Keene Public Library, Keene, NH

Little Makers: Library STEM and Maker Activities for Very Young Learners Abstract

The Challenge: Although libraries have answered the call to offer more STEM learning opportunities, librarians have few models for offering STEM activities for the very young toddler. Recent research indicates that young children are capable of engaging in science and STEM activities and that the most benefits are gained through participating in inquiry-based STEM play, which can help children to develop resilience and executive function skills.

The Solution: The Keene Public Library proposes a three year leadership project (October 1, 2018 – September 30, 2021) to develop, test, and evaluate the effectiveness of offering STEM, tinkering, and making activities for children ages 2 to 6 and their parents or care providers. The activities will foster the acquisition of science process skills, as well as provide training and resources that equip librarians and educators to offer high-quality science instruction and facilitation with young children and families.

The Outcomes: this project will demonstrate how a public library can offer STEM activities for very young children and develop training materials which will build capacity leading to more quality STEM library programming for children ages 2 – 6.. An early interest in STEM may lead more young people to enter STEM fields but it will also help all children do better in school. In tandem with other STEM library offering, making and tinkering programs for very young children, will position the library as a vital STEM community resource. As a result of this project, the Keene Public Library will have a model for developing and offering STEM experiences for very young children ages 2 – 6 and their families, which can be replicated throughout the country. We will develop a community of practice, produce a toolkit, write articles, and present at national conferences.

The Team: core members of the project team are Head of Engagement Outreach, and Youth Services, and Youth Librarian, Tracy Snow, who will serve as project manager. Joy Kubarek of PEER Associates will serve as project evaluator. Other partners include Keene State College, Cheshire Children's Museum, BLDG 61, Skokie Public Library, and the Brooklyn Public Library. An active advisory committee will provide advice and consultation on matters such as the format and content of STEM, maker and tinkering programs and the ongoing development of the community of practice.

The Budget: we are requesting $232,551 in funds to support 1) the development and evaluation of Little Makers Science Saturdays programming for children ages 2 to 6 which will be offered at the Keene Public Library and various other sites 2) the development of an toolkit providing program plans and tips on facilitating caregivers and very young children with making and tinkering, which will ultimately be made freely available online.

Sustainability and Dissemination: The replicability of our activities will be an essential element of project success and sustainability. By taking advantage of our resources and toolkit, which will be distributed widely on the internet and on various professional list serves and Facebook groups, librarians throughout the country in big and small libraries will be able to more effectively engage children and families with STEM learning opportunities. Hands-on activities and other resources developed during the project will be selected with an eye to accessibility, adaptability, ease of use and cost.

STATEMENT OF NEED

Libraries are the perfect place to introduce young children and families to Science, Technology, Engineering and Mathematics (STEM). Libraries are free, open to everyone, and programs are offered at times that children and families can attend. Statistics from the American Library Association (ALA) show that minority and economically disadvantaged families make up a high percentage of groups that visit libraries frequently. Libraries bridge the gap for children who do not have access to expensive STEM camps, museum passes, or programs at school. Out-of-school time is important learning time: only about 18.5% of child's day is spent in a formal learning program and libraries can offer a low-stakes, hands-on environment that is built on child directed interests.

STEM education has been in the forefront of recent education policy discussions in the media. Likewise, developing and improving early childhood education with a focus on emergent literacy and executive function has been an important goal. However, little attention has been given to STEM programs for very young children. "There is limited high-quality practical guidance to drive effective practice for early childhood STEM education, and access to this guidance is not distributed equally across the spectrum of early childhood programs" (Early Child Working Group, 2017). The Early Childhood STEM Working Group met over a period of two years and developed guiding principles and recommendations for providing high-quality STEM experiences for young learners. This work along with IMLS publication "Making + Learning in Museums and Libraries: A Practioners Guide and Framework" are excellent resources and solid foundations to build upon in our work to expand STEM learning in libraries.

STEM and science have been a priority in libraries as far back as 1994, when the American Association for the Advancement of Science (AAAS) and author Maria Sosa published *Great Explorations: Discovering Science in the Library*. Her work highlighted the unique role public librarians could play by offering a more personalized constructivist approach to science learning in support of standards based science learning and informal hands-on learning projects. Sousa encourage family involvement; "Libraries can help make parents more aware of the importance of science. They can also provide opportunities for families to participate in informal science experiences that provide a strong foundation for learning science" (Sosa, 1994).

Research confirms that young children are receptive to learning from STEM activities. Preschoolers and some verbal toddlers can learn concepts in specific science domains (Gelman and Brenneman, 2004), exhibit reasoning skills for making sense of science investigations (Gopnik, 2012), use number sense to estimate and compare quantities (Clements and Sarama, 2003), and apply algorithmic thinking to create simple computer programs (Bers, 2008). The ability to reason using statistical inference is present very early in a child's development and may be at the root of understanding scientific inquiry and probabilistic reasoning (Denison and Xu, 2010; Kushnir, Xu, and Wellman, 2010; Xu and Garcia, 2008). An early introduction to STEM, tinkering and a maker mindset can develop science vocabulary and fluency, but it can also foster curiosity, which can lead to a lifetime of learning. In 1993, The National Education Goals Panel (NEGP) suggested that children who start school with "a lack of curiosity are at greater risk of subsequent school failure than other children" and reported that kindergarten teachers believed that curiosity was a more

important predictor of school readiness than the ability to count or recite the alphabet (NEGP, 1993). Finally, early STEM experiences can support children's growth across areas as diverse as executive function and literacy development (McClure et al., 2017).

