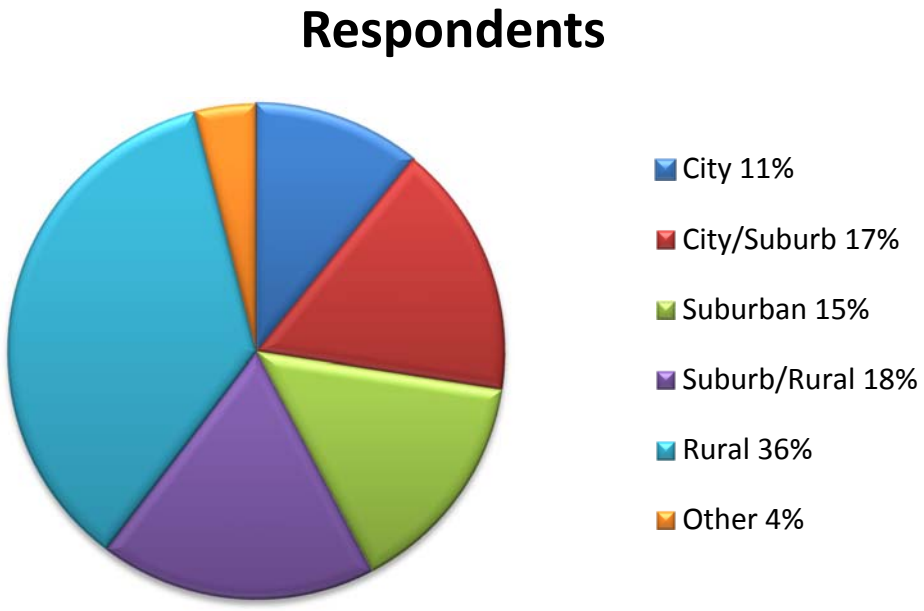
A total of 455 respondents (66% of those who started the survey) completed the Library Professionals survey. A total of 72 respondents (57% of those who started the survey) completed the STEM Professionals survey.

In addition to the online self-administered surveys, 23 librarians were contacted by phone for an interview. These open-ended interviews provided in-depth responses regarding exactly what kinds of STEM-related resources libraries need.

Section 3. Library Professional Survey Results

3.1 Communities Represented

When asked to define the type of community where their library is located, 178 (36%) respondents identified their community as rural, followed by 90 (18%) suburban/rural and 83 (17%) city/suburb. The following pie chart represents the total respondents' (499) self-identified communities.



Of 23 phone interviews, 14 (~60%) were with librarians living in rural communities.

Population of the libraries' service areas were mixed. The largest percentage of Library Professionals (n=109, 22%) indicated their library served between 10,000 and 24,999 patrons followed by those who served between 25,000 to 74,999 (104, 21%), those who served between 1 to 4,999 patrons (87, 17%), and those who served between 5,000 to 9,999 patrons (82, 16%).

3.2 Current STEM Programming and Target Audiences

STEM programming is offered fairly frequently in our responding libraries, with 138 (30%) saying they offer STEM programming at least "Occasionally" (2 or more times a year), 135 (29%) saying they offer them "Frequently" (more than once per month), and 122 (26%) indicating they offer STEM programming "Monthly." "We tried it once" and "Summer only" responses were low at 30 (7%) and 36 (8%) respectively.

Table 1. If you offer STEM-rich learning experiences, which of the following best describes them? Check all that apply.

#	Answer		Response	%
1	Hands-on investigations		324	65%
2	Art-based STEM projects		254	51%
3	Demonstrations		187	37%
4	STEM-related reading programs		137	27%
5	Interactive exhibits		84	17%
6	Maker spaces		168	34%
7	Field trips		19	4%
8	Lectures		72	14%
9	Documentary showings		28	6%
10	Discussions		43	9%
11	Career-focused STEM learning programs		28	6%
12	Other:		39	8%
13	We do not offer STEM-rich learning experiences.		69	14%
14	STEM-related storytimes		246	49%
15	Observation/Looking experiences		142	28%

As shown in the chart above, respondents offer Hands-on investigations, Art-based STEM projects, STEM-related storytimes most, followed by Demonstrations, Maker spaces, and Observation/Looking experiences. Sixty-Nine respondents (14%) indicated “We do not offer STEM-rich learning experiences.” When asked what types of programs would be most successful for their patrons, “Hands-on investigations” scored highest at 413 (95%) followed by “Art-based STEM projects” (342, 78%), “Interactive exhibits” (302, 69%) and “Maker spaces” (295, 68%).

