



Vermont Early Literacy Initiative -- Science, Technology, Engineering & Mathematics (VELI-STEM) Project

Year Three Final Project Evaluation Report
November 28, 2018

YEAR THREE FINAL PROJECT EVALUATION: EXECUTIVE SUMMARY

Like its Year One and Year Two predecessors, the final Year Three evaluation of the VELI-STEM project relied heavily on the data and anecdotal feedback provided by the librarians and project leadership team members who made this project such a resounding success; so, every effort has been made to let their voice prevail – this is their story to tell. They are the ones who ensured that the project achieved its goals of:

1. Delivering trainings and resources to librarians to support their provision of STEM learning experiences to children and families;
2. Recognizing and utilizing opportunities to infuse STEM throughout library practices;
3. Transferring STEM knowledge and skills to community child care providers/early educators to enable them to introduce STEM learning experiences to the young children they serve; and
4. On-going development of an online STEM Clearinghouse of Resources.

High-lights of the total quantitative, as well as the *qualitative*, impact of the project over three years include:

- **33 librarians trained**, with annual involvement of 24-26 librarians each of the project's three years –
 - *Librarian average self-reported STEM knowledge & skill levels rose from 3.6 before the first training to 4.8 after receipt of training on a 5-point scale*

VELI-STEM Grant Award

In 2015, the federal [Institute of Museum and Library Services \(IMLS\)](#) awarded the [Vermont Department of Libraries](#) a three-year [National Leadership Grant for Libraries](#) totaling \$339,861 to partner with the [Vermont Center for the Book](#) and [Montshire Museum of Science](#) to expand the [Vermont Early Literacy Initiative \(VELI\)](#) in 25 public libraries by training librarians to provide STEM programming on science inquiry and physical science for 3-7-year-old children, parents, and child care providers. IMLS funding ran from November 1, 2015 through October 31, 2018.

"The [trainings] ... result in us internalizing everything we learn and they instill confidence."

VELI-STEM Librarian

- **Delivery of over 1,900 STEM programs –**
 - 80 percent of 3 to 7-year-olds reported by their family members as being very engaged in STEM programming
- **Total STEM program participation levels of over 30,000¹ including 3-7-year-olds, other-aged children, family members and other caregivers, child care providers/early educators, and community members –**
 - Over 75 percent of family members/caregivers felt "very much" more able to encourage their children's interest in STEM
- **Over 170 early STEM literacy trainings for child care providers/early educators, who – in turn – made or will be making STEM learning opportunities available to over 1,700 young children –**
 - Almost 90 percent of child care providers/early educators reported that the STEM training they received from librarians "very much" helped them develop a better understanding of what STEM means to children ages 3-7 years old
- **Community outreach and engagement with STEM resource people exceeding 2,000² –**
 - In the words of a VELI-STEM community partner, "[The local library] absolutely increased STEM infusion throughout children's programming"
- **Weekly traffic for the VELI-STEM Weebly Site's online STEM resources climbed from an average of 30 unique visitors per week in Year One to over 150 unique visitors each week in Year Three –**
 - Spikes in traffic analytics occurred after presentations on the project, including on the STEM Clearinghouse of Resources, at state and national conferences.

"Families have come to expect STEM opportunities ... they are part of the fabric of our programming, our collection, and our interactions with children, parents, teachers & caregivers."

VELI-STEM Librarian

"Several librarians at the final VELI-STEM workshop in October 2018 said they planned to continue to work with child care providers in their towns, now that the connections had been made."

VELI-STEM Leadership Team On-site Observation

"Both of my granddaughters loved the activity and it seemed that they felt very empowered that 'girls could do science too'."

Family Member Feedback on Children's STEM Programming

In this digital age where the role of libraries is continually transforming, projects like VELI-STEM are a highly effective means of leveraging and elevating the role of the library.

Equipping librarians to offer early

STEM learning experiences positions libraries to be strategic partners in the creation of life-long learners who are capable of contributing to the requisite intellectual capital for a thriving 21st Century global economy.

¹Some individuals may have participated in more than one STEM program; so, participation statistics speak to the scope of interest and engagement in STEM programming but may not represent unique counts of individuals.

² Some individuals may have been engaged more than one year; so, participation statistics speak to the scope of community engagement in STEM programming but may not represent unique counts of individuals.

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YEAR THREE FINAL PROJECT EVALUATION: REPORT OVERVIEW

The Year Three Final Project Evaluation Report serves two key purposes:

- A. It is an **outcomes report**, measuring the success of the VELI-STEM in achieving the overarching goal of transforming library practices through the infusion of STEM content, skills, and knowledge into all aspects of working with young children and their families.
- B. It **supports replication**, compiling important lessons learned – and appending information, materials, and resources that other programs can adopt and adapt – to foster the provision of STEM learning opportunities for young children by libraries more broadly across Vermont and beyond.

This report is structured around the project's nine objectives:

- ❖ **Objective 1: Recruit and train 25 librarians from rural communities in STEM content (Physical Science Through Inquiry), skills and knowledge over three years**
- ❖ **Objective 2: Develop and monitor an online STEM Clearinghouse of Resources for project librarians to access and inform during the three years of the project**
- ❖ **Objective 3: Investigate with librarians ways to recognize STEM language and concepts in picture books and other existing library resources, in order to be confident and competent in using this knowledge in ongoing programming**
- ❖ **Objective 4: Assist librarians in the infusion of appropriate STEM content into their regular practice, including collection development, ongoing programming, conversations, bibliographies, displays and outreach**
- ❖ **Objective 5: Provide librarians with non-fiction books, STEM resources and hands-on learning materials to be used throughout the library setting and in programming with children, families, and child care provider trainings and in the development of library "Discovery Science Centers"**
- ❖ **Objective 6: Support development of programmatic relationships between librarians and community STEM resource people**
- ❖ **Objective 7: Develop and promote a YouTube channel and other social media for librarians to use as resources and networking tools**
- ❖ **Objective 8: Evaluate efficacy of training and materials for refinement and dissemination of results, and for replicability**
- ❖ **Objective 9: Disseminate and promote project results.**

For each objective, statistical and anecdotal evidence are provided of the outcomes achieved and lessons learned over the course of the three years of the VELI-STEM project. The two types of evidence were collected from:

- Participating librarians
- Family members/caregivers who accompanied children at STEM programming
- Child care providers/early educators who were trained by librarians on early childhood STEM literacy
- Community stakeholders who helped support or benefitted from the project
- Project leadership team members
- Project evaluator.

YEAR THREE FINAL PROJECT EVALUATION: FINDINGS

Objective 1: Recruit and train 25 librarians from rural communities in STEM content (Physical Science Through Inquiry), skills and knowledge over three years

Librarian recruitment – The [Vermont Department of Libraries](#) (VDOL) and [Vermont Center for the Book](#) (VCB) launched the VELI-STEM project three years ago with 25 libraries. The 25 libraries were selected based on six criteria, which the VDOL and VCB determined were critical indices of a library's potential and willingness to expand its capacity to provide early childhood STEM programming:

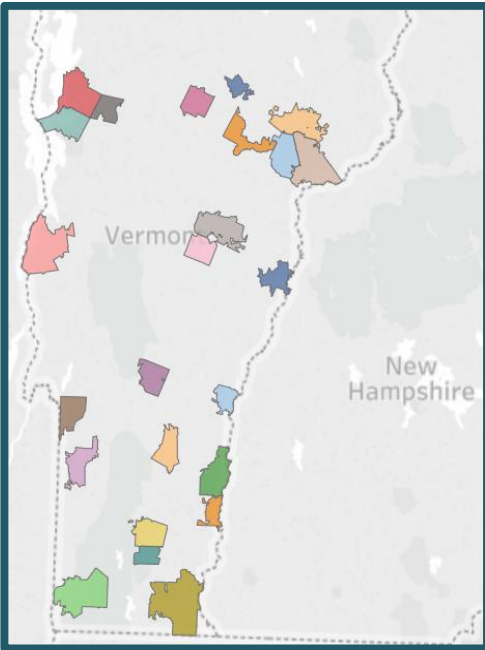
- Selection Criterion #1 – Prior or current involvement in the [Vermont Early Literacy Initiative](#) (VELI)³
- Selection Criterion #2 – Willingness and ability to participate in VELI-STEM
- Selection Criterion #3 – Located in a rural setting
- Selection Criterion #4 – Geographic mix of library locations
- Selection Criterion #5 – Variety in library staffing models
- Selection Criterion #6 – Replicability of VELI-STEM in other libraries in Vermont and across the United States.

An analysis of the original sample of 25 libraries selected for participation in the VELI-STEM project was conducted in Year One and is [posted on the VELI-STEM Weebly website](#), and the characteristics of the sample remained largely intact throughout the three years.

VDOL and VCB maintained or exceeded their goal of 25 libraries participating throughout the first two years of the three-year VELI-STEM project, with some attrition and some additions yielding 26 participating libraries participating at the end of Year Two. At the beginning of Year Three, two librarians left their libraries and were replaced. Initially, one of the new librarians was hesitant to join the project since her experience was with slightly older (school-age) children programming, but the project's leadership team reached out several times to explain how the project could easily be folded into what the librarian would already be doing at the library, and the librarian agreed to sign on. Near the end of the final year, there was turnover in two of the 26 libraries that limited on-going participation in the project. Prior to their departure, both of the librarians attended the final two-day training in April 2018 and received the Year Three books and materials. Neither knew who their replacements would be, but they said they would attempt to pass on the STEM information for Summer programming. The project ended with 24 fully engaged libraries.

³ The Vermont Early Literacy Initiative (VELI) was developed in 2010 by the VCB and VDOL to support the development of early literacy skills and school readiness by providing training and resources to public librarians working with young children and their parents and caregivers. Given the common target population of the two programs, the original sample of 25 VELI-STEM libraries – which represent approximately 50% of the over 50 libraries statewide that had participated in VELI at the time – had unique opportunities to leverage certain skills and knowledge acquired through their VELI participation.

LIST OF 24 VELI-STEM LIBRARIES AT PROJECT END



Map showing distribution of 24 libraries

Ainsworth Public Library (Williamstown)	Aldrich Public Library (Barre)	Bennington Free Library	Bixby Memorial Free Library (Vergennes)
Bradford Public Library	Burnham Memorial Library (Colchester)	Cobleigh Public Library (Lyndonville)	Craftsbury Public Library
Fletcher Memorial Library (Ludlow)	Hartland Public Library	Lydia Taft Pratt Library (West Dummerston)	Jamaica Memorial Library
Jeudevine Memorial Library (Hardwick)	Lanpher Memorial Library (Hyde Park)	Milton Public Library	Pawlet Public Library
Pope Memorial Library (Danville)	Poultney Public Library	Rockingham Free Public Library (Bellows Falls)	Sherburne Memorial Library (Killington)
Springfield Town Library	St. Johnsbury Athenaeum	Wardsboro Public Library	Westford Public Library

Over the course of the three-year project, the distribution of library roles among the participants held steady at approximately 30-40 percent in the role of library director, 50-60 percent in the role of children/youth services librarian, and a small percent occupying different roles (e.g., assistant librarian, coordinator of library services). In some cases, librarians occupied more than one role. In Year three, the amount of time spent working in those library roles averaged 31 hours per week (range of 12-40), which was similar to the other two years of the project.

Key Lessons Learned – Librarian recruitment:

- **Get it right from the start** – The leadership team was highly confident from the beginning about the original group of librarians they selected for the VELI-STEM project, and were gratified to see that the cohort “worked” with very little attrition. Considering the training time, programming demands, and data collection requirements, keeping such a majority of the original core group was a huge success.
- **Anticipate attrition** – The leadership team had anticipated even more attrition when the proposal was being developed; so, the fact that the core group remained more or less intact was a welcomed surprise. That said, with a project

like this whose sample of participants includes a significant portion of part-time librarians and spans a three-year period, a certain degree of attrition is inevitable; so, it is prudent to have a transition plan in place and to establish an original sample size with some room to offset any future attrition while still maintaining or approximating the target sample size. Care is needed to select a sample where, even with a limited amount of attrition, the residual sample will continue to be representative of the attributes of the overall population of librarians. That was fairly easy to accomplish in Vermont, where the universe of libraries is predominantly rural.

- **Account for turnover** – Again, with a project spanning multiple years and involving part-time librarians, a degree of turnover can be expected. With the VELI-STEM project, funds had to be identified mid-course to purchase some of the previous project year’s books and materials for librarians who on-boarded mid-project, so that programming on the themes from previous years could be continued along with new programming for the current year. It would have been helpful if resources had been allocated in advance for training replacement participants and providing previous years’ books and materials throughout the course of the project.
- **Plan for transitions** – In some cases, the turnover involved transition, where one VELI-STEM librarian transferred to another library that had not previously been participating in the project. The lesson learned was how important it is to have a prudent reserve also for that scenario, since the books and materials that have already been distributed typically stay with the original library (they don’t travel with the librarian to the new site).
- **Archive materials electronically** – Given attrition and turnover, it is helpful to archive as many project materials electronically as possible so that new participants can easily access resources and materials, as was done in this project using a [Weebly website](#).
- **Recruit highly-engaged librarians** – An important lesson learned from library transitions is that the group dynamic of trainings improved as a result of the on-boarding of libraries with a stronger level of engagement in the project. The leadership team sensed at project convenings that having every librarian excited and energized made the experience better for all.
- **Orientation for new librarians** – In hindsight, it would have been useful to have a plan in place for orienting new librarians to the project over the three years. The leadership team had mixed results with its ad hoc efforts to meet in person with new librarians throughout the course of the project. Something like a pre-designed and assembled orientation packet could have served as a handy reference for new librarians, and also could have served as a helpful reminder about project details for seasoned librarians. Instead of an official orientation packet, the VELI-STEM leadership team provided new librarians with the project proposal and pointed them to the [VELI-STEM Weebly website](#), explaining how the on-line resources were organized. Later, the new librarians indicated that the Weebly site was a valuable tool as they worked their way through their initial

year. Also, it proved useful to have a group of librarians who were “old hands” at the VELI-STEM project, as well as other VELI work. Their interactions with the new librarians at the trainings seemed to allay the apprehension of new librarians. The enthusiasm of the “seasoned” librarians proved infectious, helping to welcome new people aboard.

Librarian training – This section provides an overview of how the project’s goal of training librarians in STEM content, skills and knowledge over three years was achieved. Discussions of the specific aspects of librarian trainings relevant to [Objective 3](#) (librarian training on recognition of STEM language and concepts in library resources) and [Objective 4](#) (librarian training on infusion of appropriate STEM content into regular library practice) are provided under those objectives.

“The Vermont Center for the Book works so hard to meet every conceivable need of librarians at trainings to make it easy and comfortable to brainstorm and share in a completely safe environment; we all treasure the trainings – they result in us internalizing everything we learn and they instill confidence.”