In 2013, IMLS published "Growing Young Minds: How Museums and Libraries Create Lifelong Learners" with the call to become more intentional about our role in early learning to prepare all children for a lifetime of learning and success. The report described ten ways museums and libraries are supporting young children. Number three directly informs our project: "Supporting development of executive function and "deeper learning" skills through literacy and STEM-based experiences" (Institute of Museum and Library Services, 2013).

Even with this history of STEM programs for children and families, libraries have few models for quality STEM programming for the very young child. A look at what libraries are offering shows that the emphasis of programming has been for school age children. A 2016 survey of librarians and science educators conducted by the STAR Library Education Network found the most common STEM-rich learning experiences are hands-on investigations, art-based STEM projects, STEM-related storytimes, and demonstrations. 34% of the respondents indicated that they offer library makerspaces. The most common age targeted in these experiences are elementary school age students (87%), middle school students (64%), and Pre-K students (57%). "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" (Hakala and MacCarthy, 2016).

Previous library "Little Makers" have targeted to older learners. In 2014, the Fayetteville Free Library offered a Little Makers program to children ages 5-8. The Clearview (CO) Library District has a program for ages 5-9. The Mini Makers programs at the Boca Raton Public Library are for children ages 5-11. The demand for these programs for younger children is growing. The Henderson (NV) Library offers a Little Makers program for ages 3-5 and the Lacrosse Public Library offers a Little Makers program for ages 2-5. The recognized value of these programs is expanding and there is a need for evidence-informed programs and curriculum created especially for libraries. Our project will fill the gap.

The makerspace concept is about developing collaborative learning, with an emphasis on learning by doing. In a makerspace for the very young child, you might find robotics and computation, thinking activities, wind tubes, and building with cardboard and other recycled materials. *Tinkering* is the playful act of exploring materials, tools, and ideas with or without a defined outcome while *making* refers to the process of using hands-on, interest-driven learning to construct ideas and products. Rooted in constructivism and constructionism, both concepts would be beneficial in an early childhood STEM activity program. *Engineering* might be thought of as a more intentional process, which adds another dimension through the design process (define the problem, plan solutions, make a model, test the model, reflect/redesign). All three are related and help to contribute to a growth mindset, which promotes the idea that capabilities are continually developed, improved upon, and refined through experiences involving success, mistakes, and

(See the Bibliography in the Supporting Documents for citations)

persistence. The Boston Children's Museum explains in, educator's guide "Tinker Kit" that "tinkering often leads to making something, and it is absolutely the foundation to more complex making, technology and engineering. Learning how to manipulate tools, understand the properties of materials, and identify unique solutions to problems is at the core of all of making and engineering" (Boston Children's Museum).

There is research showing the important role that out-of-school experiences play in student achievement and learning. In "American Scientist," Falk and Dierking (2013) suggest that for greater impact, "we should explore the role that free-choice (or informal) experiences play in the public understanding of STEM." (Falk and Dierking, 2013) Research shows that a family's involvement and attitude is the single most important predictor of student success (Henderson and Mapp, 2002). All research points to the importance of libraries engaging families in STEM fields and activities, but little research has been done to show how libraries can best do this with very young children.

There is a push for more STEM from the youngest student to the oldest learner. In January 2015, Governor Maggie Hassan of New Hampshire unveiled a report "Pathways to STEM Excellence." She called for more students in science, technology, engineering, and math. "New Hampshire's K-12 science and math achievement is not strong enough to supply future workforce demand. In both math and science, proficiency drops dramatically in the early grades. In science, only 51 percent of students are proficient or better in the 4th grade, dropping to 31 percent by 8th grade" (N.H. Charitable Foundation, 2014).

This project builds upon the research of McClure, Guernsey, Clements, Bales, Nichols, Kendall-Taylor, and Levine, in "STEM starts early: Grounding science, technology, engineering, and math education in early childhood." Among other findings, their analysis of National Science Foundation grants found that younger children are not studied as often as older children. Their recommendations include connecting learning with community "charging stations in informal learning environments such as museums and libraries to engage children, and also provide direct instruction to parents on how to engage with their children around STEM features and continue their learning beyond that environment."

The IMLS report "Making + Learning in Libraries and Museums" also provided framework for this project, which has similar goals to build capacity for libraries to create and sustain effective makerspaces and related programs for learning. The report describes a model of learning and engagement developed at the Children's Museum of Pittsburgh. Learning Practices of Making, which serve as observable behaviors of learners in the museum's MAKESHOP® including "Seek & Share, Resources, Hack & Repurpose, Express Intention, Develop Fluency, Simplify to Complexify" (Institute of Museum and Library Services). This project will create Learning Practices of Making for Libraries, which align with an important mission of many libraries to expand learning opportunities that prepare our youngest children for a lifetime of learning and success.

PROJECT DESIGN and ACTIVITIES

This project will test and evaluate 24 Little Makers Science Saturday programs for children ages two to six and their parents or care providers at the Keene Public Library (KPL) and at our partner institutions. Curriculum for the Little Makers Science Saturdays will be designed by KPL staff with the advice of the Advisory Committee. Little Makers Science Saturdays will be facilitated by KPL staff and trained KSC interns.