As shown below, Science, Engineering, and Technology most interest library respondents with Math rated lower at only 46% (n=227).

Table 2. Which STEM areas would most interest your library? Please check all that apply.

#	Answer		Response	%
1	Science		410	83%
2	Technology		396	80%
3	Engineering		403	82%
4	Math		227	46%
5	None		8	2%

As shown below, Elementary students are currently targeted most for STEM programs in libraries followed by Middle School students and Pre-K children. Seniors, Young Adults, and Adults were the least targeted general age levels. When asked what age groups they would like to reach with STEM programming, 396 (89%) said "Elementary students," 380 (85%) said "Middle school students," followed by "Pre-K" (328, 73%) and "High School students" (317, 71%).

Table 3. What general age levels do you target with STEM programming? Please check all that apply.

#	Answer		Response	%
1	Pre-K		271	57%
2	Elementary students		414	87%
3	Middle school students		305	64%
4	High school students		179	38%
5	Young adults		100	21%
6	Adults		108	23%
7	Seniors		49	10%
8	Mixed ages (Families)		171	36%
9	Other:		15	3%

This information was reflected again in the phone responses with the added concern that librarians have significant difficulty connecting with and developing programming for teen and adult audiences. As one librarian said, "*We struggle with public perception of libraries as places for reading, not necessarily places for science learning*." Interview participants repeatedly stressed that libraries often have little or no funding for marketing, meaning that

programs have to sell themselves. One librarian said, "*It's about exposure, access, skills! It has to be something new, exciting, and different!*"

As seen in the next two Tables (4 and 5), Library staff are tasked overwhelmingly with developing and conducting STEM programs for libraries, with Outside partners and Volunteers conducting the programs more than developing the programs.

Table 4. Who develops STEM programming at your library? Please check all that apply.

#	Answer		Response	%
1	Library staff		448	96%
2	Outside partner(s)		196	42%
3	Volunteer(s)		67	14%
4	Other:		19	4%

Table 5. Who conducts STEM programs at your library? Please check all that apply.

#	Answer		Response	%
1	Library staff		437	93%
2	Outside partner(s)		243	52%
3	Volunteer(s)		101	22%
4	Other:		18	4%

For STEM program development and implementation, Libraries partner/collaborate with "Science centers/Museums" most frequently (181, 60%), followed by "Other" (111, 37%). The "Other" responses included 4H, local science teachers, community organizations, avocational science community members, etc. (See Appendix G for the complete listing). "Universities/colleges" (96, 32%) and "Zoos/Aquariums" (85, 28%) were also identified as active partners/collaborators.

Funding for STEM library programming comes overwhelmingly from the "Library budget" (325, 78%) or from the "Friends of the library/Foundation funding" (209, 50%). "Community partners" were cited as funding STEM programming at 25% (104), and "Regional or national grants" were identified at 16% (65) (see Appendix G for a listing of regional and national grants identified.)

Table 6. Are you interested in offering (more) STEM programming opportunities to library patrons?

#	Answer		Response	%
1	Yes		423	97%
2	No		15	3%

As seen above in Table 6, Libraries are very interested in offering more STEM programming opportunities to their library patrons, but significant factors prevent them from beginning or increasing STEM programming. "Lack of staff time" (311, 70%), "Lack of funds" (286, 64%), and "Lack of equipment/supplies" (283, 64%) were cited most frequently. "Lack of adequate space" (191, 43%), "Library staff not prepared to lead STEM-based activities, demos, or discussions" (187, 42%), and "Library staff not knowledgeable about STEM topics" (170, 38%) were also identified as factors preventing more STEM programming. Only 3% (15) indicated they felt "There are no barriers."

And finally, when asked to rank a list of items that would be most helpful to them to increase the amount of STEM programming opportunities in their community (see Appendix G for a complete listing of the responses to be ranked) the library professionals ranked "How to procedures for conducting hands-on STEM activities, crafts, and demonstrations" first (mean 3.06), followed by "Sample program ideas," (mean 3.84) and "Sources for ready-made programing materials and kits" (mean 4.77).