VELI-STEM Librarian

Each of the three years of the project, librarians received two trainings –

1. A two-day training in April to introduce knowledge, model and develop skills, and distribute books and materials for the current year’s theme; and
2. A one-day follow-up training in October to reinforce key STEM constructs, take stock of the previous year’s activities and progress to date, facilitate exchanges and peer learning among librarians around effective STEM-infused library practices, and gather essential feedback for any necessary course corrections as the project went forward.

April two-day trainings:

Each of the April trainings included a full first-day and an abbreviated second day. The first day ran from morning registration through an evening activity. Day one of each annual April training included arrival and registration, welcoming remarks and introductions, delivery of general STEM content and content on the year’s theme, lunch, small group explorations and activities, dinner, and an evening activity. Day two of each April training was abbreviated and included breakfast, review of the previous day’s content and explorations, distribution of the year’s books and materials, some time for program planning, lunch, review of evaluation requirements around librarian data tracking and submission, and time for questions before concluding mid- to late afternoon. The Year One April training also covered the project’s administrative and logistical details and included a visit by representatives of Vermont’s U.S. Congressional offices in order to promote the project.

Extensive preparation went into each of the spring two-day trainings. The winter before the Year One April two-day training, the leadership team mapped out the objectives of the project and determined the best way to launch the project with librarians, including how to introduce the Year One theme. Before the Year Two April training, the leadership team convened with subject matter experts (SMEs) for a planning discussion, which was informed by Year One

project evaluation reports, site visits, program templates, and other sources of initial project insights.

The thematic focus of each of the three years' trainings were:

1. Year One – Force & Motion
2. Year Two – Building & Engineering
3. Year Three – Sound and Light.

*"Thank you for 3 years of
STEM trainings!"*

VELI-STEM Librarian

In the first two years of the project, the April two-day trainings were conducted through a blend of lecture to the full group and small-group, hands-on activities. There was a predominantly lecture format in the initial two years, because there was the need to explain to and foster proficiency among librarians in foundational STEM concepts and skills, such as:

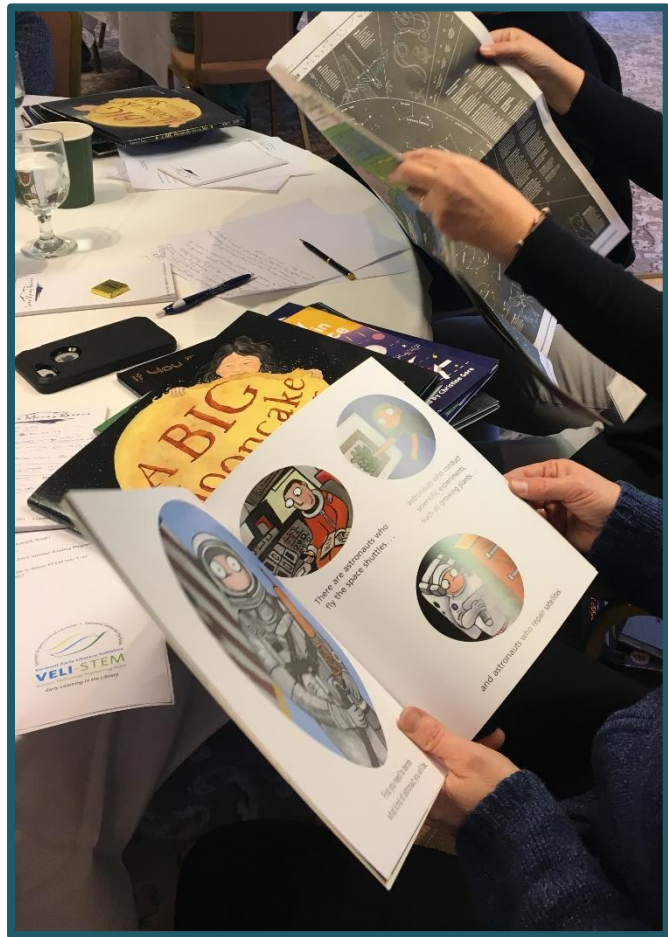
- (a.) Basic STEM inquiry;
- (b.) What science means to/how it is experienced by young children;
- (c.) The need for children to have repeated experiences with materials (i.e., same materials, same book over and over again);
- (d.) Identification of opportunities to incorporate ongoing STEM learning experiences for young children and their families;
- (e.) Identification of different settings in which STEM learning experiences can be provided for young children;
- (f.) Engaging young children in science-learning opportunities;
- (g.) Encouraging young children to develop and use a range of science practices as described in the Next Generation Science Standards;
- (h.) Accessing early STEM literacy resources;
- (i.) Transferring STEM knowledge and skills to early childhood educators; and
- (j.) Conducting STEM outreach and informational exchanges with the library's community.

By the final year, the core group of seasoned project librarians already had a grounding in basic STEM concepts and skills; so, the Year Three two-day April training transitioned more immediately on Day One into hands-on activities after a quick discussion.

The agenda for the Year Three April 2018 two-day training is included in [Appendix A](#), with a more detailed description of that training contained in [Appendix B](#). Information on books and materials distributed during the Year Three April 2018 training are included below under [Objective Three](#) and in [Appendices C](#) and [D](#). The agendas for the two-day April trainings during the first two years of the project are included in the appendices of the evaluation reports for [Year One](#) and [Year Two](#), along with more detailed descriptions of trainings and books and materials distributed.

October one-day follow-up trainings:

For the first two years of the project, the October one-day follow-up training was less of a formal training and more of an opportunity for the project leadership team to reinforce key STEM constructs, take stock of the previous year's activities and progress to date, facilitate an exchange among librarians of helpful information and suggestions on effective STEM-infused library practices going forward, and gather essential feedback for course corrections. They also helped reinvigorate librarians and equip them with additional STEM activities to conduct throughout the winter. Since the Year Three October training was the final project convening of librarians, the focus was on equipping them with ideas for the 2019 Summer Reading Program theme (space exploration). Librarians were provided with picture books about Space (and the Moon) and, prior to the October gathering, were asked to bring their favorite space/moon books in to share with their colleagues.



Subject matter expert, Meredith Wade, attended once again, and she presented ideas about STEM activities librarians could do around this topic. Librarians were thrilled to have ideas and supplemental books to support the 2019 Summer Reading Program.

"The best training in 10 years. Very usable ... Awesome materials and learnings, and the opportunities to talk to and have fellowship with other librarians is invaluable."

VELI-STEM Librarian

The agenda for the Year Three October 2018 one-day follow-up workshop is included in [Appendix E](#), and information on the books distributed during that workshop are included in [Appendix E](#). The agendas for the one-day October workshops during the first two years of the project are included in the appendices of the evaluation reports for [Year One](#) and [Year Two](#).

Key Lessons Learned – Librarian training:

- **Utilize peer learning** – All of the project training sessions were led by eminently qualified subject matter experts, and post-training survey findings and anecdotal comments from librarians indicated very high ratings and reviews of the professional trainers. That said, one of the most notable successes of the

trainings from the librarians' perspective seemed to be the chance the trainings regularly provided to share with and learn from their peers about infusing STEM throughout their library practices and overcoming barriers to STEM programming and stakeholder engagement: **"Peer learning through VELI-STEM trainings has absolutely helped around ways to combine books with activities – math-based, observation-focused ... each librarian has different ways of looking at things in their own unique way; rare chance to talk to peers – very valuable."** The peer learning component of trainings, as well as Facebook exchanges, seemed to be an integral part of building the requisite confidence in STEM knowledge and skills for librarians to succeed.

- **Fill professional development gaps** – In a small rural state like Vermont, easily accessible professional development opportunities are in limited supply. The VELI-STEM project not only provided essential project-specific training, it helped fill gaps in the Vermont librarian professional development landscape.
- **Leverage different streams of programming** – In Year Two of the project, training activities on the year's theme, "Building and Engineering," were tailored to work with that year's upcoming national Summer Reading program focus, "Building a Better World." That worked so well that in Year Three, instead of going with the previously selected theme of Air and Water, the leadership team chose Sound and Light, because it would tie in with the next Summer Reading program topic, "Rock it!" At the Year Three April training, activities were introduced that could be used in conjunction with both the VELI-STEM project and the 2018 Summer Reading program.
- **Librarian see, librarian do** – Trainings seemed much more effective when STEM inquiry techniques were modeled for librarians. During site visits, librarians were observed using the same language in their programming that they learned in the trainings. Therefore, trainings should provide opportunities for librarians to actually experience what they will be expected to present. This best practice makes particular sense with librarians, most of whom are more literature-oriented than science-oriented.
- **Build planning into trainings** – At each year's trainings, ample time was allowed for exploring how to adapt a particular activity to each library's space and audience. Librarians found networking with their project colleagues to be important as they planned. The time provided at each training to plan STEM programming enabled librarians to return to their libraries, ready to hit the ground running. Any training should include that planning time.
- **Make evening activities "pop"** – An important lesson after Year One was that the evening activity on the first day of the two-day April trainings had to be

"The VELI-STEM trainings provide an amazing base of education and experience ...rare opportunity to get intensive information."

VELI-STEM Librarian

active and highly engaging, given librarian “cognitive bombardment” and post-dinner physical fatigue after a full day of training. The more active small groups of librarians were, the more the activity seemed to provide a bonding experience for librarians – both veteran and any new additions. Another lesson was that the evening activity should be something librarians could parlay into activities for groups of families. These two lessons guided the design of evening activities in Years Two and Three that were both fun and useful, and that type of two-for-one approach to designing trainings was helpful in maximizing the limited time with librarians each spring.

Objective 2: Develop and monitor an online STEM Clearinghouse of Resources for project librarians to access and inform during the three years of the project

In Year One, a comprehensive [VELI-STEM website](#) was launched on a Weebly platform that is publicly accessible and linked to the [Vermont Department of Libraries website](#). The [VELI-STEM website](#) has served several important purposes, including linking VELI-STEM librarians to STEM resources and supporting replication of STEM-infused library practices across Vermont and beyond. The [VELI-STEM website](#) includes a range of resources, such as training information, programming resources (activity ideas, book lists), photos, library links, and project-specific administrative and evaluation forms that others could adopt and adapt for their own purposes if they wanted to replicate the project. The [VELI-STEM website](#) also hosts the [STEM Clearinghouse of Resources](#), which is a compilation of the strongest hands-on STEM activities in the field available in an easy-to-use, online location. Clearinghouse content was driven, in part, by VELI-STEM librarian survey scores and anecdotal feedback during the project indicating areas where additional supports were needed on how to encourage children to develop and use a range of STEM practices.



The Weebly site was promoted to Chief Officers of State Library Agencies (COSLINE) members who had attended an October 2017 training in Burlington, and there was an uptick in site usage after that conference, with anecdotal feedback from at least one COSLINE member about conducting their own training using the Weebly resources. There also was an uptick in site

usage after a delegation from the VELI-STEM project gave a presentation at the 2018 Association for Rural and Small Libraries (ARSL) conference.

Site analytics indicate that the site is used regularly, with an average of 550 views per week and over 150 unique visitors each week in Year Three, up from an average of 118 visits per *month* from May through October 2016 of Year One of the project.

Key Lessons Learned – STEM Clearinghouse:

- **Efficacy of electronic dissemination of resources** – The [VELI-STEM website](#), including the [STEM Clearinghouse](#), proved to be an effective strategy for developing an on-line presence in support of project administration, sharing resources with project librarians, and supporting broader replication.
- **Increase site traffic** – A lesson learned after the site was launched in Year One was how important it was to remind librarians about the website and for the leadership team to post resources more frequently and then notify librarians to drive them to the site and encourage them to use it regularly. It also was important to spread the word to librarians outside of the project and to early care providers/educators and encourage them to use the resources.
- **Learning from peers, not paper** – The Year One April training included an introductory session, “Program Templates & Planning.” Librarians provided input on the design of the template at that first training and were asked to complete Program Templates throughout the first project year. The Vermont Center for the Book edited completed program templates for consistency and posted them on the VELI-STEM website to make program activity and story hour ideas widely accessible. However, it proved to be an onerous task for librarians, who already have heavy workloads. Also, librarians each have unique programming planning and delivery styles; so, the templates were often too idiosyncratic to be of value to other librarians. In addition, the templates often missed the content mark, including either too much or not enough information; so, in both cases, the leadership team had to revise the templates for uniformity, which sometimes caused them to lose their utility. In short, learning directly from peers, not from paper templates, seemed to be more effective.

“I am grateful for the VELI STEM website ... so that we have access to all of the information that was covered at the training to refer back to and use.”

VELI-STEM Librarian

Objective 3: Investigate with librarians ways to recognize STEM language and concepts in picture books and other existing library resources, in order to be confident and competent in using this knowledge in ongoing programming

All of the project's trainings were designed to increase awareness and comprehension of STEM language and concepts in books and other STEM materials, as well as instill confidence and build competence in ongoing programming and trainings that librarians provided. The project was particularly successful with instilling confidence, as many of the librarians shared.

"VELI trainings have given me an understanding of concepts and [importantly] the materials to incorporate science and intentional language into almost all of my programming for young children."

VELI-STEM Librarian

Given the efficacy and popularity of the experiential learning model used in Years One and Two trainings, the bulk of Year Three trainings were hands-on, with "lecture" style instruction kept to a minimum. At each training, a collection of old and newly published picture books was used to illustrate how a "regular" book can be a jumping-off point for the introduction of a STEM activity, with an emphasis on how STEM can be gleaned from almost all books. Whenever possible at trainings, "everyday" picture books were used and examples were given of how they could be used in STEM programming to help librarians generate ideas. Also, specific books were tied to activities during trainings. Consequently, during the site observations of STEM programming that the leadership team members conducted, librarians demonstrated an ability to "find" STEM in a variety of books and incorporate it seamlessly throughout their programming.

"When developing themes for story times, I now look consciously for STEM concepts to incorporate and am seeing the faces of kids and parents light up with understanding."

VELI-STEM Librarian

Librarians also were trained and supported in using other materials for their STEM programming. For example, at the Year Two April training, a portion of the first day centered around three building and engineering activities with specific challenges at three stations that librarians rotated through: "Building With Cups, Cardboard and Blocks"; "Building With Keva Planks"; and "Building With Straws and Connectors." Librarians were given time

and guidance in experimenting with the materials so that they could gain proficiency, since each library received a set to take back to their libraries. A programming process of plan, create, test, improve, and finalize was shared with the librarians, and librarians followed that process during the training activities.

Year Two and Year Three trainings also included discussions about the possible ways to connect each year's VELI-STEM project theme to that year's national Summer Reading Program theme, with peer brainstorming sessions in small groups seated around tables, so librarians could bounce ideas off each other.

Key Lessons Learned – Competence and confidence in recognizing STEM language and concepts:

○ **The essential C: Confidence –**

The value of the librarian supports provided throughout the project (e.g., trainings, on-site visits, on-line resources) seemed to be as much about building confidence as about building knowledge and skills.