The Project Director will be Youth Librarian, Tracy Snow. Partners include Maker Ed, Keene State College (KSC), PEER Associates, Boulder Public Library, Brooklyn Public Library, Skokie Public Library, and the Cheshire Children's Museum. We will add one more library to the mix. We want to include a western library and have approached the Santa Clara County Public Library District but they have not yet committed. An Advisory Committee will provide advice and consultation in the early stages and throughout the project. Virtual meetings will be scheduled using WebEx. Members of the Advisory Committee will visit KPL at the start of the grant period to refine the Logic Model and to set the framework for the project. During this visit, Advisory Committee will offer short presentations to KPL staff and KSC interns. These presentations will be recorded so that future interns can benefit from them and that eventually they can be incorporated in our online toolkit. The Committee will visit at the start of the second year to provide training for the partner institutions that will begin offering Little Maker Science Saturday programming.

Year 1: The Project Director will recruit KSC interns and volunteers who will serve as Little Maker Science Saturday facilitators. The Project Director will work with Dr. Deborah Black of KSC to develop curricula for the Little Makers Science Saturday programs.

Over the 3 year grant period, at least 24 Little Maker Science Saturdays will be scheduled and promoted. Some programs will target children ages 2-3 and their families some will target ages 3-6 and their families, and others will target the full age range 2-6. Families will register and attend these activities involving language and sensory awareness play, along with authentic materials, tools, and processes. Each program will include open-ended challenges, familiar, and unusual materials, and opportunities for scaffolding and iteration to encourage children to explore, tinker, make and engineer. All materials will be safe and age appropriate for the youngest children with emphasis on reusable and recycled materials. Children will have consistent access to materials so they can recall, reflect, and build upon prior knowledge. New materials will be added to each subsequent program. Possible activities will include computational thinking with Cubetto robots, circuitry with Squishy Circuits and Circuit Blocks, and engineering with cardboard.

We will do special outreach to ensure that we have participation from both boys and girls and people of diverse cultural and socioeconomic backgrounds. To encourage repeated participation in events, the library will offer incentives such as passes to the Cheshire Children's Museum. Passes will be awarded to families that attend and participate in at least 5 events.

Parents play a key role in shaping children's early experiences in STEM and therefore Little Makers Science Saturdays will include parents and caregivers in all activities. According to "Early STEM Matters," "we need robust supports that build adult and child self-efficacy around STEM, inspire

family involvement in STEM at home, convey the importance of STEM experiences in early childhood, and empower families to expect and advocate for high quality STEM education in their children's schools" (Early Childhood STEM Working Group, 2017).

We will use constructivist and constructionist learning approaches along with Blooms Taxonomy, which goes beyond the "who," "what," "where," "why" questions, and looks at different levels of understanding, especially abstract thinking. Each of our programs will indirectly explore science phenomenon and encourage children to explore a line of questions and possible answers to elucidate understanding. Programs will involve making and tinkering activities, age appropriate real tools, and trained facilitators to help redirect and model STEM engagement for families. This project seeks to find ways to effectively incorporate reflection into library tinkering and making activities for Little Makers. One method we will employ is to include a video selfie station in the activity room so that parents and children can share the stories of their made objects.

The Project Director will create a YouTube Channel and write a blog to share our experiences facilitating the Little Makers Science Saturdays and the findings of our project. The YouTube Channel will eventually be incorporated in the project Toolkit.

KPL will work with PEER Associates Senior Research Associate Joy Kubarek, Ph.D. to design tools that recognize and measure productive patterns of family participation and their associated learning outcomes in the library programs. We will pilot instruments for data collection during the first year of the project. KPL staff and KSC interns will be trained in the observation protocol for evaluation.

Year 2: With PEER Associates, we will conduct a mid-point evaluation and refine our Saturday Programs based on results of the evaluation. KPL will build a Community of Practice (CoP), open to all librarians interested in making and tinkering with very young children. We will do this through list serves such as ALSC-L and Facebook groups such as Makerspaces and Participatory Libraries, Storytime Underground and Programming Librarian. The Advisory Committee and KPL staff will develop training materials and instruct staff at our alternative programming sites in how to conduct and evaluate Little Maker Science Saturdays. KPL will continue to offer and evaluate Little Maker Science Saturdays and expand programming to our alternative sites. We will connect with partner institutions with WebEx. We will analyze data to inform the development of a facilitation guide, which will equip librarians to offer high-quality science instruction and facilitation with young children and families.

Year 3: KPL will write and publish a print & web Toolkit, which will include program plans, a self-evaluation guide, facilitation question cards for librarian to print and use with parents and children, tips & recommendations, suggested books, and criteria for selecting the best STEM related books, tools, and materials. KPL staff will seek to present project findings at various professional conferences including the ALA, New England Library Association, Association to Library Service to Children, Public Library Association, and National Center for Families Learning, National Association for the Education of Young Children as well as showcases such as Maker Faires. Articles will be written for submission. Results will be shared on KPL's website and on social media.

(See the Bibliography in the Supporting Documents for citations)

PROJECT EVALUATION

We will track progress towards outcomes regularly and make adjustments. We will use a variety of evaluation methods including retrospective pre-post surveys, interviews, and observation. We will begin with a detailed logic model to capture the intended theory of change as well as the plan for implementation to accomplish that change. Measures will include parental interest and self-efficacy in supporting their children's engagement in science both pre and post experience. We will observe families during STEM explorations and access parent-child engagement during the activities. We will also create library portfolios documenting the activities for evaluation.

