INSTITUTE of Museum and Library SERVICES

Museums for America

Sample Application MA-249061-OMS-21
Project Category: Lifelong Learning

ECHO, Leahy Center for Lake Champlain

Amount awarded by IMLS:	$187,003
Amount of cost share:	$194,275

The project description can be viewed in the IMLS Awarded Grants Search:
https://www.imls.gov/grants/awarded/ma-249061-oms-21

Attached are the following components excerpted from the original application.

- Narrative
- Schedule of Completion

When preparing an application for the next deadline, be sure to follow the instructions in the current Notice of Funding Opportunity for the grant program and project category to which you are applying.

1. Project Justification

STEM in Motion 2.0 will take advantage of new hybrid (the combination of in-person and virtual) programming opportunities to increase the museum's capacity to serve rural schools and build the next version of our *STEM in Motion* school outreach program. Virtual program delivery to remote schools has only recently become possible in our region due to the rapid expansion of broadband service and teachers' wide-scale adoption of virtual learning tools following the COVID-19 pandemic. STEM in Motion 2.0 will serve to double the museum's contact with rural partner schools, magnifying our outreach program's impact on teachers and students. The project will build upon the museum's in-person STEM (an interdisciplinary approach to teaching science, technology, engineering, and math) outreach efforts by integrating new, virtual teacher professional development and classroom programs that were previously impracticable. This project's primary products will include: the delivery of 2 year-long teacher institutes that blend in-person and virtual professional development; the delivery of 270 in-person and virtual classroom programs; and the production of 18 classroom curriculum kits and standard-activity aligned guides. As a result of STEM in Motion 2.0's activities, 54 teachers will have increased capacity to deliver high-quality STEM learning experiences to 918 K - 5th grade students in underserved, rural communities.

What is the need, problem, or challenge will your project address and how was it identified?

STEM is our children's future—the knowledge economy in which they live, their best career options, and their key to wise decisions. More broadly, a STEM-literate person is able to consider how STEM can improve the social, economic, and environmental conditions of their communities. But not all children are given equal opportunity to achieve STEM literacy. Standardized testing shows a 20 point achievement gap among Vermont's fourth-grade science students, with fewer than 50% testing as proficient overall (Pache, 2015). Unfortunately, our primary schools have limited capacity to address this gap. Primary teachers are unlikely to have science backgrounds (Schwartz & Gess-Newsome, 2008), and fewer than one-third report feeling well qualified to teach science, resulting in a lack of content knowledge and confidence (Fullp, 2002). Moreover, in a 2015 report, researchers from the Center on Rural Education & Communities point out that because of their small size and isolation, Vermont's schools experience persistent teacher shortages in specialized fields and often lack substantive access to communities of support (Hall & Burfoot-Rochford, 2015).

Regrettably, most teacher professional development is ineffectual, suffering from poor design features. Foremost among these is lack of implementation support. Teacher professional development is commonly structured around discrete, one-off workshops, abandoning teachers during the real work of implementation (Gulamhussein, 2013). Poor design is further typified as being disconnected from teacher's planning and unit content. Effective professional development must integrate in-classroom support as teachers attempt to master new skills. A study by Kleickmann (2016) found that access to expert scaffolding resulted in significant gains in teacher motivation, instructional quality, and student achievement.

Driving distances have historically restricted the museum's ability to provide this type of sustained, expert scaffolding to rural teachers. But a narrowing digital divide in our region presents new hybrid programming opportunities. Recent, large-scale investments in regional broadband have resulted in 98% of Vermont schools meeting national standard for broadband connectivity (Drescher, 2019). And teachers' comfort with virtual technology has skyrocketed as a byproduct of remote schooling during the COVID-19 pandemic (87% of teachers in a May 2020 survey by EdWeek reported an improved ability to use education technology). Conventional schooling will resume once the virus passes, but the technological adoption happening today present lasting opportunities to change how the museum connects to remote audiences.

Who or what will benefit from your project?

- 54 K - 5th grade teachers, representing 12 - 18 grade-level teaching teams.

- 918 K - 5th grade students.

This group will be primarily drawn from teachers and students from the museum's existing network of rural partner schools (letters of support from a subset of schools are provided as part of Supportingdoc2). Partner schools are located in rural communities with limited services, rank in the bottom 50% of Vermont schools based on standardized testing, and serve a high-need student population. Among ECHO's current partner schools, 51% of students qualify for free or reduced lunch. Additional teachers and students will be recruited through the planned expansion of our partner school network. During COVID, 10 unique school districts (representing 8 of Vermont's 14 counties) have been participating in our newly launched Virtual STEM Academy program, five of whom are new partners. Teachers from this group that meet the above need-based criteria may also participate in the project.