“My STEM library practices are much more intentional now that I have the language to talk about STEM concepts and have passion and excitement about the topics ... It has instilled greater confidence in me ... I have begun pursuing my MLS.”

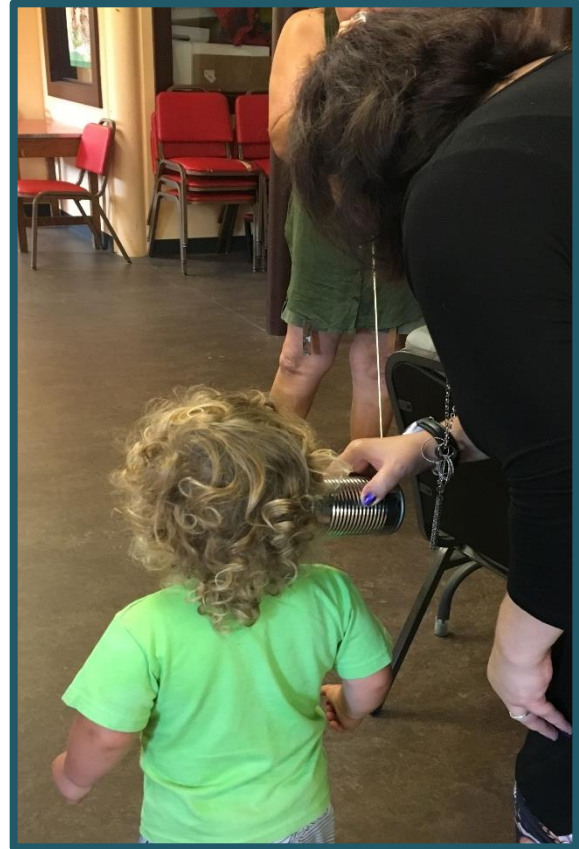
VELI-STEM Librarian

For some librarians, the

confidence building experience took the form of an epiphany that they had been doing STEM all along, even before their participation in the project (and doing it well). For other librarians, the confidence building experience took the form of an epiphany that even **“book worms can be scientists”** and can help others discover their own inner scientist. As one of the project librarians captured so well, **“I thought I knew nothing about science or teaching science, but the VELI-STEM trainings have provided us with the knowledge, skills, and confidence to try new things, only to discover that I’ve been doing STEM all along. I’m just more intentional and confident about it now – the trainings taught me to use what we’ve been doing and let it lead to wherever it goes, using STEM inquiry both in the planning and delivery of programs.”**

- **Create a ripple effect** – The reach of the project trainings extended well beyond library practices geared toward the target population of 3-7-year-olds. As one librarian noted, **“The project changed my approach to leading STEM programs for all ages – in addition to this project that focuses on 3-7-year-olds, our library also has a 4th-6th grade STEM program and there’s lots of crossover with using guiding questions, which has been really helpful since I haven’t received any training for the program for the older kids.”**
- **Target professional development voids** – As previously noted, the project trainings filled a critical professional development void in Vermont, not just around STEM-focused library practices, but related to delivering effective programming to young children. According to one of the project librarians: **“The trainings enriched my awareness of effective STEM programming I could do with kids, as well as my awareness of Vermont Early Learning Standards ... Great to have opportunities to be training on library practices specifically geared toward youth ... other than VELI-STEM, we would only have Vermont Library Conference one time a year.”**

- **Tap into the power of experiential learning** – The experiential learning format, immediately followed by opportunities to explore how to apply each activity to librarians’ settings and audiences, was used throughout all three years of training activities, which provided an immediacy to recognizing STEM language and concepts in the context of instantly applying that knowledge to program development. This, in turn, translated into librarian proficiency in using picture books and other existing library resources in STEM displays, activity centers, and other STEM programming: **“The VELI-STEM project has increased the intentionality of my library practices. With my story hours, other activities, and materials, I factor tactile learning in more.”**



Objective 4: Assist librarians in the infusion of appropriate STEM content into their regular practice, including collection development, ongoing programming, conversations, bibliographies, displays and outreach

As already noted, modeling was a particularly effective approach to assisting librarians with infusing STEM content throughout their library practices. Trainings were much more effective when STEM inquiry techniques were actually conducted – not just explained – by the leadership team and SMEs for librarians to observe. Trainings included modeling of how to infuse STEM content into a variety of programs. That approach worked well early on in the project’s trainings; so, it was maintained over the three years.

Using concrete examples of what STEM-infused library practices look like also was an effective approach to assisting librarians with the infusion of appropriate STEM content into their regular practice. For example, when training librarians in Year Three on the STEM theme Sound and Light, librarians were given ideas of how to incorporate some of these Sound activities from the training into what they were already doing around using music and singing in their story hours. The Vermont Center for the Book developed, printed, and distributed Sound and Light cards for families and child-care providers (see [Appendix D](#)).



Peer learning was another effective approach to assisting librarians with infusing STEM content throughout their library practices. Librarians were given time at each training to share with one another about how they were able to achieve success with infusing STEM throughout their library practices in various ways. For instance, at the Year Three October training, librarians were asked to share concrete ideas. One of the librarians outlined how she was able to incorporate a STEM component into almost all of her youth/children programming and how she planned to sustain that approach. Other librarians talked about continuing meetings with child care providers even after the project concluded, noting that STEM would still be a good topic, because there were so many books in their collections now that could lend themselves to the topic.

“I’m infusing “play” with STEM and taking this out into the community.”

VELI-STEM Librarian

In addition to various approaches used at in-person trainings, remote tools were also effective in assisting librarians with the infusion of appropriate STEM content into their regular practice, such as the closed VELI-STEM Facebook group. Throughout the three years of the project, librarians shared a great deal of what they were doing in their libraries (along with new ideas they had come across) on the closed Facebook group. This project’s group of librarians seemed more familiar with Facebook than any other social media platform; so, there were frequent posts about STEM content and themes. In essence, once the Facebook page was set up by the project’s leadership team, the librarians created their own learning community. Seeing pictures posted on Facebook from fellow librarians proved to be an effective means of encouraging librarians to think outside of the box and try new delivery systems.

Key Lessons Learned – Infusing STEM throughout library practices:

- **Be concrete** – A key lesson learned early on in the project and then applied successfully going forward was the importance of being concrete in the delivery of trainings. At the initial Year One training, trainers introduced several Force

and Motion activities that did not readily translate into library programming for ages 3-7. The simple ramp activities that had been reviewed in Year One with librarians *did* work well, and the leadership team learned that the more hands-on experiences librarians have with the materials they are given (without any enhancements), the more confident librarians become in their STEM programming abilities. It is far more important to be concrete about (and model) what librarians should do with children, including what vocabulary to use and which open-ended questions to ask. The further afield the trainings went in the area of STEM, the less useful the information proved to be. While it is useful to some librarians to learn about STEM concepts in more detail – even to an abstract level, that needs to be done in moderation to reach the most librarians the most effectively. For example, with Sound and Light, most librarians were more interested in learning how to explore shadow play inside their libraries than learning everything there is to know about light.

- **Focus on changing perspectives, not just practices** – Assisting librarians with infusing STEM content throughout their library practices was as much about instilling a mindset of child-like wonder, as it was about teaching concrete skills and imparting specific knowledge. In the words of two of the project’s librarians:

- **“This project has made science more fun ... I look at science in a different way and from a child’s perspective.”**
- **“It’s like I have a new set of lenses through which to view my library practices.”**

“Looking ahead, we plan to continue the STEM programming, since we’re now equipped with the training needed.”

VELI-STEM Librarian

- **Recognize the layers of target audiences** – The impact of supporting STEM-infused library practices ended up going well beyond STEM program participants and other library patrons – librarians commented on how much it even transformed the way *they* view science: **“Really enjoyed the project - has had an impact on librarians like me, not just kids, families, and community members.”**

- **Target supports on engaging child care providers/early educators** – A challenge that a number of librarians in the project continued to encounter throughout all three years of the project was engaging child care providers/early educators in STEM trainings, given the

“Adult education programs are the most difficult sell for us at the library for VELI. The attendance is poor or zero despite lots of advertisement and enticements. We can do adult education at the school and get a few people for programming but is usually the same people and not that dynamic. Educators report that although they are interested, they don't have the time.”

VELI-STEM Librarian

few child care providers/early educators based in the small communities in which project libraries were located and their full schedules. Discussing this challenging aspect of the project at the annual librarian trainings seemed to boost confidence in persevering.

- **Expect a learning curve** – Librarians tend to be avid learners, but often they are not trained scientists. Projects geared at infusing STEM throughout library practices need to anticipate a gradual transformation from bibliophile to researcher: **“I’m not very science-oriented (more literature-oriented, like many librarians).”** However, over time, librarians embraced this new way to approach their library practices: **“My involvement in this project opened up the range of materials I include in the library collection for kids ... I’ve now added STEM learning opportunities ... and it has motivated me to do STEM inquiry at story times and in STEM programming.”**

Objective 5: Provide librarians with non-fiction books, STEM resources and hands-on learning materials to be used throughout the library setting and in programming with children, families, and child care provider trainings and in the development of library “Discovery Science Centers”

In all three years of the project, VELI-STEM librarians were provided with STEM books and materials on the year’s theme at the annual April two-day training and again at the annual October one-day convening.⁴ In October of the final year of the project, librarians were provided with books about Space (and the moon) to help prepare for the 2019 national Summer Reading Program theme (space exploration).

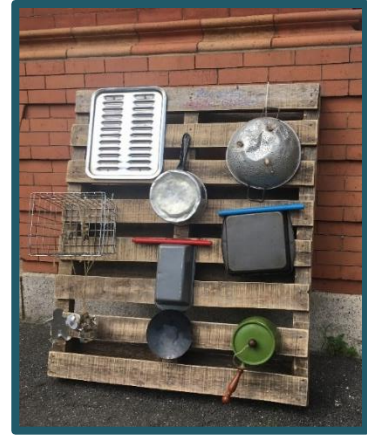
With some of the project’s thematic areas, such as Light in Year Three, there was a paucity of relevant fiction books. For light, the classic, *Moonbear Shadow* proved to work well. Also, there are many non-fiction books that explore STEM topics and the leadership team’s task was to weed through as many as possible and find interesting ones that librarians would be able to share easily with young children.

In addition to books, other STEM resources were provided to librarians through the project. For instance, in Year Two, librarians were provided with a 400-piece set of Keva planks and a large (705-piece) set of Straws & Connectors. While Keva planks have been used by Vermont Center for the Book over the years, VCB had never provided them as part of a project, due to the expense, nor had VCB seen them in action in a group setting. More recently, VCB has been using them in trainings with child care providers and has seen the enthusiasm they bring to that

⁴ The lists of books and materials provided to librarians in Year Three are in [Appendices C, D](#) and [F](#). Details on books and materials distributed during the first two years of the project can be found in the [Year One Evaluation Report](#) and [Year Two Evaluation Report](#).

kind of building; thus, the decision to provide them to librarians to use in their STEM programming with children, families, and child care providers/early educators.

With many of the STEM themes, every day, ordinary objects proved to be useful materials and seemed to work best for activities, which meant the programs could be easily replicated. For example, with Sound and Light, pots and pans could be used for Sound activities and cellphone flashlights could be used for Light activities.



Key Lessons Learned – STEM books & resources:

- **A little guidance goes a long way** – Librarians really took the STEM resources that were provided to them and ran with them: **“The STEM bibliographies provided through the VELI-STEM project really help guide my family programming, story times, collections. I look at reviews in School Library Journal of books listed in the VELI-STEM bibliography.”**
- **Provision of materials is a vital component of project impact** – Cultivating STEM knowledge, skills, and confidence were essential to the project’s impact, but so was the distributions of free STEM materials. According to one of the child care providers/early educators who received training and materials through the project: **“The kiddos in my Registered home child care program have gotten so much out of using the recycled materials by building and incorporating other toys with them ... Also, the books were a huge hit.”**
- **Plan early for sustainability** – At the last October workshop, a discussion was facilitated with librarians about ways to provide more STEM resources in their libraries after the project concluded. There was a brief brainstorm session on their community resources and how they might apply for small grants. In hindsight, it would have been helpful to emphasize this from the beginning of the project so that strategy sessions could have been held with librarians throughout the three years.

Objective 6: Support development of programmatic relationships between librarians and community STEM resource people

Outreach is a part of regular library practice; so, all the project’s participating librarians already had a foundation in that aspect of library practices. Also, almost all of the VELI-STEM librarians were selected out of the larger pool of Vermont Early Literacy Initiative (VELI) libraries. As part of their VELI participation, librarians were supported in serving children and families and

offering outreach to local organizations, including child care programs. Therefore, a vast majority of VELI-STEM librarians already had a proven track record of collaboration and outreach in their local communities, and the VELI-STEM project was designed to provide these librarians with additional opportunities to leverage their community engagement skills and knowledge specifically around STEM.

“This year was much improved over last year in terms of stakeholder participation. I was more outgoing and felt comfortable engaging folks about the VELI-STEM grant. Although I did not have overwhelming response, the ones who engaged were interested and very supportive and helpful. Their input was valuable and enriched my program offerings.”

VELI-STEM Librarian

During the early stages of VELI-STEM, librarians struggled with community engagement. Based in rural libraries with limited resources, many of the librarians faced the challenge of accommodating an additional demand on their time and attention as they got up to speed on the STEM programming elements of the project; so, outreach had to take a back seat initially. Also, some of the librarians were STEM neophytes who felt the need first to build up their science-based knowledge, skills, and confidence, before having a firm enough grasp on the concepts to knowledgeably identify and then reach out to potential community partners.

In response to these early project challenges, the leadership team allocated time at subsequent trainings to brainstorm with librarians on the different relationships they could forge in their communities. As the project went on, there was an increase in the total number of STEM community stakeholders engaged. That said, some of the project’s annual themes lent themselves more to community engagement than others. Based on anecdotal reports, the Year Three theme, Sound and Light, may not have been as conducive to fostering community relationships. Several libraries had relationships with local musicians, and those were mined to promote Sound explorations, but Light and Shadows may have been a more difficult topic to promote with community stakeholders.



A more tenable challenge related to community outreach throughout the project was engaging child care providers/early educators to fulfill the VELI-STEM's objective of providing training on early STEM literacy, with some of the most common issues cited including:

"I believe that our childcare training was the most informative and successful for the [child care] providers who attended. They were VERY disappointed when we reminded them that this was the last year of this particular grant. Several of them told us that these trainings are the only ones they are able to attend and that the giveaways provided were the only new books they obtained this past year. We will have to find a way to continue this connection in years to come."

VELI-STEM Librarian

- A limited or no pool of child care providers/early educators for librarians to train within the library's own community;
- Lack of willingness or ability of libraries in nearby towns to partner with VELI-STEM sites in providing trainings to the providers in neighboring communities;
- Poor or no attendance by child care providers at trainings that librarians offered.