EVALUATION DESIGN

This project will involve formative and summative evaluation with a naturalistic mixed-methodology. This design supports the collection and analysis of quantitative and qualitative data related to the effectiveness of introducing of STEM expert narratives to library family science engagement activities. Parents and caregivers at STEM activities will be given surveys, with a smaller sample of participants to be interviewed at a later date. There will be observational studies during the course of the program. Project staff will keep reflective journals to document learning processes and program implementation. *(See supporting documents from Peer Associates for more detail.)*

DATA COLLECTION and ANAYLSIS

Joy Kubarek, Ph.D., Senior Research Associate at PEER Associates will be contracted to conduct the evaluation of the project. *A detailed evaluation plan in provided a supporting document.* We will draw on ethnographic methods (participant observation and journals, audio-video analysis (if appropriate), photographic documentation of children's artifacts (if appropriate), interviews with children, parents, and program staff, and an examination of tinkering artifacts over time. The results of this project will be shared with librarians and museum educators at professional conferences at the state, regional, and local level. Articles will be written for professional librarians and submitted for publication to *School Library Journal* and *Children and Libraries: The Journal of ALSC.* Results will also be shared on the library's website and on social media.

PROJECT RESOURCES

TIMELINE: This project will occur over a three-year period beginning on October 1, 2018 and concluding September 30, 2021. *A detailed project timeline, as directed in the IMLS guidance, is located in the Supporting Documents section.*

FACILITIES: At KPL, most programs will be held in the Youth Department Storyroom or the Kay Fox Meeting Room, which is 500 square feet. Programs will also be held at the Cheshire Children's Museum and at the Boulder Public Library, Brooklyn Public Library, and Skokie Public Library.

BUDGET: *(See the separate supporting documents for all figures and justifications)*
Cost sharing: Other than the Project Director, the salaries and benefits for Keene Public Staff will be contributed. The facilities, equipment, and supplies to support this project will be a blend of existing KPL resources and grant-funded purchases.

PERSONNEL: (*Key staff is detailed in the supporting documents*) KPL has 12 Youth and YA Librarians. Many of these are part-time librarians. Project Director, Tracy Snow will recruit and hire part-time student interns whose primary responsibility will be this project. *The intern job description is included in the supporting documents.*

ADVISORY COMMITTEE: *(letters of support included in Supporting Documents)* An active advisory committee made up from leaders in the Youth Maker Movement, Museums, and Libraries will provide advice and consultation. The advisory committee will work to build formative evaluation feedback into the project as it evolves. Commitment to serving on the advisory committee has already been received from the following individuals: Dr. Deborah Black (KSC), Dr. Lisa Brahms, (Children's Museum of Pittsburgh, Stephanie Chang (Maker Ed), Saroj Ghoting (Earlylit.net), Joy Kubarek (PEER Associates), Dr. Lisa Regalla (Bay Area Discovery Museum Center for Childhood Creativity), Dr. AnnMarie Thomas (University of St. Thomas).

PARTNER ORGANIZATIONS *(letters of support included in Supporting Documents)*
Keene State College has been an NCATE accredited institution since 1954. The Elementary Education program meets state and national standards and prepares teacher candidates who demonstrate appropriate content knowledge, pedagogical knowledge and skills, ability to impact student learning, and professionalism. *KSC will provide interns as part of a practicum.*
PEER Associates is a team of evaluators with diverse expertise. They provide customized, highly responsive, utilization-focused program evaluation, and educational research services for organizations nationwide. They specialize in place-based education, environmental, and sustainability projects. *PEER Associates will evaluate our project.*
Cheshire Children's Museum opened in 2012 offers dynamic exhibits and programs, that integrate the arts, science, math, and literature for children to discover, explore, and learn through the power of play. *The Museum will provide an alternative site to test programs and incentives.*
Boulder Public Library BLDG 61 is a free all-ages community Makerspace in the Boulder Public Library (Boulder, Colorado) that provides maker education and technology to the public in a creative and inclusive environment. *The Library will be an alternative site to test programming.*
Brooklyn Public Library is the public library system of the borough of Brooklyn, in New York City. It is the fifth largest public library system in the United States. We will work with Jessica Ralli, Coordinator of Early Literacy Programs. *The Library will be an alternative site to test programming.*
Skokie Public Library has been serving the community of Skokie, Illinois, since 1929. In 2008, the library received the National Medal for Museum and Library Service for outstanding community service. We will work with Amy Koester who oversees library programs for children and families. She serves on the board of the Association for Library Service to Children. Amy maintains All Things STEAM, a resource for offering library programming in science, technology, engineering, arts, and mathematics on her blog "The Show Me Librarian." *The Library will be an alternative site to test programming.*

<div align="center">DIVERSITY PLAN</div>

Throughout the grant, we will seek advice and feedback from advisory committee members to ensure that the project meets diversity goals. Collectively, these individuals will represent libraries

(See the Bibliography in the Supporting Documents for citations)

and institutions from across the country of various sizes, geographical areas, and racial and cultural diversity. We will also intentionally reach out to underserved communities to promote our programs and activities to these families. We will broaden access but "equity is not only a matter of broadening access to high quality STEM learning experiences. . . . Equity lies in the how of teaching and learning (Vossoughi, Escude, Kong, Hooper, 2013). We will follow their recommendations and pay attention to the intellectual, emotional, and cultural resources that children and families will bring to our activities and leverage our tinkering activities to create intellectually respectful and socially meaningful educational experiences.

NATIONAL IMPACT

This project will demonstrate how libraries can position themselves as a vital STEM resource for families and young children. Engaging in making and tinkering activities can build on a child's natural curiosity and help young children to develop deep firsthand learning about scientific concepts, engage children in practices of science and engineering, define problems, test solutions, and respond to feedback (Ritz, 2007). Because STEM learning is closely related to language learning, STEM is an excellent way for children to prepare for kindergarten and school success. "STEM amplifies language development; language enables STEM thinking. As children engage in STEM experiences, they hear and practice new words. Growing vocabularies allow children to make sense of increasingly complex ideas and phenomena, and early exposure to vocabulary used for concepts can support children later on to master higher order thinking" (Hadani and Rood, 2018).