The greatest request in the phone interviews were for programming, particularly pre-packaged programming. There is no time, space, nor staff to host exhibits, and programming is very difficult to create for librarians, many of whom have very limited time, resources, and STEM knowledge. One respondent commented, *"I would have loved to apply for the STEM interactive exhibits but tying up my programming rooms for three months was unacceptable. We do a large amount of programming in those rooms."* Another said, *"Some of our staff are trained, but we need more training!"*

3.3 Communities of Practice and Professional Development

The last part of the online survey for library professionals asked questions about communities of practice (CoP) and professional development. As seen in Table 7, the majority of respondents indicated they did not belong to a CoP, with about a quarter (26%) indicating they did belong to one. Eighty respondents were not sure. Most of those in CoPs (72, 49%) indicated they participated both online and face-to-face, while 30% (44) said their CoP was face-to-face, and 22% (32) said it was online.

Table 7. Do you participate in a "Community of Practice?"

#	Answer		Response	%
1	Yes		116	26%
2	No		258	57%
3	Not sure		80	18%

When asked what they felt made a successful CoP, most indicated common goals, followed by having a like-minded group to discuss issues with, and having a like-minded group to plan programs with. Strong community of practice leadership was also ranked fairly high (see Table 8).

Table 8. What factors do you feel make a successful community of practice? Please check all that apply.

#	Answer		Response	%
1	Common goals		178	65%
2	Common approaches		47	17%
3	Having a like-minded group to discuss issues with		122	45%
4	Having a like-minded group to plan programs with		116	42%
5	Strong community of practice leadership		95	35%
6	Other:		22	8%

Primary communication sources for finding out about STEM programming opportunities and resources were online via email, listservs, and web searches, while face-to-face contact, such as meetings or conferences, were cited far less common, and print sources, such as newspapers or journals, were listed only twice.

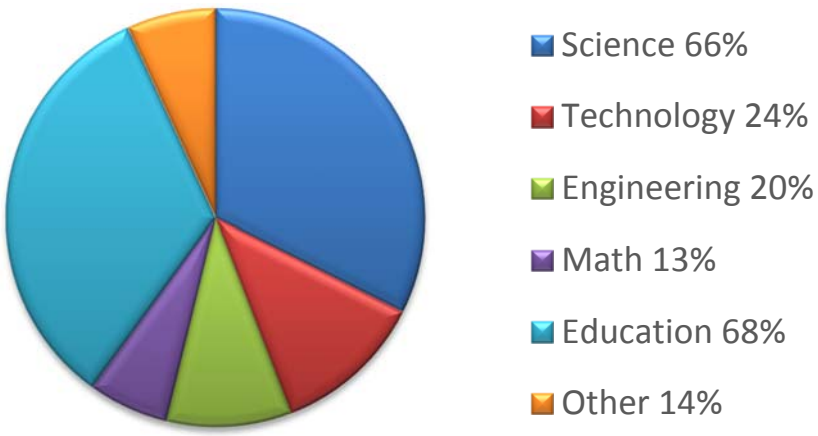
As shown in Table 9, face-to-face training in their library was ranked as the most valued type of professional training, with on-line webinars ranked a close second. State library association meetings and a community of practice were ranked third and fourth, respectively, with a national conference that brings together library and STEM professionals fifth.

Table 9. Which types of professional training/continuing education would you value the most? Please check all that apply.

#	Answer		Response	%
1	State library association meetings		212	47%
2	A national conference that brings together library and STEM professionals		128	28%
3	Face-to-face training in your library		321	71%
4	A Community of Practice		198	44%
5	On-line webinars		283	63%
6	Other:		19	4%

Section 4. STEM Professionals Survey Results

4.1 Professions Represented



For the STEM professionals survey, a majority of the respondents worked in science and education, as shown in the pie chart.

4.2 STEM Programming and Target Audiences

Most respondents describe their STEM facilities as a "Museum" or "Science center" (29, 41%), and are offering the STEM-rich learning experiences as seen in Table 10 below.

Table 10. If you offer STEM-rich learning experiences, which of the following best describes them? Please check all that apply.

#	Answer		Response	%
1	Hands-on investigations		55	76%
2	Art-based STEM projects		35	49%
3	Demonstrations		37	51%
4	STEM-related reading programs		13	18%
5	Interactive exhibits		38	53%
6	Maker spaces		17	24%
7	Field trips		31	43%
8	Lectures		37	51%
9	Documentary showings		15	21%
10	Discussions		17	24%
11	Career-focused STEM learning programs		28	39%
12	Other:		11	15%
13	We do not offer STEM-rich learning experiences		3	4%

STEM programming is offered "Frequently (more than once per month)" (48, 70%) and the target ages for programming was considerably older than in libraries: While it still included "Elementary students" (45, 64%) and "Middle school students" (50, 71%), "High school students" (44, 63%), "Young adults" (38, 54%), and "Adults" (32, 46%) figured largely. Staff at these STEM facilities are responsible for developing and delivering their programs (66, 93% and 64, 90%, respectively).