Librarians were given time at trainings to brainstorm with each other with leadership team facilitation about ways to engage with child care providers/early educators around STEM trainings and programming. Hearing others' experiences with this element of the project seemed to boost librarians' confidence in persevering despite the obstacles they were facing, and great strides were made as the project went on in connecting with child care providers/early educators through innovative strategies to provide early STEM literacy training, such as multiple libraries teaming up to conduct regional trainings instead of individual trainings within each library's small community.⁵

"My greater community received a 'Promise Community' grant and my library is a participant. Through the contacts with the Promise Community, I will be holding another series of programs for childcare providers."

VELI-STEM Librarian

Also, a few of the VELI-STEM libraries seized outreach opportunities presented by their town's designation as a Promise Community. Leveraging Federal Early Learning Challenge – Race to the Top funding, the Department for Children and Families of the Vermont Agency of Human Services has invested in 24 [Promise Communities](#), an initiative that strives to

make use of both state and local resources and promote community-based changes to improve school readiness for young children in Vermont's highest need, rural (by federal standards) communities.⁶ Being a VELI-STEM library within a Promise Community afforded libraries an opportunity to infuse STEM content throughout their library practices in intentional ways around their community's efforts to "move the needle" on Kindergarten readiness, third grade

⁵ More detailed data on child care provider/early educator trainings are cited below under [Objective 8](#).

⁶ Let's Grow Kids. (no date). [Vermont's Promise Communities blog](#).

reading proficiency, and high-quality afterschool programs.⁷ For example, one of the VELI-STEM libraries conducted a Science in the Park STEM program, which entailed local playground activities offered in partnership with the Promise Community initiative. As part of the project, the Vermont Center for the Book offered resources to support VELI-STEM libraries in Promise Communities in being seen as an important resource.

Key Lessons Learned – Engaging community STEM resource people:

- **Expand horizons** – The new knowledge, skills, and mindset cultivated through the project inspired new avenues for library outreach practices: **“I’ve become involved in CLiF (Children’s Literacy Foundation) and partnered with the [local] Conservation Commission and the Vermont Energy Education Program (VEEP kits).”**

“While we have the support and assistance of our staff, Trustees, Town government and Select board, I feel that the level of engagement could and should be deeper. I had also planned on getting re-involved with [[Building Bright Futures](#)] about our VELI-STEM programs (and more) and that is something we failed to do. We will make it a goal moving forward.”

VELI-STEM Librarian

- **If it ain’t broke** – Not only did librarians conduct innovative outreach, they also relied on some tried and true avenues of library outreach to support the project and deepen connections with their library’s community stakeholders: **“An important part of the success of this program has been the involvement of Board members.”**

“This was my first year at [the library] and also as a part of this wonderful grant. I was very confused by this concept and didn't feel confident in my abilities to bring STEM to stakeholders or the community and focused ... on story times and the children aspect of the grant and to try and make that as successful as possible.”

VELI-STEM Librarian

- **Take it one step at a time** – In hindsight, it may have been more effective to layer on some of the components of the program – perhaps, beginning with building a firm foundation of delivering programming to children, families, and child care providers/early educators. Then, once the sense of proficiency and confidence in that project area increased, adding on other components of the project, such as community engagement.

⁷ Department for Children and Families, Vermont Agency of Human Services. (February 26, 2015). [Promise Community Initiative - Frequently Asked Questions](#); Let’s Grow Kids. (no date). [Vermont’s Promise Communities blog](#).

- **Provide intensive, upfront support of outreach** – A project like this in which community engagement is an integral component requires early, intensive supports, communication, and monitoring to facilitate feasible plans and ensure those plans get implemented. In hindsight, a greater effort could have been made to be more proactive in encouraging community relationships. Although

“Programming at the Farmer’s Market ... is a win-win setting – kids love being outdoors, and it draws people to the market. I had 3-4 high school students helping out; so, was able to do 4 simultaneous activities and bridge the material to different age ranges (2 to 82!).”

VELI-STEM Librarian

it was clear that some of it was taking place (in the Facebook group), it could have been increased with the right timing and type of supports. The lesson was that greater emphasis should have been placed on community partners (stakeholders). Many libraries did that outreach on their own, and suggestions/strategies should have been developed to help them along.

- **Seize natural opportunities** – In addition to supporting librarians to seek out and proactively foster project partnerships with community stakeholders, it proved important to foster a set of lenses for recognizing opportunities for collaboration that may already, naturally exist, as one community partner described: “[the librarian] was walking by when I had my telescope set up [in town], and I mentioned doing an eclipse event, which the library had been thinking of ... I helped promote the eclipse activity

through the [local] Astronomy Foundation and through a friend. It was such a fun event – a hands-on opportunity to do some real science where everyone, regardless of actual age, became a 3-7-year-old. There was more of a spirit of ‘play’ than ‘teach’.” Peer learning was especially helpful in helping librarians develop a set of lenses for where such opportunities exist.



Objective 7: Develop and promote a YouTube channel and other social media for librarians to use as resources and networking tools

A variety of social media were utilized to provide librarians with ready access to STEM resources and networking tools and to support replication of the project.

As already noted, a VELI-STEM Facebook (closed) group was created in Year One, which had a spike in activity in subsequent years of the project without any targeted encouragement from the leadership team, indicating that Facebook was a natural entry point for librarians to share about their STEM practices. Almost all the VELI-STEM libraries were already on Facebook with their own library site for promotion and outreach purposes, and they posted photos and captions for their programming. Thus, the Facebook group was highly successful. The Facebook page will be kept active and librarian interaction will continue to be encouraged as long as the librarians find it beneficial. Also, resources will continue to be added to the Weebly site, with on-going outreach to librarians to encourage their STEM activities and sharing with others.

The project called for the creation of a YouTube channel to serve as a resource for librarians and promote the project. A VELI-STEM YouTube channel was created in Year One of the project, as was a blog post to the [Institute of Museum and Library Services](#) (IMLS). However, the Vermont Department of Libraries was without a Youth Services Consultant for most of Year Two of the project (the position that took the lead for the Department on the VELI-STEM project); so, these two social media outlets were not further developed.

Key Lessons Learned – Social media as resources and networking tools:

- **Stick with what works** – The creation of a Weebly site worked. Project librarians – and later on, other librarians – accessed the site, checked out the links, and used the activities. The leadership team posted PDFs of STEM resource cards, which were downloaded by others and distributed. Bibliographies also were posted and downloaded. Librarians checked out the web sources of some of the STEM materials such as acetate sheets and prisms for Light explorations, or extra sets of Keva planks for child-care providers to purchase if possible. Subject Matter Expert, Meredith Wade, shared online videos of some of the activities she had presented from PBS Kids and other sites. The closed Facebook group also worked well. Therefore, those online tools were maintained throughout the project and will be maintained as a resource going forward.
- **Know your audience** – While the remarkable popularity and utility of Facebook for linking librarians to resources and to one another was more of an organic phenomenon that happened on its own than a concerted effort, the leadership team’s move to set up the Facebook group reflected how well they gauged the right tools to support their librarian partners on the project.
- **Think ahead** – Not every contingency can be accounted for in advance, especially for a multi-year project. As one of the project leadership team members noted, **“In Year Two of the project, the Vermont Department of**

Libraries was without a Youth Services Consultant for most of the year ... so social media outlets were not further developed mid-project.” Leadership teams need to be facile in temporarily or permanently shifting key administrative duties to other leadership team members in the event of any team member transitions, and every team member needs to be fully on board with whatever contingency plans are developed, to avoid mid-project setbacks.

- **Diversify your toolbox** – Since not all of the project’s planned social media strategies fully materialized, it was prudent of the VELI-STEM leadership team to start off with a variety of tools for librarians to use to access resources and network. Developing a YouTube channel may have been an impossible goal. It would have taken Vermont Center for the Book considerable additional time to make this happen and solicit video (and create video) from librarians for upload, and the staff changes at the Vermont Department of Libraries throughout the project made it difficult for them, as well.

Objective 8: Evaluate efficacy of training and materials for refinement and dissemination of results, and for replicability⁸

Project Evaluation Overview – A detailed evaluation plan was fully developed by a consultant in close collaboration with the leadership team during the early phase of the project’s implementation in Year One, based on the high-level evaluation plan synopsis that was included in the VELI-STEM grant proposal. The fully developed evaluation plan was designed to gauge whether training and materials provided to librarians resulted in an improvement in the librarians’ proficiency in the delivery of STEM programming to 3-7-year-old children and in the infusion of STEM concepts and skills throughout their regular library practices. Based on extensive feedback from librarians after Year One of the project, a number of modifications were made to evaluation processes to ease the data burden on librarians, but the project’s overall evaluation plan remained largely intact throughout the three years of the project. The evaluation process included the following key elements:

1. Librarian completion of a Baseline Self-Assessment Survey prior to the project being launched and post-training surveys after each of the three annual spring trainings, on STEM knowledge, concepts, skills, and delivery levels/proficiency.
2. Librarian tracking of quantitative data and anecdotal descriptions each project year on –
 - a. STEM programming they delivered;
 - b. Family Member/caregiver perceptions of the impact of STEM programming on them and their child(ren);
 - c. Child Care Provider/early educator perceptions of the impact of the early STEM literacy training they received from librarians;
 - d. Outreach librarians conducted with STEM resource people.

⁸ Refer below to [Objective 9](#) for a discussion of dissemination and replication of project results.

3. Leadership team evaluative input on trainings and on-site observations of a sub-sample of STEM programs over the three-year project period.
4. Evaluator interviews of a subset of librarians and involved community members on the impact of the project.

The key take-aways from librarian feedback on the evaluation processes recommend:

- Uniform data submission deadline for all data sets, regardless of programmatic cycles;
- On-line process for data submission;
- Electronic posting of all data submission forms and instructions;
- Optional name field on surveys to boost response rates and candor;
- Clarification of terms that librarians might find ambiguous within data submission forms;
- Regular/repeated distribution of concise evaluation requirements.

Over the three years, data submission rates varied widely, for two key reasons. First, all of the participating libraries were rural with lean staffing models and resources. This required librarians to prioritize the project demands placed on them, with top priority most often given to the delivery of STEM programming and lower priority sometimes assigned to data submission in cases where tough decisions had to be made around allocating time and resources. Second, although submitting all four datasets was “required,” there were no enforced consequences for not submitting data. Every librarian continued to have access to the same project resources and supports regardless of whether they submitted all, some, or none of the “required” data. That said, librarian-driven improvements to the evaluation processes after Year One resulted in a much more intuitive process the following two years. That resulted in a dramatic boost in compliance in Year Two, but by the final data deadline at the end of Year Three, many librarians had already started moving on to new priorities; so, submission rates dropped. Response rates for each evaluation tool are provided directly below for each year of the project. Of the 24 remaining librarians at the end of Year Three, 22 (92%) submitted at least one of the four required data sets.

Evaluation Tools:	Year One		Year Two		Last Year	
	# submitted	submission rate	# submitted	submission rate	# submitted	submission rate
April Post-Training Librarian Survey	25	100%	25	100%	24	100%
STEM Programming data	20	80%	25	100%	20	83%
Family Member/Caregiver Surveys	15	60%	21	84%	18	75%
Child Care Provider/Early Educator Surveys	14	56%	21	84%	13	54%
Community Stakeholder data	22	88%	25	100%	21	88%
Any of the required datasets	23	92%	25	100%	22	92%
All required datasets	8	32%	19	76%	11	46%
On-Site Observations by Leadership Team	2	N/A	6	62%	8	*123%

* (3-year target = 13 on-site observations versus 16 actually conducted)

Key Lessons Learned – Project Evaluation:

- **Keep data requirements manageable** – Librarians were the linchpin of the project’s evaluation. However, while many of the librarians were quite facile with data, their attention was pulled in many directions with the implementation of VELI-STEM on top of a full plate of on-going library responsibilities. Therefore, it was imperative to keep all data requirements as streamlined and intuitive as possible. Here’s one librarian’s perspective: **“The data piece was a little overwhelming the first year – hard to remember to take pictures, track numbers, administer surveys, and take notes while being so swept up in the delivery of new STEM programming, but it wasn’t overwhelming after the first year.”**
- **Capture the story behind the numbers** – Data don’t always measure what they appear to be measuring on the surface. Sometimes, there’s an important story lurking beneath the numbers; so, it’s important to include a section in all data collection forms for respondents to provide explanatory, animating comments. For instance, there were cases where a family member assigned low points on a survey question about whether their child received a grounding in STEM knowledge and skills, but then the parent explained in the comments section that their child was much younger than the target age of the STEM activity (e.g., was an infant versus a child within the target 3-7-year-old age range) and had trouble following along with the activity; so, the low rating was more of a reflection of the child’s lack of developmental readiness to participate in an activity that was designed for older children than a true assessment of the impact of the STEM program.
- **Use averages** – Given the fluctuation from year to year in the rate of data submission, it was hard to draw conclusions about which statistics represented true increases or decreases in measures versus how much the increases or decreases were actually mathematical artifacts of fluctuations in data submission rates. For example, it is unclear whether the spike in total number of programs delivered in Year Two was an actual high for the three-year project or, instead, whether it reflected the spike in data submission rates, given that the *average* number of programs offered per library was actually higher in Year Three (40) than in Year Two (36), but the rate of data submission was *lower* in Year Three (83%) than Year Two (100%). Therefore, it’s important to report out on both total counts and averages, the latter of which is a more comparable benchmark from year to year since averages account for fluctuations in number of librarians submitting data.
- **Set realistic and enforceable data requirements** – Every effort was made to minimize the data reporting burden on librarians and, while an overwhelming majority made a valiant attempt to comply with all data requirements, it was only “required” in principle, not in practice, which the data submission rates reflect. This was especially true in Year One, when many librarians were fully consumed with getting up to speed on the project on top of other regular library

responsibilities, as well as during Year Three, when the project was coming to a close and librarians were moving on to new priorities. Over all three years, there were no enforced consequences for not submitting data. Every librarian continued to have access to the same project resources and supports regardless of whether they submitted all, some, or none of the “required” data.

Statistical and Anecdotal Findings – Statistics and narrative comments are provided below to capture the project’s key accomplishments, along with comparative analysis across years to capture trends, successes, and barriers over the project’s three-year lifespan.

IMPORTANT CAVEAT: Given the fluctuation from year to year in the rate of data submission, caution should be exercised in drawing any conclusions about whether statistics represent true increases or decreases in measures or, instead, mathematical artifacts of fluctuations in data submission rates. Some extrapolations based on averages and number of respondents are provided on each data set to capture how the data *may* have looked if all librarians had submitted all four of the required datasets. However, such extrapolations assume that all libraries had similar outcomes with their STEM efforts, which is unlikely.

That said, the following statistics and anecdotal feedback vividly convey how profoundly the project prompted regular and effective STEM-infused library practices.