Our proposed program looks to the recommendations of the Early Childhood STEM Working Group but focuses primarily on librarians rather than early childhood teachers in centers and schools. This program will raise the profile and understanding of early childhood STEM activities; revamp STEM-relating training and supports for libraries; establish initiatives, resources, and supports that promote parents' and families' involvement and engaging in their young children's STEM education; and make high-quality early STEM resources and implementation guidance available to practitioners.

We will work with experienced STEM grant evaluator, Joy Kubarek of PEER Associates, to develop protocols and tools for measuring outcomes and determining success. Outcomes will focus on enabling staff to successfully build and extend capacity in guiding parents and children's early STEM activities. Our proposed project will develop and test, with the assistance of academic researchers, a model for informal STEM engagement with toddler, preschoolers, and out-of-school kindergarten aged children that can be offered in a variety of communities. Tangible results include a toolkit for librarians, which will include note cards (modeled after Saroj Ghoting's "The Early Literacy Kit") with open-ended science questions to ask during projects or at any time.

This project will be workable for libraries in small communities, which in many cases are the only place available for free quality science enrichment activities. A replicable and scalable research-informed effective practices model will help Youth Librarians engage their patrons and support lifelong learning with STEM. Project tools and resources will positively affect the quality of library STEM programs and enhance libraries' relevance in the community.

(See the Bibliography in the Supporting Documents for citations)

Goals and Outcomes: *(Detailed Logic Model included in Supporting Document).* The specific goals of this grant are:

1. FOR EARLY LEARNERS: To engage early learners ages 2 to 6 in STEM, tinkering, and making activities through early STEM library programming in an inviting environment
   Outcomes: 1) kids will have fun at library STEM, tinkering, and making activities; 2) kids will show capability for engaging in STEM activities; 3) kids, will ask their parents how and why questions; 4) children will begin developing positive views of STEM.
   Outcome success will be measured by surveying/interviewing parents and care providers and an observation protocol implemented by library staff.

2. FOR PARENTS: To increase caregiver/parental understanding of the importance of STEM, tinkering, and making activities and increase their efficacy in engaging their children with STEM.
   Outcomes: 1) parents and caregivers choose to bring young learners to the library for STEM, tinkering, and making engagement; 2) parents and caregivers will report an increased use of appropriate scientific vocabulary and tools; 3) parents and caregivers will report that they feel more comfortable engaging their children with STEM, tinkering, and making activities; 4) parents and caregivers will support their child's STEM learning; 5) parents and caregivers will perceive the library as an important STEM, tinkering, and making learning center
   Outcome success will be measured by surveys/interviews.

3. FOR LIBRARIANS: To develop capacity for designing early STEM library programming including storytimes and informal activities which will build early STEM and executive function skills in young learners
   Outcomes: 1) librarians will feel confident planning, offering, and evaluating STEM, tinkering, and making activities for young learners with an emphasis on families and learners that would not otherwise have access; 2) librarians will have increased competencies and skills to develop a quality STEM collection and calendar of programs and activities, and initiatives that support developmentally appropriate STEM learning and best practices; 3) librarians and libraries will be considered an important community STEM resource
   Outcome success will be measured by surveys of librarians and open portfolios kept by librarians to document the physical objects created during programming.

COMMUNICATION PLAN

The goal of the Communications Plan will be to promote the Little Makers project and the STEM learning experiences and project activities taking place at KPL and at the other three sites. Gail Zachariah will report regularly on project progress and will coordinate statewide and national publicity. Findings of the project will be regularly communicated to relevant media with these points highlighted including:
- Importance of STEM learning in today's society;
- Public libraries are important community assets, freely available to all citizens, offering programs, resources and trained librarians to support and facilitate lifelong learning;
- STEM learning – by even the youngest citizens – is essential for a robust future workforce;
- Importance of family programming and parent involvement in young children's learning;
  The Project Team will create a YouTube channel for the project and will use a variety of social media methods to increase awareness of the project. Participating libraries will be

(See the Bibliography in the Supporting Documents for citations)

encouraged to provide videos and photographs of programming and other project related activities and announcements.

Little Makers Science Saturdays will be promoted and advertised through social media, radio, and TV. Team members will make presentations on the Little Makers program at national, regional and state conferences, with proposals submitted to relevant associations. At the state and regional levels, project librarians will promote the Little Makers project to their local library boards, town officials and throughout their local and regional communities. Librarians will be encouraged to contact organizations such as local Rotary Clubs to promote the project to businesses and non-profits and to recruit local project ambassadors. Project librarians will be encouraged to present programs at state library meetings and conferences and to share their knowledge and experience with other libraries. At the end of the Little Makers project, the partners will publish and distribute a full final project report, including data from each library location and information on project outcomes, informed by the Project Evaluation. The final report will be available in both print and electronic formats. The project team will also generate and distribute a pragmatic toolkit which will address the learning trajectories, measures, and demonstrable learning outcomes and offer suggested methods, activities, and tips.

SUSTAINABILITY

KPL will sustain the work of this grant by incorporating the recommendations into all of our programs for and services to young children and their families. The replicability of our activities will be an essential element of project success and sustainability. By taking advantage of our resources and toolkit, which will be distributed widely on the internet and on various professional list serves and Facebook groups, librarians throughout the country in big and small libraries will be able to more effectively engage children and families with STEM learning opportunities. Hands-on activities and other resources developed during the project will be selected with an eye to accessibility, adaptability, ease of use and cost.