Currently, STEM professionals collaborate primarily with "Universities/colleges" (46, 73%) and Science centers/museums (39, 62%), with more than ¾ funding programs from "Internal budgets" (52, 76%). "Community partners" (24, 35%) and "Regional or national grant" (24, 35%) were also cited as significant in relation to funding.

4.3 Communities of Practice

The bulk of the online survey for STEM professionals focused on questions regarding communities of practice (CoP) and professional development. The majority of respondents (39, 57%) indicated they did belong to a community of practice, with 28% (19) indicating they did not belong to a CoP, and 15% (10) were not sure. Most of those in community of practices (22, 51%) indicated they participated both online and face-to-face, while 30% (13) said their CoP was face-to-face, and 19% (8) said it was online.

Table 11. Do you feel your community of practice helps you to do your STEM job better?

#	Answer		Response	%
1	Yes		37	77%
2	No		1	2%
3	Not sure		10	21%

Overwhelmingly, STEM professionals felt that a community of practice helped them to do their job better (see Table 11) and when asked what factors made a successful CoP (see Table 12), respondents ranked common goals and having a like-minded group to discuss issues with as most important, followed by strong community of practice leadership and having a like-minded group to plan programs with. See the chart below for complete listing.

Table 12. What factors do you feel make a successful community of practice?

#	Answer		Response	%
1	Common goals		44	88%
2	Common approaches		10	20%
3	Having a like-minded group to discuss issues with		39	78%
4	Having a like-minded group to plan programs with		21	42%
5	Strong CoP leadership		25	50%
6	Other:		15	30%

“Lack of time” (45, 83%) was ranked the greatest or most common barrier to CoP success by a wide margin. “Lack of funds” (23, 43%), “Lack of community participation” (17, 31%), and “Little interest from colleagues to establish a community of practice” (15, 28%) were also cited as barriers. Primary communication sources for finding out about their community of practice were online via email and listservs, and also word of mouth.

STEM professionals were also asked "*Beyond increasing staff and funding, what would be most helpful to you in creating or sustaining a community of practice*?" Responses were various versions of *being able to connect and communicate with colleagues.* For example:

- *"Regular communication with like-minded colleagues"*
- *"Suggestions for a better way to encourage members to participate and share ideas"*
- *"Knowledge of existing CoPs to join"*
- *"Being able to communicate with the community to have them understand that almost everyone, business, colleges, city resources and state resources, such as utilities and environmentally friendly new products are all working together to promote the use, continuance, training and career opportunities for kids. Also just understanding they can all create experiences for young students communicating their purpose and STEM resources."*

Section 5. Findings and Recommendations

The online surveys of library professionals and STEM professionals, along with the telephone interviews, provide a wealth of information to consider as the STAR_Net team prepares the broad implementation of Phase 2. The following questions were answered via this evaluation, providing recommendations for future efforts:

1. What STEM programming is currently in place in libraries?
STEM programming is offered fairly frequently in libraries and is often integrated into existing literacy and arts programming such as hands-on investigations, art-based STEM projects (STEAM), and STEM-related story-times. Libraries generally target children in Pre-K through middle school for STEM programming and the most popular STEM interest areas for their libraries are science, technology, and engineering.

2. How do libraries approach and implement STEM programs?
Library staff are tasked overwhelmingly with developing and conducting STEM programs in-house at their libraries with funding for these programs coming most often from the library's own budget. Libraries, especially those in rural communities, often share resources with other libraries and integrate STEM into existing programming. When library staff seek to work with other entities for STEM program development and implementation, libraries most frequently partner/collaborate with universities or colleges and science centers or museums. Librarians also expressed a special interest in working to empower girls with STEM.

3. What obstacles prevent libraries from incorporating more STEM programming?
An impressive 97% of libraries are interested in offering more STEM programming to patrons, but are unable to accomplish this due to: limited time, staff, and resources; a lack of support for new technology; and a lack of confidence in teaching STEM material. In interviews, it was apparent that funding constraints limit time librarians can spend

researching, creating, and implementing new programming, as well as limiting supplies and space to support and host these programs. Librarians also stressed the importance of "making STEM a comfort zone" for both librarians and patrons. Because staff may be uncomfortable with STEM topics, they might avoid them completely or facilitate them poorly.