❖ *Impact of Trainings and Materials*

DATA SOURCES:

1. *Post-training Librarian Survey*
2. *Anecdotal feedback from librarians*
3. *Interviews of librarians*
4. *On-site observations by leadership team*

TRAINING AND MATERIALS FINDINGS:

- *VELI-STEM provided training and resources to 33 librarians over the three years of the project, with annual involvement of 24-26 librarians each of the project’s three years.*
- *There has been an overall average increase among librarians in all STEM knowledge & skill levels from an average level of 3.6 at baseline to 4.7 after the Year Three two-day April training on a 5-point scale (total 1.1 percentage point increase which is an over 30% increase from baseline).*

“This has been so much fun! The peer exchanges/ learning and the cumulative effect of the VELI-STEM trainings on top of the VELI trainings (on socio-emotional development, etc.) have helped really solidify the importance of the ‘predictability’ element of STEM concepts and why that’s important to infuse in programming for young children.”

VELI-STEM Librarian

- *Biggest Gain – The biggest gain since the project was launched was 1.6 percentage points on the ability to regularly provide STEM learning opportunities for 3-7-year-*

old children, which had the lowest baseline score (greatest amount of room for improvement).

- **Smallest Gain** – The smallest gain since the project was launched was just under a percentage point (0.8) on having a sense of the different settings in which STEM learning experiences can be provided, which already had a strong baseline score (limited room for improvement).
- **Likewise, there has been an overall average increase in understanding among librarians of all STEM concept & delivery areas since the project was launched three years ago, from an average level of 3.2 at baseline to 4.5 after the Year Three two-day April training (total 1.3 percentage point increase from baseline, which is an over 40% increase):**
 - **Lowest Score/Biggest Gain** – While encouraging children to develop and use a range of science practices as described in the Next Generation Science Standards continues to generate the lowest score at 4.2 (and generated some anecdotal feedback about limited understanding), the 1.9 percentage point gain represents the largest gain for any STEM concept & delivery area, indicating that training has been effective for many of the librarians;
 - **Highest Score/Smallest Gain** – The highest score of 4.7 was on what it means to engage children in science-learning opportunities within a context of science engineering practices, but the 1.2 percentage point increase in that area was the smallest gain among all STEM concept & delivery areas, although that still represents a 34% rate of improvement since the baseline score of 3.5 (there was only moderate room for improvement).

Post-Training Librarian Survey	Baseline	Year One	Year Two	Year Three	Trends <small>Green = improvement Red = decline</small>	Change since baseline
Average librarian self-reported STEM knowledge & skill Levels <small>(Scale of 1-5, with 5 being fully proficient)</small>	3.6	4.7	4.8	4.7		1.1
Average librarian self-reported level of understanding of STEM concepts and delivery <small>(Scale of 1 to 5, with 5 indicating a strong understanding)</small>	3.2	4.3	4.5	4.5		1.3

- **Consistent with February 2016 baseline and April 2016 and 2017 post-training surveys, the most frequently shared comments on the April 2018 post-training survey conveyed praise and appreciation for the value of the project trainings. Unlike prior years, a number of comments focused on continuing the project beyond the current three-year Institute of Museum and Library Services grant’s expiration on October 31, 2018.**

Q6 Other comments, observations, suggestions about the two-day VELI-STEM training:

Tools In-depth Concepts Content Fun Reporting
Confident Young Children Activities
Worthwhile Training Second Day
Opportunity Year 3 Sound and Light
Summer Reading Program Books and Materials
Prepared Group Explore Quality
Books

In addition to the librarian survey, the evaluation of the annual trainings included observations and feedback from the leadership team:

- ❖ **What worked particularly well at the Year Three two-day April 2018 training –**
 - Jumping right in to talk about what librarians have done that's STEM-related (they always have things they did that we would never have thought of);
 - Making explicit connections to the national Summer Reading Program theme, especially with the evening activity that would tie to family programming;
 - Modeling the use of everyday materials (water, chopsticks, rulers, rubber bands, tissue boxes, cellphone flashlights, small toys) to explore Sound and Light;
 - Having the evaluator in attendance.
- ❖ **Main challenges encountered at the Year Three two-day April 2018 training –**
 - Having two new librarians attend may have been more of a challenge, but because of the format of the training, everything worked out (this is more thanks to the other librarians than to the leadership team).
- ❖ **Key take-aways from the Year Three one-day October 2018 training –**
 - Many of the librarians plan to continue to incorporate STEM into their programming and to think about possible funding to support those efforts;
 - Many librarians talked about continuing contact with community child-care providers (this was a big takeaway from the grant);
 - Being able to listen to other librarians talk about their successes was once again important to the leadership team and to librarians, and it also was important to hear about the challenges librarians faced and have everyone contribute to possible solutions;
 - All appreciated the suggestions and brainstorming around STEM activities that can be offered as part of the 2019 national Summer Reading Program (space exploration), especially ideas offered by SME Meredith Wade of fun inquiry activities that can be done easily at the library with children and/or families or at a child-care training.
- ❖ **Main challenges encountered at the Year Three one-day October 2018 training –**
 - Not everyone attended – 5 of the remaining 24 librarians could not attend, and one of the project veteran librarians has shifted out of her role as a children's librarian and sent her replacement, so the newer librarians did not get the benefit of

hearing everyone share about their STEM programming (those who were absent did, at least, receive their books afterwards).

Key Lessons Learned – Librarian STEM training & materials:

- **Leverage STEM themes with other library programming** – Tying each year’s topic into the national Summer Reading Program was a proven strategy for richer programming.
- **Ensure a democratic process** – Being able to listen to librarians talk about their successes was important to the leadership team and the librarians. Hearing about librarians’ challenges and having everyone contribute to possible solutions also was important.
- **Host regular convenings throughout each project year** – The project hosted two librarian gatherings per project year. Each April, there was a two-day librarian training on scientific inquiry, focusing on the year’s theme. Also, there was a one-day librarian workshop held each October, which was less of a formal training and more of a chance for librarians to learn from one another, for librarians and the leadership team to exchange important insights, and for expert input on STEM-infused library practices. Using the second meeting as an opportunity to encourage librarians to continue STEM programming throughout the winter months proved to be important, as was encouraging them to repeat programming from previous project years.

❖ **STEM Programming**

DATA SOURCES:

1. *Librarian data*
2. *Anecdotal feedback from librarians*
3. *Interviews of librarians*
4. *On-site observations by leadership team*

STEM PROGRAMMING FINDINGS:

- ***The scope of what librarians were able to achieve with STEM programming expanded exponentially over the three years of the project:***
 - ***Total of over 1,900 STEM programs delivered over the project’s three years.***
 - ****Total number of STEM programs per year increased by over 300%, up from 198 programs offered in Year One to 797 in Year Three. ([See below for an extrapolated value for total number of programs.](#))***
 - ***For all three years of the project combined, total STEM program participation levels were over 30,000⁹, including 3-7-year-olds, other-aged children, family members and other caregivers, child care providers/early educators, and community members***



⁹ Some individuals may have participated in more than one STEM program; so, participation statistics speak to the scope of interest and engagement in STEM programming but may not represent unique counts of individuals.

- ****The total participation in all STEM programs among all libraries during Year Three was 12,615, representing a 240% increase from 3,711 in Year One, and the range of total annual participants per library was 25-2,000 in Year Three, up from 47-751 in Year One. ([See below for an extrapolated value for total number of participants.](#))**
- **Another statistic that held steady (and maintained a strong majority) is the percentage of libraries for which 3-7-year-old children were the most frequent primary target audience (76% in Year One and 80% in Year Three), which is in keeping with the focus of the VELL-STEM project.**
- **The most frequent setting among all STEM programs during Year Three (90%) was once again the library (86% in Year One), but – like other years – anecdotal feedback revealed some interesting settings outside of the library, such as sidewalk sales, farmers markets, schools, parks, and asynchronously in families’ homes (take-home kits).**

Variable	Year One	Year Two	Year Three	Trends Green = improvement Red = decline	Change since Year One
# of STEM programs reported by librarians	198	905	797		303%
Total participation (children & adults) in all STEM programs combined	3711	13778	12615		240%
% of librarians selecting children 3-7 years old as the most frequent primary target audience for their STEM programming	76%	80%	80%		4%

- **Averages for STEM programming also experienced a remarkable increase over the three years of the project:**
 - **There was an over 340% increase in the average number of STEM programs provided annually per library, up from 9 in Year One to 40 in Year Three.**
 - * Extrapolating the total number of programs offered in Year Three based on the per library average of 40 and based on all 24 libraries reporting on this data set versus the actual 20 who did, there may have been approximately 960 total programs provided among all libraries versus 797, which would have meant annual increases across all three years of the project.
 - **There was an over 250% increase in the average total participation¹⁰ in STEM programs annually per library, up from an average total participation of 177 in Year One to 631 in Year Three.**
 - **Again, extrapolating the total participation among all 24 libraries versus just the 20 who reported on this dataset using the average total annual participation of 631 per library, there may actually have been an approximate total participation of 15,144 in STEM programs among all libraries versus the total 12,615 reported by 20 of the libraries (again, that would have meant annual increases across all three years of the project).
- **One of the key insights gleaned from librarian anecdotal feedback on their STEM programming was how much they are now weaving STEM throughout all their library programming.**

¹⁰ Participation counts may include the same participant more than once, if they attended multiple programs, and includes both children who participated and adults who accompanied them.

Variable	Year One	Year Two	Year Three	Trends Green = improvement Red = decline	Change since Year One
Average annual # STEM programs delivered per library	9	36	40		344%
Average annual # STEM program participants per library	177	551	631		256%

Key Lessons Learned – STEM programming:

- **Offering programs in a series** – Given the complexity and rich learning opportunities presented by certain STEM concepts, many of the librarians tried to offer programs over the course of a series of successive sessions.

“Our STEM programming really occurred over the week we held our Library Camp this year. It was been difficult to get numbers for our story times that are offered every month ... Camp, however, was a large success.”

VELI- STEM Librarian

However, getting the same families and children to attend all of the sessions within a single series proved to be challenging. As one librarian noted, **“A continuing challenge was bringing everyone together multiple times for a series of sessions within a single program (30 participants 1st time, 10 2nd time, 0 3rd time). Lots of planning, coordinating, promoting.”** One solution for low attendance at programs offered in a series was to bring them to locations with “captive audiences,” such as schools: **“This was a challenging year as participation in programming was very inconsistent ... The families that did attend were appreciative of the free books but not to the extent that they would come back the next week to receive another. My plan is to visit the [local] Elementary School Pre-K program ... to share these programs and materials with them. Hopefully having a more captive audience will allow me to be more successful.”**

“I like that we are now confident enough to present a successful childcare provider training, requiring lots of planning and set-up, or pull an easy story time together and incorporate STEM topics without too much planning at all.”

VELI- STEM Librarian

- **Redefine success** – Librarians engaged in this type of work should be encouraged not to define the success of STEM activities as children achieving particular products at

the end of the activity. Instead, success should be defined as how engaged and inquisitive children get throughout the activity. As one librarian captured it: **“During a felt board activity designed for kids to identify which shape is different, one girl picked up the shapes and noticed the difference in firmness of shapes (hard or soft) and how they could be sorted by that attribute, as well as by shape, and this was after several weeks from the activity first being introduced ... the girl's wheels had continued turning well beyond the original activity and she had retained the questioning way of thinking demonstrated earlier.”**

- **Bring STEM programming to the people** – As the adage goes, “If the mountain will not come to Muhammad, then Muhammad must go to the mountain.” When librarians struggled to get children and families to their libraries for STEM programs, they brought the STEM programs to children and families.

“Conducting these activities at the farmer's market worked really well for us. There are already a lot of people there, parents are comfortable leaving their kids at the library tent while they check out the market, and there's way more room to spread out and do stuff than we have at our library!”

VELI-STEM Librarian

❖ **Family Member/Caregiver Survey on STEM Programming**

DATA SOURCES:

- 1. Post-STEM Program Family Member/Caregiver Survey**
- 2. Anecdotal feedback from librarians**
- 3. On-site observations by leadership team**

FAMILY MEMBERS/CAREGIVERS

FINDINGS:

- *****The total number of surveys completed by family members/ caregivers was 180 in Year Three, down from 209 in Year One¹¹. (See [extrapolation below for number of surveys.](#))**

“I am very grateful for having stimulating, thought provoking, and engaging activities provided by the library. The activities opened my children's mind to the importance of science, technology, art (music and drama) and engineering and how that relates to the everyday activities in our lives.”

Family Member Feedback on Children's STEM Programming

¹¹ Given the relatively small communities of many Vermont libraries, the size of the pool of local families/caregivers was limited; so, librarians were encouraged to use their discretion in avoiding excessive surveying of the same family members/caregivers over and over, “We don't want the evaluation element of the project to deter participation in the wonderful trainings and programs you're conducting!!”

- **There was an average of 10 surveys completed per library by family members/caregivers on the STEM programming they attended with their child(ren), down from 14 surveys per library in Year One.**

*****Extrapolating the total number of surveys completed in Year Three based on the per library average of 10 and based on all 24 libraries reporting on this data set versus the actual 18 who did, there may have been approximately 240 total family surveys completed among all libraries versus 180, which would have meant annual increases across all three years of the project.**

- **The percent of 3-7-year-old children whose family members/caregivers rated them as "very" engaged in the STEM programming dipped slightly to 79% in Year Three (from 82% in Year One).**
- **The percent of family members/caregivers who felt "very much" more able to encourage their children's interest in STEM dipped slightly to 76% in Year Three from 78% in Year One.**

Variable	Year One	Year Two	Year Three	Trends Green = improvement Red = decline	Change since Year One
# of Family Member Surveys submitted on STEM programming experience	209	296	180		-14%
Average # of Family Member Surveys submitted per library	14	14	10		-29%
% of 3-7-year-old children who were "very" engaged in STEM programming	82%	79%	79%		-3%
% of family members/caregivers who felt "very much" more able to encourage the children's interest in STEM	78%	78%	76%		-2%

- ******The total number of children of all ages reported by family members/caregivers as having participated in STEM programs dropped to 407 in Year Three, down from 485 in Year One (16% decrease).**

- ******The sub-total of participation for children 3-7 years old also decreased, down to 268 in Year Three from 355 in Year One (25% decrease).**

******Again, these drops might, at least in part, actually be a mathematical artifact of the decrease in number of family surveys submitted in Year Three.**

Variable	Year One	Year Two	Year Three	Trends Green = improvement Red = decline	Change since Year One
Total participation of children of all ages reported by family members at STEM programming <small>(some children may be counted more than once if they attended more than one program)</small>	485	733	407		-16%
Sub-total participation of 3-7-year-old children reported by family members at STEM programming <small>(some children may be counted more than once if they attended more than one program)</small>	355	451	268		-25%

One of the most common themes among family member/caregiver comments was their joy in seeing their child so fully engaged in the fun of STEM learning. A sub-sample of the comments family members/caregivers provided on the Year Three survey is provided below:

STEM Programming – what family members/caregivers had to say:

- *[My child] always came home from the STEM ...program happy and energetic due to his curiosity [that the session] stimulated. Great program (phenomenal instructor)*
- *My grandson likes hands on activities, so this program was good for him.*
- *My 4 year old loved trying all the different instruments and making various sounds.*
- *The program was wonderful and my toddler was repeating things learned.*
- *Great program! All 3 of my children [ages 5-12] loved the hands on learning part of the program. The free books were really nice too.*
- *I don't care for STEM topics. I realize my children still need to explore STEM topics. Thank you for the book and reminding us parents that STEM topics are important.*
- *I hope that you will be going to the school again this year to teach the programs that you do at the library. The school could learn a lot from you.*

Key Lessons Learned – Families/caregivers:

- **One size does not fit all –**
Young children are developing so rapidly that a span of 5 different ages can have profound implications when it comes to tailoring developmentally appropriate teaching modalities and learning supports to young children, as was the case with the 3-7-year-old target population of VELI-STEM. Many of the family surveys included feedback from parents/caregivers about their younger children not being able to follow along in STEM activities as well as their older children could, and as one

"I'm finally starting to get through to parents/caregivers that they can do STEM activities on their own and that the process of discovery/inquiry is as important as any certain outcome – that the real objective is to give kids the opportunity to try new things and see where they lead. STEM's predictability imparts opportunities to guide parents in supporting their children's social-emotional development – librarians can use neutral, non-blaming STEM language to encourage them to let their children try things on their own, whether they fail, succeed or discover something all on their own."