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Keene Public Library, NH

Tasks	Organizer	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Year 1: October 1, 2018 - September 30, 2019													
							Month						
Finalize advisory committee / Plan committee Meeting	KPL	■											
Develop Criteria for building a circulating STEM collection	KPL	■	■										
Refine Theory of Change/Logic Models/Evaluation Plan	Peer Assoc./DIR	■	■	■	■	■	■	■	■	■	■	■	■
Advisory committee meeting	Adv.Ctte. /KPL		■										
Project Consultation and Advisory	Peer Assoc/ KPL/Adv.Ctte./KSC	■	■	■	■	■	■	■	■	■	■	■	■
Observation Protocols DATA COLLECTION	Peer Assoc.												■
Develop STEM Curriculum	KPL/KSC/Adv.Ctte./ Peer Assoc	■	■	■	■	■	■						
Develop Outreach Strategies	DIR	■	■										
Purchase Program Materials	KPL				■	■							
Recruitment - Interns & Volunteers	DIR	■	■									■	■
Program Facilitation training	KPL		■	■	■	■	■	■	■	■	■	■	■
Program Evaluation training	Peer Assoc/KPL		■	■	■	■							
Develop Caretaker surveys	Peer Assoc/KPL									■	■	■	■
Develop Project Documentation and Social Media Platforms	DIR		■	■	■	■	■	■	■	■	■	■	■
Families participate in 8 Science Saturdays at KPL	FAM/KPL					■	■	■	■	■	■	■	■
Reflect and Refine practice	KPL					■	■	■	■	■	■	■	■
Observation & Data Collection Protocols Training	Peer Assoc./KPL				■	■	■	■	■	■	■	■	
Recruit Caregivers for Focus Groups	DIR/FAM				■	■	■	■	■	■	■	■	■

Organizational Key	
Adv.Ctte.	Advisory Committee
DIR	Program Director
FAM	Families
KPL	Keene Public Library Staff including Project director
KSC	Keene State College
Peer Assoc	Peer Associates Evaluators
PTR	Partner Organizations

Year 2 : December 1, 2019 - November 30, 2020													
Task	**Organizer**	**Month**											
		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Families participate in 12 Science Saturdays at KPL	FAM/KPL	■	■	■	■	■	■	■	■	■	■	■	■
Recruitment - Interns & Volunteers	DIR	■											
Conduct mid-point evaluation/refine programming	Adv.Ctte./KPL/Peer Assoc./KSC	■											
Second Advisory Committee meeting	Adv.Ctte./KPL/Peer Assoc/PTR/KSC		■										
Program Facilitation training	KPL		■	■	■	■	■	■	■	■	■	■	■
Program Evaluation training	Peer Assoc/KPL		■	■	■	■							
Create a Community of Practice (CoP) - interest in making/tinkering with very young children	DIR/Adv.Ctte./KSC	■	■	■	■	■	■	■	■	■	■	■	■
Project Consultation and Advisory	Adv.Ctte./KPL/Peer Assoc./KSC	■	■	■	■	■	■	■	■	■	■	■	■
Offer trainings to participating libraries	DIR/Peer Assoc./PTR	■	■	■	■	■	■	■	■	■	■	■	■
Develop/AdminsterParent/Caretaker Survey	KPL/Peer Assoc/FAM								■	■	■	■	■
Parent/Caretaker Interviews/Focus Groups	KPL/Peer Assoc/FAM								■	■	■	■	■
Expand Science Saturdays to Cheshire Children's Museum and participating libraries	DIR/PTR/Peer Assoc/FAM	■	■	■	■	■	■	■	■	■	■	■	■
Observation Protocols DATA COLLECTION	DIR/Peer Assoc/KPL/PTR/FAM	■	■	■	■	■	■	■	■	■	■	■	■
Write facilitation guide	DIR/Peer Assoc	■	■	■	■	■	■	■	■	■	■	■	■

Organizational Key	
Adv.Ctte.	Advisory Committee
DIR	Program Director
FAM	Families
KPL	director
KSC	Keene State College
Peer Assoc	Peer Associates Evaluators
PTR	Partner Organizations

Year 3 : October 1, 2020 - September 30, 2021														
Task	**Organizer**	**Month**												
		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Families participate in 4 Science Saturdays at KPL	FAM/KPL	▓	▓	▓	▓	▓							
Write facilitation guide	DIR	▓	▓	▓	▓	▓	▓	▓	▓	▓	▓	▓	▓
Project Consultation and Advisory	Adv.Ctte./KPL/Peer Assoc./KSC	▓	▓	▓	▓	▓	▓	▓	▓	▓	▓	▓	▓
Share results on blogs and social media	KPL	▓	▓	▓	▓	▓	▓	▓	▓	▓	▓	▓	▓
Observation Protocols DATA COLLECTION	DIR/Peer	▓	▓	▓	▓	▓	▓	▓	▓	▓	▓	▓	▓
Develop/Adminster Parent/Caretaker Survey	KPL/Peer Assoc/FAM/PTR	▓	▓	▓	▓	▓	▓	▓	▓	▓	▓	▓	▓
Parent/Caretaker Interviews/Focus Groups	KPL/Peer Assoc/FAM/PTR									▓	▓	▓	▓
Librarian/Project Staff Interviews/Questionnaire	Peer Accoc/KPL/PTR									▓	▓	▓	▓
Present: America Library Association	KPL/Peer Assoc				▓					▓			
Present: New England Library Association	KPL/Peer Assoc	▓											
Present: Association for Library Service to Children	KPL/Peer Assoc												▓
Present: Public Library Association	KPL/Peer Assoc					▓							
Present: National Center for Families Learning	KPL/Peer Assoc												▓
Present: National Association for Education of Young Children	KPL/Peer Assoc		▓										
Infosys-Crossroads Conference	KPL/Peer Assoc								▓				
Bay Area Maker Faire	KPL/Peer Assoc								▓				
New York Maker Faire	KPL/Peer Assoc												▓
Write articles for publications such as to School Library Journal, Children and Libraries: The Journal of ALSC, and Make Magazine	KPL/Peer Assoc	▓	▓	▓	▓	▓	▓	▓	▓	▓	▓	▓	▓