4. What kind of training and resources would be most helpful to librarians?
When asked to rank a list of items that would be most helpful to increase the amount of STEM programming opportunities in their community, the library professionals highlighted the need for: how-to procedures for conducting hands-on STEM activities, crafts, and demonstrations; sample program ideas; and sources for ready-made programing materials and kits. Face-to-face training in their library was ranked as the most valued type of professional training, with on-line webinars ranked a close second. Communities of Practice were another valuable training source for librarians and were indicated as being most successful based on members having common goals and being in a like-minded group with which issues could be discussed and programs could be planned.

Recommendations:

- Develop and distribute pre-packaged programming and how-to instructions for library professionals that are available on-line and are able to be shared among libraries.

- Provide concrete examples of activities, techniques, and games that are shown to be effective at teaching STEM concepts, especially math.

- Integrate STEM themes into existing programs already popular with girls and seek partnerships with organizations such as Girl Scouts or Boys and Girls clubs.

- Provide training, both in-person and online, for library professionals oriented towards STEM knowledge and skills.

The findings of the front-end evaluation of STAR_Net 2.0 answered the following questions about the roles of communities of practice from the viewpoints of STEM professionals:

1. What factors influence and enhance the success of Communities of Practice?
Overwhelmingly, STEM professionals felt that a community of practice (CoP) helped them to do their jobs better and when asked what factors made a successful CoP, respondents ranked common goals and having a like-minded group to discuss issues with as most important, followed by strong community of practice leadership and having a like-minded group to plan programs with. The STEM professionals felt that the greatest barrier for becoming involved with a CoP was lack of time.
A particularly beneficial finding from the surveys and interviews about CoPs was that librarians and STEM professionals generally value similar factors of success,

participation, and communication in these groups. Both groups highlighted the need for communities that were online and face-to-face. Primary communication sources for finding out about their CoP or STEM programming opportunities and resources was online via email and listservs, as well as by word of mouth. When asked what factors made a successful CoP, both groups ranked common goals and having a like-minded group to discuss issues with as the most important attributes. Additionally, STEM professionals have seen success connecting to the demographic with which libraries struggle most, middle school and high school students. In turn, libraries assist underserved populations not frequently able to be reached by STEM organizations. Ultimately, sharing of resources could prove exceptionally beneficial for all parties.

Recommendations:

- Connect library professionals with STEM professionals and educators in communities of practice – newly created or already in existence – for support, skills building, knowledge training, and programming that is engaging and relevant for various audiences.

Section 6. Conclusion

The front-end evaluation of the STAR_Net Phase 2 Broad Implementation (STEM and Libraries National Survey) sought to determine the types of STEM programming currently offered in libraries and how libraries approach and implement these programs. The evaluation sought to understand the obstacles that prevent libraries from incorporating more STEM programming and the kind of training and resources that would be most helpful to librarians. It also sought to explore the factors that influence and enhance the success of communities of practice, with input from STEM professionals. The results from the library professionals survey and interviews, along with the STEM professionals survey provide excellent information regarding the issues, perceived barriers, and desires for STEM programming in libraries, as detailed above.

Libraries are ideal environments for STEM programming. They are institutions defined by their accessibility to knowledge, and as such they reach a wide and varied public audience. Patrons go to libraries to learn skills, find employment, and gain access to resources like research materials and technology that they might otherwise not have.
Providing library professionals with programs that have explicit instructions and "scripts" (or outlines) of how to explain concepts and answer questions – without having to research – and are complete with supplies needed to conduct the programs, and are ready to market to their patrons will most help library professionals. Additionally, library professionals require training that adequately provides the skills and the confidence to conduct STEM programming in their communities. Finally, the results of these surveys and interviews indicate a crucial need for a community of educators comprised of both librarians and STEM professionals. Ideally, this community will exist online, where an overwhelming majority of participants search for, and receive information. A forum structure would enable open

communication and more collaboration between library professionals and STEM professionals, serving as a support network, or community of practice.

The STAR_Net project has the potential to truly establish libraries as STEM learning centers in their communities. Results from this national survey provide guidance with which the project team can make the decisions that will greatly enhance its success.

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