VELI-STEM Librarian

librarian noted, **“Some of the ideas/programs don't work with the considerable age range of target population (3-7-year-olds) – there's lots of developmental variance within even those five ages, especially for the younger years. It can be so hard to work STEM concepts into story times for those younger kids.”** When defining a project's target population, the nuances of developmental ranges need to be captured in training and programming. Since many resource-strapped libraries tend to have more heterogenous children's programming that encompasses a wide range of ages, training also needs to attend to how to include adaptations for children outside of the target range.

- **Planting a seed** – In addition to librarians delivering STEM learning opportunities for young children in libraries and other settings, a key component of the VELL-STEM project was transferring their ability to do that to family members and other types of caregivers (including child care providers/early educators), in order to exponentially foster young children's interest in STEM outside of library-based STEM programming. It took some trial and error, as well as perseverance, but librarians learned ways to plant seeds in families and other caregivers that could grow outside of the library. As one family member remarked: **“I like that [the librarian] does experiments with things that we have at home so we can try them at home again.”**

“[Our local library's] staff always provides our children ... with clear directions, inspiring ideas, and awesome materials for the kids to use creatively. We all learn a lot and are excited to continue our experiments and building at home.”

Family Member Feedback on
Children's STEM Programming

❖ **Child Care Provider/Early Educator Survey on Early STEM Literacy Training**

DATA SOURCES:

- 1. Post-training Child Care Provider/Early Educator Survey**
- 2. Anecdotal feedback from librarians**
- 3. Anecdotal feedback from leadership team**
- 4. Interviews of child care providers/early educators**
- 5. On-site observations by leadership team**

CHILD CARE PROVIDER/EARLY EDUCATOR FINDINGS:

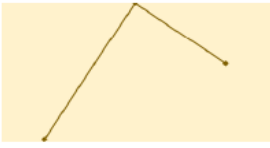

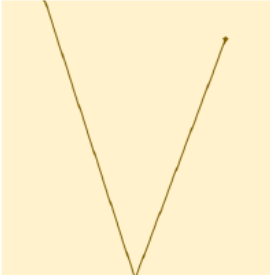
- **Over the course of the project, librarians experienced increasing success in reaching child care providers/early educators to**

“The STEM activity ... correlated PERFECTLY with our curriculum... Kids were actively engaged and excited about their learning! Parents that were there and participated were very impressed!”

Child Care Provider/Early Educator

conduct early STEM literacy trainings, as both anecdotal information from librarians and quantitative data from the Child Care Provider/Early Educator Survey attest:

- Over 170 early STEM literacy trainings for child care providers/early educators, who – in turn – made or will be making STEM learning opportunities available to over 1,700 young children
- The number of surveys completed by trained child care providers/early educators rose from 18 in Year One to 60 in Year Three (over 230% increase).
- In Year One, only 9 (36%) of the VELI-STEM libraries were represented among completed child care surveys, whereas 13 (54%) of libraries had surveys completed on the training they conducted in Year Three.
- The average number of hours of early STEM literacy training that each child care provider/early educator received was 2 (same as Year One), with a range of 1 to 2.5 hours of training in Year Three.
- The percent of child care providers/early educators reporting that the STEM training by librarian(s) "very much" helped them develop a better understanding of what STEM means to children ages 3-7 years old held steady in Year Three at 88% (89% in Year One).

Variable	Year One	Year Two	Year Three	Trends <small>Green = improvement Red = decline</small>	Change since Year One
# of Child Care Provider/Early Educator Surveys submitted on STEM training experience	18	94	60		233%
Average # of hours of training received per CC Provider/Early Ed Survey respondent	2	2	2		0%
% of CC Providers/Early Eds reporting that the STEM training by librarian(s) "very much" helped them develop a better understanding of what STEM means to children ages 3-7 years old	89%	82%	88%		-1%

- The percent of child care providers/early educators who introduced or planned to introduce STEM learning experiences to the 3-7-year-old children in their program dropped slightly from 100% in Year One to 97% in Year Three.
- *****The total approximate number of children who were/will be provided STEM learning opportunities following the training that child care providers/early educators received rose from 163 in Year One to 511 in Year Three.

*******The seemingly large jump over three years in number of children who were/will be involved in the STEM learning experiences child care providers/early educators introduced/plan to introduce may be, at least in part, an artifact of the spike in number of surveys submitted; yet, since more library communities were represented, it does do a better job of capturing the extent of the ripple effect of this program throughout communities in Vermont, as librarians train child care providers/early educators, who – in turn – provide early STEM learning opportunities to the children in their programs.**

Variable	Year One	Year Two	Year Three	Trends Green = improvement Red = decline	Change since Year One
% of CC Providers/Early Eds who introduced/ planned to introduce STEM learning experiences to the 3-7-year-old children in their program following training provided by local librarian(s)	100%	93%	97%		-3%
Approximate # of children who were/will be involved in the STEM learning experiences CC Providers/Early Eds introduced/planned to introduce	163	1045	511		213%
Average # of children per CC Provider/Early Ed who were/will be involved in the STEM learning experiences	11	11	9		-18%

- **There were shifts in how the survey respondents were distributed across certain types of early care and education programs, with representation among family child care programs holding steady at around a third of all survey respondents:**

- **Preschool program – 26% in Year Three, down from 44.4% in Year One**
- **Early Head Start/Head Start program – 8% in Year Three, up from 0% in Year One**
- **Child care center – 20% in Year Three, up from 11% in Year One**
- **Family child care program – 33% in Year Three, holding steady with 33% in Year One**
- **“Other” child care/early education program – 13% in Year Three, up from 11% in Year One.**



- **A prominent theme among comments shared by child care providers/early educators on the Year Three survey was how useful and applicable the training and materials were on early STEM literacy. A sub-sample of the comments child care providers/early educators provided about the early STEM literacy training they received in Year Three is provided below:**

“The STEM training has been awesome.”
Child Care Provider/
Early Educator

STEM Programming – what child care providers/early educators had to say about the training they received:

- *Provided lots of inspiration and ideas.*
- *Thank you! Great hands on resources!*
- *Love concept of "introduction" for k-1. Let them play and experiment.*
- *Very fun, informative, and helpful. Great instructors that made learning fun.*
- *Great ideas of how to ask questions and extend what I already do.*
- *Asking questions to make the children think further and ways to make the activities work for younger children too were good, because I have a lot of younger children ... I liked the sunset that we got to watch from the window ... someone noticed it and [the librarian] talked about how the sunset cooperated with the STEM part about light and looked up online why the sunset makes colors having to do with the light and she reminded us that we don't have to be experts on science and math, but we can know how to find answers that kids or us adults have. That is good too, because I didn't like science and math in school.*
- *Wonderful suggestions and ideas and learning for all age groups. I feel like I am prepared to elaborate on this! Thank you!*

Key Lessons Learned – Child care providers/early educators:

○ **Engaging child care providers/early educators –**

As noted previously, a challenge that a number of librarians in the project continued to encounter throughout all three years of the project was engaging child care providers/early educators in STEM trainings. One of the more successful strategies for engaging providers was teaming up

with another library or two to provide regional trainings. Also, conducting the trainings on site worked well, and promoting the free STEM resources that providers would receive during trainings also was effective. Another successful strategy was to center child care providers/early educators trainings around family events. As one child care provider/early educator noted: **"[The librarian] brought STEM to present to families [of children in my early learning program], inviting parents to stay and read books, and did activities with pulleys, ramps, and other materials."**

"Three librarians worked together to provide a training for child care providers from all three of their towns ... Collaborating on this training really made the activities come alive—they worked well together. [Also], all of the providers are isolated in some way geographically and getting everyone together in one place definitely made sense."

VELI-STEM Leadership Team On-site Observation

- **Modeling as an effective training strategy** – Just as with project trainings of librarians, child care providers/early educators seemed to prefer observing librarians actually conduct STEM activities instead of being

“[The librarian’s] STEM programming (both the programs she delivered and how she modeled STEM program delivery when training me) sparked my awareness and interest in delivering that to my students on-going.”

Child Care Provider/Early Educator

subjected to didactic methods of training, with survey respondents frequently remarking on how effective it was for librarians to explain techniques as they were actually using them with children to encourage STEM inquiry. A preschool teacher shared: “[The librarian] came to my program and demonstrated and explained how to deliver STEM in my classroom’s block area, making ramps and such. By modeling how to experiment, teaching the use of STEM language, and showing how to do inquiry questioning, [the librarian] demonstrated for me how to be more intentional with STEM (e.g., using weighted balls and asking the children to think which would be fastest down the ramps). That introductory experience of learning what STEM is motivated me to take an all-day training ... on STEM programming for Head Start-aged children.”

“I paired the Red Clover Book Award list with STEM and STEAM activities and visited 5 local early childhood centers as well as the elementary after school program (K-1 group) MONTHLY. I also provided these activities at the library story time. Very well received by all.”

VELI-STEM Librarian

- **Carefully consider the timing and designated collector of feedback from child care providers/early educators** – The significant increase in total number of surveys completed and number

of libraries represented by those surveys over the course of the project may reflect the impact of revisions suggested by librarians and then incorporated into the timing and administration method of the surveying process. Initially, surveys were administered to child care providers/early educators at the end of the project year by the project evaluator. At the end of Year One, child care providers/early educators reported that it was hard to remember the impact of the STEM training they received given the delay in completing the survey from the time they received the training, and librarians reported that child care providers/early educators were reluctant to provide feedback to someone they had never met (the project evaluator); thus, the changes in the surveying process and spike in survey responses in subsequent project years.

❖ **STEM Community Stakeholders**

DATA SOURCES:

- 1. Librarian data**
- 2. Anecdotal feedback from librarians**
- 3. Anecdotal feedback and summarized observations from leadership team**
- 4. Interviews of community stakeholders**

COMMUNITY STAKEHOLDER FINDINGS:

- **Over the project’s three years, community outreach and engagement with STEM resource people was in excess of 2,000¹²**
- *******In Year Three, there were 587 total STEM community stakeholders collectively engaged among all librarians, up from 572 in Year One.**
 - **The average number of community stakeholders each individual librarian engaged rose by 12%, from 25 in Year One to 28 in Year Three, with the number of stakeholders each librarian recruited ranging from a 0 to 80 in Year Three.**
 - *****Extrapolating the total number of community stakeholders among all 24 libraries versus just the 21 who reported on this dataset using the average of 28 total annual stakeholders engaged per library, there may actually have been approximately 672 total stakeholders engaged among all libraries in Year Three versus the total 587 reported by 21 of the libraries.**
- **Drilling down to a more granular level, here are the changes in total number of each type of community stakeholder engaged among all librarians for Year One versus Year Three:**
 - **STEM professionals/businesses – 53 in Year Three, up from 43 in Year One**
 - **Library staff, directors, and trustees – 153 in Year Three, down from 175 in Year One**
 - **[BBF Regional Council Members](#)¹³ – 68 in Year Three, up from 39 in Year One**

“[The local library] absolutely increased STEM infusion throughout children’s programming. Really liked how [the librarian] merged STEM with each summer reading program. Programs and family nights were always full. [The librarian] reports monthly with statistics on the programming to Library Trustees and Friends of the Library and it all sounds very positive. Early literacy is the keystone of education. Really like the fun approach to science – great approach. Tremendous success.”

VELI-STEM Community Stakeholder

¹² Some individuals may have been engaged more than one year; so, participation statistics speak to the scope of community engagement in STEM programming but may not represent unique counts of individuals.

¹³ [Building Bright Futures \(BBF\) Regional Councils](#) are a central artery in Vermont’s early childhood system of care, health and education. Regional Councils organize local communities to engage, plan and act. They disburse local, state, and federal funds to community programs and offer technical support so services to children and families are high quality, accessible and affordable. The purpose of this network of regional councils is to align solutions at the local level with effective policy at the state level. [Retrieved from the [Building Bright Futures website](#)]

- **Town officials – 57 in Year Three, up from 4 in Year One**
- **Public or private school staff members – 149 in Year Three, down from 173 in Year One**
- **Child care organizations¹⁴ – 60 in Year Three, down from 66 in Year One**
- **Higher education staff and faculty members – 10 in Year Three, down from 13 in Year One**
- **Other local library stakeholders – 37 in Year Three, slightly down from 39 in Year One**
- **Over the course of the three-year project, the most highly engaged types of STEM community stakeholders were public or private school staff members (25% of all stakeholders in Year Three, 26% in Year Two, and 30% in Year One) and library staff, directors, and trustees (26% of all stakeholders recruited in Year Three, 24% in Year Two, and 31% in Year One and).**
- **In Year Three, more librarians utilized AmeriCorps volunteers than was cited in previous years.**

“I’m glad the library has an interest in STEM and that the VELI-STEM project didn’t end up complicating library practices, which was an initial concern, and glad for the opportunity to partner with the library on STEM.”

VELI-STEM Community Stakeholder

Variable	Year One	Year Two	Year Three	Trends <small>Green = improvement Red = decline</small>	Change since Year One
# of STEM community stakeholders engaged	572	961	587		-3%
Average # of STEM community stakeholders engaged per library	25	38	28		12%

- **In Year Three, one of the most remarkable aspects of this component of VELI-STEM project was how much more proficient, creative, and enthusiastic librarians were about engaging the community in their STEM activities:**

¹⁴ “Child care organizations” refers to child care providers/programs engaged beyond training purposes, such as members of Starting Points, VAEYC representatives, and other child care providers/programs that may have helped with delivering programming, recruiting child care providers for trainings, etc.