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DIGITAL PRODUCT FORM

Introduction

The Institute of Museum and Library Services (IMLS) is committed to expanding public access to federally funded digital products (i.e., digital content, resources, assets, software, and datasets). The products you create with IMLS funding require careful stewardship to protect and enhance their value, and they should be freely and readily available for use and re-use by libraries, archives, museums, and the public. However, applying these principles to the development and management of digital products can be challenging. Because technology is dynamic and because we do not want to inhibit innovation, we do not want to prescribe set standards and practices that could become quickly outdated. Instead, we ask that you answer questions that address specific aspects of creating and managing digital products. Like all components of your IMLS application, your answers will be used by IMLS staff and by expert peer reviewers to evaluate your application, and they will be important in determining whether your project will be funded.

Instructions

Please check here if you have reviewed Parts I, II, III, and IV below and you have determined that your proposal does NOT involve the creation of digital products (i.e., digital content, resources, assets, software, or datasets). You must still submit this Digital Product Form with your proposal even if you check this box, because this Digital Product Form is a Required Document.

If you ARE creating digital products, you must provide answers to the questions in Part I. In addition, you must also complete at least one of the subsequent sections. If you intend to create or collect digital content, resources, or assets, complete Part II. If you intend to develop software, complete Part III. If you intend to create a dataset, complete Part IV.

Part I: Intellectual Property Rights and Permissions

A.1 What will be the intellectual property status of the digital products (content, resources, assets, software, or datasets) you intend to create? Who will hold the copyright(s)? How will you explain property rights and permissions to potential users (for example, by assigning a non-restrictive license such as BSD, GNU, MIT, or Creative Commons to the product)? Explain and justify your licensing selections.

http://us.creativecommons.org

We will assign the Creative Commons "Attribution-Noncommercial-No Derivatives 4.0 Open Access License" to the content created by the project to provide broad access to information disseminated during the 3 year grant period.

A.2 What ownership rights will your organization assert over the new digital products and what conditions will you impose on access and use? Explain and justify any terms of access and conditions of use and detail how you will notify potential users about relevant terms or conditions.

Our openly available resources will be accessible online through our already established social media channels, such as Facebook, Youtube, and Tumbler. E-community participants will adhere to the community standards policy for these platforms. Materials may also be made available by members of the community of practice that we will develop during the project. Downloadable materials will be available through our City of Keene Public Library website and existing e-community.

A.3 If you will create any products that may involve privacy concerns, require obtaining permissions or rights, or raise any cultural sensitivities, describe the issues and how you plan to address them.

Families who participate in our research and are documented will sign waivers for use of video, audio, and photography. We will not share any personal information about participants. Our waiver grants permission for information to be in print, online, or broadcast in another manner without further consideration.

Part II: Projects Creating or Collecting Digital Content, Resources, or Assets

A. Creating or Collecting New Digital Content, Resources, or Assets

A.1 Describe the digital content, resources, or assets you will create or collect, the quantities of each type, and format you will use.

Facilitators Guide : This guide will be created to make it easy for libraries to replicate our programs. We will have electronic files available for download, and will be available through City of Keene Public Library's website.

We will collect and index digital assets developed during the program to be disseminated to our community of practice

Community of Practice:

Project Documentation: The progress of the project will be documented online through the developed community of practice and online channels using standard HTML web formatting.

Published Research Articles: Research articles will be published in print and digital journals as electronic PDF documents.

Data Sets: Data Sets will not be fully shared with the community because of privacy concerns. They will be digitally archived with the City of Keene.

A.2 List the equipment, software, and supplies that you will use to create the content, resources, or assets, or the name of the service provider that will perform the work. The library owns or will purchase digital video and still cameras and appropriate sound recording equipment. We may include photos taken by participants as incidental documentation.

A.3 List all the digital file formats (e.g., XML, TIFF, MPEG) you plan to use, along with the relevant information about the appropriate quality standards (e.g., resolution, sampling rate, or pixel dimensions).

Photographs will be archived as .jpg or RAW files of highest resolution. Printed materials will be made available through downloadable PDF's and when appropriate .docx and .odt formats for customization by partner organizations Data sets will use Open XML. Digital video will be saved in AVI and MPEG. Web assets will use multiple file types following WC3 guidelines. We will adhere to quality standards put forth by ALA and WC3. We will consult with the City of Keene IT department to deliver high quality materials in a low tech format in order to accommodate rural libraries with inadequate digital infrastructure.

B. Workflow and Asset Maintenance/Preservation

B.1 Describe your quality control plan (i.e. how you will monitor and evaluate your workflow and products).
In house workflow and assets will be managed by the project director in consultation with the City of Keene IT Dept. Until further consideration we will be using Google Docs to share and collaborate. Google drive or similar cloud computing infrastructure that offers the easiest and widest unencumbered access with be used.

B.2 Describe your plan for preserving and maintaining digital assets during and after the award period of performance. Your plan may address storage systems, shared repositories, technical documentation, migration planning, and commitment of organizational funding for these purposes. Please note: You may charge the federal award before closeout for the costs of publication or sharing of research results if the costs are not incurred during the period of performance of the federal award (see 2 C.F.R. § 200.461).

Public access to digital products will be housed through City of Keene Servers. In house documents will be housed on a separate private network within the City of Keene Digital Infrastructure.
C. Metadata

C.1 Describe how you will produce any and all technical, descriptive, administrative, or preservation metadata. Specify which standards you will use for the metadata structure (e.g., MARC, Dublin Core, Encoded Archival Description, PBCore, PREMIS) and metadata content (e.g., thesauri).

Descriptive and technical metadata will be produced for assets and resources as they are created. Metadata will be

discussed and decided upon through consultation with advisory committee participants and staff.

C.2 Explain your strategy for preserving and maintaining metadata created or collected during and after the award period of performance. The project manager working with staff technical librarians and City of Keene IT Department will determine preservation strategies.

C.3 Explain what metadata sharing and/or other strategies you will use to facilitate widespread discovery and use of the digital content, resources, or assets created during your project (e.g., an API [Application Programming Interface], contributions to a digital platform, or other ways you might enable batch queries and retrieval of metadata).
All published materials will be accessible through standard web browsers, devoid of special software requirements for open access and through contributions to existing cloud based digital repositories. Materials that contain confidential information will remain on secure servers maintained by the City of Keene IT department.

D. Access and Use

D.1 Describe how you will make the digital content, resources, or assets available to the public. Include details such as the delivery strategy (e.g., openly available online, available to specified audiences) and underlying hardware/software platforms and infrastructure (e.g., specific digital repository software or leased services, accessibility via standard web browsers, requirements for special software tools in order to use the content).

All published materials will be accessible through standard web browsers, devoid of special software requirements for open access and through contributions to existing cloud based digital repositories.

D.2 Provide the name(s) and URL(s) (Uniform Resource Locator) for any examples of previous digital content, resources, or assets your organization has created

Website: https://ci.keene.nh.us, Twitter: https://twitter.com/keeneplibrary,
Facebook: https://www.facebook.com/keenepubliclibrary, Pinterest: https://www.pinterest.com/gail_zachariah

Part III. Projects Developing Software

A. General Information

A.1 Describe the software you intend to create, including a summary of the major functions it will perform and the intended primary audience(s) it will serve. N/A

A.2 List other existing software that wholly or partially performs the same functions, and explain how the software you intend to create is different, and justify why those differences are significant and necessary. N/A

B. Technical Information

B.1 List the programming languages, platforms, software, or other applications you will use to create your software and explain why you chose them. N/A

B.2 Describe how the software you intend to create will extend or interoperate with relevant existing software. N/A

B.3 Describe any underlying additional software or system dependencies necessary to run the software you intend to create. N/A

B.4 Describe the processes you will use for development, documentation, and for maintaining and updating documentation for users of the software. N/A

B.5 Provide the name(s) and URL(s) for examples of any previous software your organization has created. N/A

C. Access and Use

C.1 We expect applicants seeking federal funds for software to develop and release these products under open-source licenses to maximize access and promote reuse. What ownership rights will your organization assert over the software you

intend to create, and what conditions will you impose on its access and use? Identify and explain the license under which you will release source code for the software you develop (e.g., BSD, GNU, or MIT software licenses). Explain and justify any prohibitive terms or conditions of use or access and detail how you will notify potential users about relevant terms and conditions. N/A

C.2 Describe how you will make the software and source code available to the public and/or its intended users. N/A

C.3 Identify where you will deposit the source code for the software you intend to develop: N/A

Name of publicly accessible source code repository:URL: N/A

Part IV: Projects Creating Datasets

A.1 Identify the type of data you plan to collect or generate, and the purpose or intended use to which you expect it to be put. Describe the method(s) you will use and the approximate dates or intervals at which you will collect or generate it.

A.2 Does the proposed data collection or research activity require approval by any internal review panel or institutional review board (IRB)? If so, has the proposed research activity been approved? If not, what is your plan for securing approval?

A.3 Will you collect any personally identifiable information (PII), confidential information (e.g., trade secrets), or proprietary information? If so, detail the specific steps you will take to protect such information while you prepare the data files for public release (e.g., data anonymization, data suppression PII, or synthetic data).

A.4 If you will collect additional documentation, such as consent agreements, along with the data, describe plans for preserving the documentation and ensuring that its relationship to the collected data is maintained.

A.5 What methods will you use to collect or generate the data? Provide details about any technical requirements or dependencies that would be necessary for understanding, retrieving, displaying, or processing the dataset(s).
A.6 What documentation (e.g., data documentation, codebooks) will you capture or create along with the dataset(s)? Where will the documentation be stored and in what format(s)? How will you permanently associate and manage the documentation with the dataset(s) it describes?

A.7 What is your plan for archiving, managing, and disseminating data after the completion of the award-funded project?

A.8 Identify where you will deposit the dataset(s):

Name of repository:URL: https://ci.keene.nh.us/keene-public-library

A.9 When and how frequently will you review this data management plan? How will the implementation be monitored? Quarterly during the first year of the project and annually thereafter.