STEM Community Stakeholder Engagement – what librarians had to say:

- *[Our] bookmobile is staffed by AmeriCorps members and AmeriCorps required that they do STEM programming at some of their stops. All through August [2018,] they chose [the Year 3 VELI-STEM focus of] Light and Sound as their theme.*
- *[Library] staff ... set out the Straws and Connectors at some of their weekly stops at the rec center and the farmer's market, and at several other community events during summer, and give out STEM-in-a-Bag kits.*
- *VELI STEM was a wonderful excuse for getting people outside the library interested and engaged in helping with programming. Community members seemed interested in helping youth to learn about science in particular and had an interest in helping with programming ideas and educational tools.*

Additional¹⁵ Key Lessons Learned – Community Stakeholders:

- **From a challenge to a solution** – One of the exciting shifts over the course of the three-year project was a greater awareness and appreciation among librarians of the value of engaging STEM resource people, with the sense of feeling daunted by trying to conduct outreach for the VELI-STEM project decreasing over time. Instead of that component feeling like an overwhelming undertaking that consumed scarce resources needed for other components of the project, STEM outreach came to be viewed by many of the librarians as a means of infusing STEM throughout their library practices more effectively and efficiently.
- **Peer learning** – In the small rural libraries of this project, there are very few staff members (in many cases, just one part-time staff member) to do all of the work, which limited how much time and attention could be devoted to this project while also keeping up with regular library practices. Therefore, the need for libraries to outsource some of the work of a project like VELI-STEM needs to be built into the project's implementation model (e.g., facilitate peer exchanges around utilizing volunteers).

❖ Leadership Team On-Site Observations of STEM Programming

DATA SOURCES:

- 1. On-site observations forms completed by leadership team**
- 2. Anecdotal feedback from leadership team**

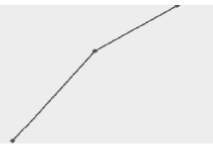

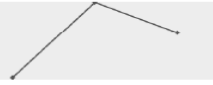

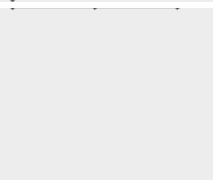
ON-SITE OBSERVATION FINDINGS:

¹⁵ Primary key lessons learned about librarian engagement of community STEM resource people are provided above [under Objective 6](#).

- **During the three years of the project, important insights were gleaned by leadership team members from first-hand observations of STEM programming at a sub-sample of libraries:**
 - **There were 16 on-site observations conducted over the course of the project – 2 in Year One, 6 in Year Two, and 8 observations at 6 sites in Year Three, representing a total of over 60% of the 25 VELI-STEM libraries (over 120% of the target of 13 total observations for the three-year project period).**
 - **Of the 117 total number of 3-7-year old children who were observed participating in STEM programs during all of the on-site observations, an average of 100% seemed "very engaged" in the STEM programs for all three years.**
 - **Of the 80 total family members/caregivers who were observed participating in STEM programs over three years, an average of 78% seemed to "very much" encourage their child(ren)'s interest in STEM during or after STEM programming.**

"[The librarian] had a STEM tent for children at the local farmer's market most Friday afternoons over the summer ... very informal, with a big blanket laid on the ground under the tent with books and hands-on materials spread out ... Children were fully engrossed ... [the librarian] gave the STEM 'spiel' to some community members (without children) who stopped by and I could tell they were impressed that this was a library program and that it wasn't just a craft activity."

VELI-STEM Leadership Team Member

Variable	Year One	Year Two	Year Three	Trends Green = improvement Red = decline	3-Year Total
% of libraries that have had an on-site observation of their STEM programming and practices	8%	24%	32%		64%
# of on-site STEM program observations conducted by leadership team	2	6	8		16
Total participation of all children	13	85	56		154
Sub-total participation of 3-7-year-old children	13	64	40		117
Average % of 3-7-year-old children observed in active & passive STEM programming who were "very engaged"	100%	100%	100%		100%

- *A sub-sample of the comments that leadership team members shared on the on-site observation forms in Year Three is provided below:*

On-site Observations – what leadership team members had to say:

- *I noticed one of the moms paying attention to how [the librarian] was guiding one of the other children, and then asking those same questions of her own child.*
- *All of the stations featured activities the librarians had learned at the April 2-day VELI-STEM librarian training ... [and] many of their guiding questions and discussion topics mirrored what they had experienced at their own training.*
- *[The librarian] had set up two Exploring Sound stations on the sidewalk outside the library during a Sidewalk Sale the town was holding that Saturday. (She called it “Sidewalk STEM.”) She had two AmeriCorps volunteers helping her so the stations weren’t passive ... There was lots of chatter and lots of opportunities for guiding questions and discussions about Sound.*
- *[The Librarian] had created a Discovery Center exploring Sound with take-home STEM backpacks ... A mom with two young children (and friend of the children) were exploring the center (unguided, pretty much) and ... it was evident that they were regular visitors to the library and had come to expect STEM experiences.*

Key Lessons Learned – On-site observations:

- **Balancing reach with inter-rater reliability** – In Year One of the project, only one member of the leadership team conducted on-site observations, given the departure of the originally assigned person for that role. In Year Two, the same leadership team member plus an additional member conducted on-site observations, which helped to increase the number of observations that were conducted, but might potentially explain at least a portion of the variance in ratings. In Year Three, there was only one observer again. While inter-rater reliability was not tested due to such a small sample size, important considerations for both small and large-scale replications of this project include the number of observers to use and the training of those observers to minimize individual observer bias.
- **If it ain’t broke** – In Year One, the evaluator gathered input from the leadership team to guide the development of a consistent format for conducting on-site observations, which included demographic questions, Likert scale questions, and open-ended questions for anecdotal observations. At the end of the first year, the evaluator solicited feedback on that observation format and the leadership team did not recommend any course corrections. The same held true the following year; so, there were no changes to the approach to capturing observations over the course of the project.
- **Consider the value-add of evaluation strategies** – In addition to providing invaluable insights on the impact and outcomes of the project for the leadership team and evaluator, the on-site observations had the added value of providing

librarians a sense of their accomplishments being heard and seen and being supported through challenges.

- **Sample versus all** – Given the value to all involved of on-site observations, visiting *all* participating libraries would be worth the time and resources, if available. Unfortunately, that was not possible with this project. The librarians who did receive visits were very excited to have someone visit and see what they were doing in their communities. They are proud of what they are doing and they want to share that excitement.
- **Suspend preconceived notions** – Prior to on-site observations, leadership team members assumed that high-quality, meaningful STEM programming might require a threshold of resources that certain small, rural Vermont libraries might understandably lack. However, on-site observers were pleasantly surprised to discover how exceptional the caliber of STEM programming was even in the smallest of small, rural Vermont libraries. The lesson learned is that meaningful STEM explorations can be conducted with the most rudimentary and inexpensive of materials (e.g., used cardboard, tape, scissors, clipboards, and a library trustee in a hard hat), and the ingenuity to use those materials to engage young children and families in STEM learning does not cost a thing.

Objective 9: Disseminate and promote project results

Dissemination and promotion of VELI-STEM project results helped maintain transparency and foster collaboration among the leadership team and librarians in the project's ongoing implementation and continuous quality improvements. It also underscored for librarians how much their efforts were having an impact and being acknowledged. In addition, dissemination and promotion efforts supported replication across Vermont and beyond. Several effective strategies are summarized here.

State and National Librarian Trainings

The project's leadership team and librarians disseminated project results and promoted the project through presentations at several state and national conferences.

Most recently (and [as previously noted](#)), Vermont Center for the Book traveled to Springfield, Illinois, to present at the annual [Association for Rural and Small Libraries \(ARSL\) conference in September 2018](#). Project librarians Bree Drapa (Westford Public Library), Ian Gauthier (Aldrich Public Library, Barre), and Sam Maskell (Rockingham Free Public Library, Bellows Falls) presented on all three years of the project. Each presentation incorporated a very brief talk about each of the project year's themes and the programming librarians had done on that theme, with slides of programs that were held. Following those presentations, the 40 ARSL librarians in attendance from all around the country got to experience the STEM activities through different stations – just as project librarians did at VELI-STEM trainings. Each ARSL attendee received two copies of *Let's Try it Out With Towers and Bridges* by Seymour Simon

and sets of VELI-STEM resource cards. Part of the ARSL presentation included an orientation to the [VELI-STEM Weebly site](#) and attendees were invited to use it as a resource, which – as noted earlier – prompted a subsequent spike in site traffic.

It should be noted that, not only did the 2018 ARSL presentation serve as a *means* of promoting the project, it actually was the *result* of promoting the project (i.e., there has been a nationwide ripple effect of project promotional efforts). The ARSL presentation came about because Becky Heil (Library Consultant, Library Support Network, State Library of Iowa), Sharon Rawlins (Youth Services Specialist, New Jersey State Library), and Donovan Mays (Assistant Director, Stuttgart Public Library, Arkansas) had attended the 2017 [Council of State Library Agencies in the Northeast \(COSLINE\) training](#), prompting the submission of a proposal to ARSL to present VELI-STEM. When the proposal was accepted, Ms. Heil asked Vermont to do the presentation, which attests to the impact of the COSLINE STEM presentation and efficacy of the project team’s promotion efforts.

In May 2018, Vermont Center for the Book and Vermont Department of Libraries co-presented VELI-STEM to approximately 40 librarians at the annual [Vermont Library Association Conference](#). Although the time allotted for the presentation was brief, it sufficed in piquing the interest of attendees. Once again, project librarian Sam Maskell, along with project librarians Michelle Stinson (Springfield Town Library) and Hannah Peacock (Burnham Memorial Library, Colchester), presented the topics and hands-on activities. Sets of VELI-STEM resource cards were given to all attendees.



Also, as just noted, the VELI-STEM training in Vermont at the October 2017 COSLINE conference was a major initiative to promote the project in support of replication. Sally Anderson and Wendy Martin of Vermont Center for the Book and Greg DeFrancis of Montshire Museum of Science met with representatives from 16 state libraries to introduce and talk about the VELI-STEM project. The Vermont Department of Libraries hosted the conference in Burlington, Vermont, from October 2-4, 2017. Each of the 16 participating states in the VELI-STEM session at the conference was provided with four picture books plus

one 400-piece set of Keva planks. The goal was for the 16 library representatives to return to their state with the books and materials, train children's services personnel, purchase additional materials, and offer programming in libraries. The five-hour training was a "train the trainer" model, with stations set up to represent the first two years of programming: ramps and balls (Year One: Force and Motion); and Straws and Connectors, Keva planks, and Building with Cups and Cardboard (Year Two: Building and Engineering). The VELI-STEM team also introduced the [VELI-STEM Weebly site](#) to the group to use as a resource, which prompted a subsequent uptick in site usage. The leadership team is aware of at least one STEM training that took place as a result (in Maryland in mid- October 2018). Evaluation information from that training has been requested.

Web Presence

[As discussed above](#), the online [STEM Clearinghouse of Resources](#) and the [VELI-STEM website](#) where the Clearinghouse is located have been utilized to promote opportunities for libraries in Vermont and across the country to learn how VELI-STEM librarians have incorporated rich, hands-on STEM learning experiences for young children, their families, and community child care providers/early educators. Numerous photos of project activities have been posted on the VELI-STEM website to help animate other content on the site. Also, VELI-STEM libraries have promoted the project on their own individual library Facebook pages, as well as on the closed VELI-STEM Facebook group. In Year Two of the project, there was media coverage of the April 2017 two-day VELI-STEM training on STEM Inquiry: Engineering & Building through a May 5, 2017 piece in the [Eagle Times](#) (serving the Connecticut River Valley in New Hampshire and Vermont).

Evaluation Reports

Pages on the Weebly site have been devoted for posting evaluation reports, and efforts have been made to drive people to those reports.

[Year One evaluation reports](#) were posted on the site for myriad purposes (disseminating results, promoting the project, supporting replication), and librarians and others were pointed to the reports:

- [Sample of Libraries-March 2016](#)
- [Librarian Baseline Self-Assessment Survey Data-March 2016](#)
- [Librarian Post-Training Survey Results-May 2016](#)
- [Year 1 Evaluation Summary](#)
- [Year 1 Evaluation - Full Report](#)



All project librarians were sent the [Year One Evaluation Summary](#) by email and were pointed to the [full Year One Evaluation Report](#) on the Weebly site. A customizable press release template was developed by Wendy Martin of the Vermont Center for the Book for librarians to use to publicize Year One VELI-STEM achievements as a group, while showcasing their own achievements. According to anecdotal feedback, many librarians shared the evaluation summary with their library trustees and other community members. Also, the full Year One evaluation report was shared with project SMEs (Karen Worth, Greg DeFrancis, Meredith Wade, and advisor Pat Fitzsimmons), as well as with several officers of private foundation from which Vermont Center for the Book has occasionally received funding for library programming and librarian professional development. In addition, the entire report was shared with other VCB funders, with highlights of especially relevant evaluation findings.

[Year Two Evaluation Reports](#) also had a dedicated page on the [VELI-STEM website](#), including:

- [Librarian Post-Training Survey Results \(May 2017\)](#)
- [Year 2 Evaluation - Full Report](#)

Like the Year One evaluation reports, the Year Two reports were posted on the VELI-STEM website to support broader replication of STEM learning opportunities for young children by libraries across Vermont and beyond. The reports compiled successes achieved and lessons learned and appended information, materials, and resources for libraries outside of the project to adopt and adapt.

Cultivating a Replication Mindset

Examples of on-going efforts to cultivate a replication mindset throughout the three years include:

- Requiring librarians to track data and share insights on their experience of infusing STEM content throughout their library practices, for compilation and wide dissemination in support of replication;
- Capturing the leadership team’s methods of administrative and fiscal oversight of the project, including tracking expenses related to time and materials;
- Urging Vermont Department of Libraries to share project results with the Vermont legislature;
- Lengthy discussion with project librarians at the October 2018 training about finding funding to continue trainings for project and other Vermont libraries; and
- Vermont Center for the Book’s on-going pursuit of funding to support STEM and other learning opportunities for librarians in Vermont and elsewhere.

Key Lessons Learned – Disseminating project results and promoting the project:

- **Humility is over-rated** – The importance of providing young children with STEM learning opportunities cannot be overstated. The project librarians are now infusing STEM content throughout their library practices to provide their community’s young children and families with opportunities to explore a wide range of STEM topics, practice inquiry, express their curiosity and experience the excitement of problem-solving and genuine discovery. In this way, VELI-STEM libraries are helping to create life-long learners, which will better position the State of Vermont to build the requisite intellectual capital for a thriving 21st Century global economy. As far as the librarians are concerned, this was the most important work they had done in their communities. Project librarians have expressed that the VELI-STEM project has elevated the role of the library, which was certainly one intention of the project. The majority of the project’s librarians now express a better comfort level at presenting STEM programming to children, families, and most especially child-care providers. Going forward, the job of continuing to heighten awareness about this important role of libraries will fall on the shoulders of those doing this important and time-consuming work – librarians, who can sometimes be humble by nature. However, humility is over-rated when sustainability is at stake.
- **Be intentional** – Centralized efforts to promote the success of a project can get lost in the fray of project development, implementation, and administration. It is

“Now it’s time to let everyone know about VELI-STEM, to invite them to access the Weebly and try it out themselves in their own libraries. The Vermont community (local and state) needs to know what’s going on in libraries. That is one of the keys to procuring future funding. We will encourage VTLIB to promote the success of VELI-STEM throughout the state and wherever we (VCB) can, we will do so as well.”

VELI-STEM Leadership Team Member

essential to be intentional and have promotional strategies designed and resources allocated upfront for promotion of the results projects achieve.

- **Librarians are great ambassadors of STEM** – Conference participation by project librarians provided the leadership team with a great opportunity to witness what great ambassadors they are of STEM. The librarians' presentations were lively and informative, and audiences were highly engaged, asking many questions about how to replicate the program. Also, on-site observations provided an opportunity to witness librarian enthusiasm about STEM, which spilled over to community members. While it would have been understandable for librarians to have been overwhelmed by the demands of the project, they “rolled with the punches,” parlaying Vermont traditions, such as summer Farmers Markets and sidewalk sales, into rich STEM learning outlets.

YEAR THREE FINAL PROJECT EVALUATION: SUMMARY OF FINDINGS

High-lights of the total quantitative, as well as the *qualitative*, impact of the project over three years include:

- **33 librarians trained, with annual involvement of 24-26 librarians each of the project's three years –**
 - *Librarian average self-reported STEM knowledge & skill levels rose from 3.6 before the first training to 4.8 after receipt of training on a 5-point scale*
- **Delivery of over 1,900 STEM programs –**
 - *80 percent of 3 to 7-year-olds reported by their family members as being very engaged in STEM programming*
- **Total STEM program participation levels of over 30,000¹⁶ including 3-7-year-olds, other-aged children, family members and other caregivers, child care providers/early educators, and community members –**
 - *Over 75 percent of family members/caregivers felt "very much" more able to encourage their children's interest in STEM*
- **Over 170 early STEM literacy trainings for child care providers/early educators, who – in turn – made or will be making STEM learning opportunities available to over 1,700 young children –**
 - *Almost 90 percent of child care providers/early educators reported that the STEM training they received from librarians "very much" helped them develop a better understanding of what STEM means to children ages 3-7 years old*
- **Community outreach and engagement with STEM resource people exceeding 2,000¹⁷ –**
 - *In the words of a VELI-STEM community partner, "[The local library] absolutely increased STEM infusion throughout children's programming"*
- **Weekly traffic for the VELI-STEM Weebly Site's online STEM resources climbing from an average of 30 unique visitors per week in Year One to over 150 unique visitors each week in Year Three –**
 - *Spikes in traffic analytics occurred after presentations on the project, including on the STEM Clearinghouse of Resources, at state and national conferences.*

In this digital age where the role of libraries is continually transforming, projects like VELI-STEM are a highly effective means of leveraging and elevating the role of the library. Equipping librarians to offer early STEM learning experiences positions libraries to be strategic partners in the creation of life-long learners who are capable of contributing to the requisite intellectual capital for a thriving 21st Century global economy.

¹⁶Some individuals may have participated in more than one STEM program; so, participation statistics speak to the scope of interest and engagement in STEM programming but may not represent unique counts of individuals.

¹⁷ Some individuals may have been engaged more than one year; so, participation statistics speak to the scope of interest and engagement in STEM programming but may not represent unique counts of individuals.

Appendix A



VELI-STEM Conference, Year 3 April 23 and 24, 2018 Lake Morey Inn and Resort

Monday, April 23:

- 8:30-9:15 Arrival and Registration (Morey Room, off lobby—coffee, etc. in lobby bar)
- 9:30 am Welcome and Introductions, Goals of the Conference and Expectations
Sally Anderson, Executive Director, Vermont Center for the Book
- Looking Back Over Two Years: Where was the STEM?
Karen Worth, Chair, Elementary Education Department, Wheelock College
Greg DeFrancis, Education Director, Montshire Museum of Science
Meredith Wade, Science Educator
- 10:30 am Exploring Vibrations and Sound (Stations)
- 12 noon Lunch Buffet (dining room, downstairs)
- 12:45 pm Sound Walks and Sound Maps
- 1:45 pm Introducing the Books
- 2:15 pm Exploring Shakers (plastic eggs and various materials)
- 3:15 pm Build Musical Instruments (Found objects and other materials)
- 4:30 pm Break
- 6 pm Dinner Buffet (dining room, downstairs)
- 7 pm Family Program: Let's Start a Band! (Morey Room)

Tuesday, April 24:

- 7 am Breakfast available in lobby bar
- 8:30 am Introduction to Light Explorations (mirrors, color, shadows)
- 11:30 am Room check-out and distribution of books and materials
- 12 noon Lunch
- 12:45 pm Evaluation Requirements for Year 3 with Kelly Myles
- 1:30 pm Program Planning
- 2:30 - 3 pm Questions and Adjourn

Appendix B

Year Three– Detailed Description of April Two-Day Training

Description of Year 3 Training

Twenty-eight (28) librarians from 25 libraries attended the April two-day training conference. Three libraries sent two people to the conference.

The focus of Year Three was Sound and Light. The Summer Reading Program theme for 2018 was “Rock it!;” so, activities were introduced that could be used in conjunction with that theme.

Each library received a set of books and materials to support Sound and Light explorations.

Greg DeFrancis from the Montshire Museum of Science, Karen Worth and Meredith Wade joined the Vermont Center for the Book staff as co-trainers.

The conference opened with the posing of the question: “What’s the one thing (program) you have done in the first two years that is ‘most’ STEM?” Librarians were then asked librarians to talk at their tables about whether they thought their programs hit the mark. In Karen Worth’s words, the morning was about the science and the afternoon was about the inquiry. Karen Worth and Greg DeFrancis then gave a brief introduction to Sound:

- Sound is a form of energy
- Sound is caused by vibrations of an object or substance
- Some force/action causes the vibration
- We hear sound when the vibrations reach our ear

Vocabulary that was introduced include: sound, source, vibration, pitch, volume, timbre.

Five stations were set up for the following explorations (which were designed for librarians to replicate in their libraries):

- Vibrations with Flat Objects (rulers)
- Vibrations and Water
- Vibrations with Metal Objects
- Vibrations with String and Cups (telephone)
- Vibrations with Rubber Bands (banjo boxes)

After lunch, there was a time to process the morning’s explorations, and librarians were asked:

- What surprised you?
- What did you learn about Sound?
- What ideas do you have for doing this in your library?
- What Sound questions would you like answers for?

Sound Maps and Soundscapes explorations followed with librarians going outside to listen.

Meredith Wade then led an Exploring Shakers activity. This was followed by Building Musical Instruments from many different objects.

In the evening, Greg DeFrancis introduced a Family Program that librarians could do in their communities: *The Battle of the Bands*. Each small group formed a musical band, created album art and costumes and instruments, then performed their hit single.

The second day of the conference focused on Light explorations:

- Light is another form of energy, the one kind of energy we can see
- There must be a source of light
- Light travels in straight lines
- Light can be absorbed by an object—opaque (creates a dark shadow), partially absorbed—translucent (creates a light shadow), pass through—transparent (creates no shadow) or reflected
- We see color when some parts of the light are reflected

Karen Worth introduced the Light explorations, and then there was facilitated exploration of a number of indoor and outdoor shadow activities with prisms, cellphone flashlights and objects.

Appendix C

VELI-STEM

Year 3 April Two-Day Training: Books and Hands-on Materials

Sound

Non-Fiction

Sounds All Around by Wendy Pfeffer. Simple explanations of sounds and hearing. Activities included.

Sound: Loud, Soft, High and Low by Natalie Rosinsky. An exploration of all the different ways sound are made.

The Listening Walk by Paul Showers. Shhh...stand still, listen, what do you hear? You're on a sound walk.

Can an Aardvark Bark? by Melissa Stewart and Steve Jenkins. A noisy non-fiction exploration of sounds animals make. Children will want to grunt, growl and bark along with these animals.

Fiction

Moses Goes to a Concert by Isaac Millman. Moses and his school friends are deaf, but like most children, they have a lot to say. Today, Moses and his classmates are going to a concert and thanks to a teacher, this concert will be a special event.

Zin! Zin! Zin! A Violin by Lloyd Moss. A lively introduction to the instruments in an orchestra. A counting book too!

Max Found Two Sticks by Brian Pinkney. Max taps with his sticks to repeat neighborhood sounds and to communicate with his family.

General STEM

Grace Hopper: Queen of Computer Code by Laurie Wallmark. Who was Grace Hopper? A software tester, workplace jester, cherished mentor, ace inventor, avid reader, naval leader—AND rule breaker, chance taker, and troublemaker.

Hands-on Materials:

Plastic straws, chopsticks, string, clipboard, metal racks,
craft sticks Resource cards for families and child-care
providers

For families (15 sets per library):

Sounds All Around
Moses Goes to a Concert
Resource cards

For child-care provider trainings (5 sets per lib.):

Sounds All Around
Moses Goes to a Concert
Resource cards

VELI-STEM

Year 3 April Two-Day Training: Books and Hands-on Materials

Light

Non-Fiction

Daylight Nightlight by Franklyn Bradley. An exploration of where light comes from.

I See Myself by Vicki Cobb. Find out about vision, light, and reflection by playing with a mirror, a flashlight and a ball.

Light is All Around by Wendy Pfeffer. Introduces the properties of light with just the right amount of information for young children.

Fiction

Moonbear's Shadow by Frank Asch. No matter how hard he tries, Bear cannot lose his shadow.

Oscar and the Moth by Geoff Waring. As Oscar the kitten watches the sun set one evening, he has lots of questions about light and dark. Who better than Moth to help out?

Hands-on Materials:

Mirrors, acetate (color filter) sheets, prism, set of plastic animals (for shadows) Resource cards for families and child-care providers

For families (15 sets per library):

Oscar and the Moth
Moonbear's Shadow
Resource cards

For child-care provider trainings (5 sets per lib.):

Oscar and the Moth
Moonbear's Shadow
Resource cards



Exploring Sound



Sounds are all around us. Your voice is a sound, music is a sound, and all sorts of things make sounds—both living things and non-living things.

Vibrations of an object or substance cause sound.

Stretch a rubber band so that it's tight, then pluck it. Can you see the band moving quickly back and forth? That movement is called a vibration. When a vibration reaches your ear, you hear sound.

A vibration is caused by a force or action.

Hold a ruler flat on the table so a portion of it extends off the edge. Flick the overhanging part of the ruler. What happens?

A little at a time, slide more of the ruler off the edge while still firmly holding the other end flat to the table. How does the sound change? How would you describe the different sounds?

Sound can travel through many different objects.

Cut two pieces of string (16-18 inches long) and tie them onto the ends of a metal coat hanger, cake rack or large metal utensil. Wrap the strings' loose ends around your index fingers, then place your fingers next to your ears. Gently swing the metal object away from your body and let it tap a hard surface such as the edge of a table or back of a chair.

What do you hear? How do you think the sound is reaching your ears? Test and compare different metal objects. How are the sounds the same or different?

Talking and Exploring Together

Make a string telephone: You'll need two large paper cups, string and two large paper clips.

Poke a hole in the bottom of each cup, then cut a string at least 20 feet long and thread the ends into the cups. Tie a paperclip to each end of the string (this anchors the string inside each cup).

Try out your telephone: first try it with the string loose between you and your child, then make the string tight. How is the sound different? Can you hear one another? If not, how can you fix it?

Listen to the sounds around you, indoors and outdoors.

Indoors: Sit quietly and listen. What do you hear? How would you describe the sounds?

Outdoors: Go on a listening walk. As you walk, stop every few minutes and listen for sounds. What is making the sound? What is the sound's source? How would you describe the sounds you hear?



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Light and Shadows

Talk together about what you already know about light and shadows. What makes light? What is the source of the light? What makes a shadow?

Here are some things we learn when we explore light and shadows:

- Most things don't make their own light.
- Light travels in a straight line.
- Light comes from natural and human-made things.
- We see things when light bounces off them into our eyes.
- A shadow is made when an object blocks the light.
- A shadow shows the shape of an object.
- You can change the size of a shadow by moving your body or an object closer to or farther from the light.

Indoor Shadows

How many different-shaped shadows can you make with one object while keeping the light source in the same place?

What are the different ways you can make a shadow larger or smaller but not change its shape?

What shadow shapes or creatures can you create with your fingers and hands?

What happens when you make shadows with many different light sources?

Talking and Exploring Together



Outdoor Shadows

Play shadow games by calling out different shapes, letters or numbers and creating them in shadows. Or call out movements like standing on one foot, reaching up high to touch the sky, and walking on all fours.

How did the shadow change? (Did it move, rotate, grow, shrink, etc.?)

Where can you see your shadow? Where *can't* you see your shadow?

Can you find other outside shadows?

Go outside and find a sunny place. Use chalk to mark where your child's toes are so she can stand in the exact same place later on. Place a pebble on the ground in the shadow of your child's head. Go back an hour later and have your child stand where her feet were when you traced them and place another pebble where the shadow of her head is now. What happened? Why do you think the shadow changes? What's different about where the sun was this morning and where it is now?



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Appendix E

VELI-STEM October 16, 2018

Year 3 Follow-Up Workshop

8:30 am	Registration/coffee, Waterlot (ground floor)
9—9:15	Welcome and day's agenda (Sally)
9:15—10:15	Activity: Egg from Saturn
10:15—11:15	Ask librarians to bring their favorite “moon” books, one fiction and one non-fiction Look at the books they're getting at this workshop and brainstorm STEM ideas for “space” programs, given what they've learned over the three years. Book talk with Sally (<i>If You Decide to Go to the Moon...and Astronaut Handbook</i>)
11:15—12:00	Brainstorm: How have they been able to infuse STEM into their ongoing programs? (Sally and Wendy)
12:00—12.45	Lunch
12:45—1:30	In-kind time sheet forms for librarians to complete
(Wendy) 1:30—2:30	What Makes it Fly? Things in flight, things that move
(Meredith) 2:30—3:00	Closure (Sally and Wendy)

Appendix F

VELI-STEM Year 3 October 16, 2018 workshop

Additional books distributed to librarians:

International Space Station by Franklyn M. Branley

What Makes Day and Night by Franklyn M. Branley

The Moon Book by Gail Gibbons

A Big Mooncake for Little Star by Grace Lin

Astronaut Handbook by Meghan McCarthy

If You Decide to Go to the Moon by Faith McNulty

Me and My Place in Space by Joan Sweeney