How have project beneficiaries been involved in the planning of your project?

Feedback from partner schools over the last two years, collected through surveys, focus groups, and regular communication, have been essential to defining STEM in Motion 2.0's activities and approach. In our most recent evaluator's report from Fall 2020, teachers identified the following as strengths of the current program:

- "Most of the teachers mentioned that they were very impressed with the demonstration lessons that the ECHO staff offered in their classrooms. The lessons modeled effective strategies for using the STEM toolkits and teachers reported that the ECHO staff were skilled in working with children and in classroom settings. They also commented that the students retained the information they learned from the demonstration lessons for a long time. The teachers also appreciated that the demonstration lessons and the kits were tied to Vermont's local issues, which were highly relevant to the students." This project will increase the number of demonstration lessons by leveraging new, virtual tools.
- "The curriculum kits provided them new ideas and materials readily available for teaching and were appropriate and adaptable for different grade levels." Rather than sharing kits among schools, teaching teams will be given personal curriculum kits (their number one request) as part of this project.
- "Overall, the teachers showed great enthusiasm for being part of the collaboration. They benefited from the partnership with ECHO, not only because of the valuable STEM materials and resources but also because ECHO staff's demonstrations and work approach were inspiring and supportive." This project will increase contact with ECHO staff via virtual touch-bases.

The report also identified the following areas for improvement, which will be addressed in the project work place:

- "Most teachers indicated that they did not use the Carnegie Science Center's STEM Excellence Pathway goal-setting tool or did not remember the details. The commonly mentioned barriers to using it were time constraints and the cumbersome system. The teachers indicated that more concise language, streamlined systems, detailed instructions, and examples from other schools could improve its usefulness." This project will replace the Carnegie tool, which was originally developed for use by large, urban school districts, with an abbreviated tool customized to the Vermont context.

In addition to the above, ECHO outreach staff reported that dedicated time for teachers to work on STEM program improvement outside of regular in-service days would allow teachers to better focus on planning activities. This project responds to this opportunity by using a year-long teacher institute model that leverages in-person and virtual strategies as well as summer planning time.

How will your project advance your institution's strategic plan?

In 2016, ECHO conducted a focus group with 58 educators from across the state in order to better understand the needs of our school audiences. In response to the question, "In respect to serving the educational

community, ECHO's efforts are best spent enhancing. . .” 32 of 47 respondents selected “outreach.” This answer is consistent with the group’s write-in responses, in which 33 out of 55 respondents cited the need for more outreach programs in some form. Supporting school outreach programs also overwhelmingly topped the findings from a 2016 planning study, in which the state’s top donor families were interviewed by a philanthropic advisory firm. Moreover, in 2017, ECHO participated in the American Alliance of Museum’s (AAM) Museum Assessment Program (MAP) for community engagement. Among the top recommendations of the resulting report, prepared by a peer reviewer following a year-long process, was the geographic and demographic diversification of our audience. These results led to investments in rural outreach as a strategic priority for the museum in our 2019 - 2023 Strategic Plan. The plan specifically details the following, all of which are addressed in this project:

Goal 1: Expand youth learning opportunities in rural communities.

- Build school partnerships that build community capacity and energy around science education.
- Grow our STEM curriculum kit lending library.
- Expand delivery of virtual programs.
- Support teacher professional development and curriculum coaching.

How will your project address the goals of the Museums for America program and align with the Lifelong Learning project category?

STEM in Motion 2.0 leverages the museum’s position, “as a unique teaching and inquiry-focused institution” with expertise in constructivist and STEM learning to support “today’s informal and formal learning ecosystem,” responding directly to the Lifelong Learning category’s prime directive. The principal aim of the project is to “empower” teachers by equipping them with knowledge, material resources, and communities of support needed to design and implement learning experiences that “provide high-quality, experiential educational opportunities” to their students. STEM in Motion 2.0 will also bring the museum’s unique skills and resources directly to underserved students through programming that engages students in inquiry-based STEM while modeling best practices for teacher partners.

2. Project Work Plan

What specific activities, including evaluation, will you carry out?

STEM in Motion 2.0's project design responds to the most common issues surrounding teacher professional development. It involves teachers in their own curriculum planning, supports them during implementation, and encourages them to reflect on practice. It also works at the unit of grade-level teaching teams, rather than individual teachers, in order to reap the collaborative and cultural benefits associated with communities of practice (Gulamhussein, 2013). The model aligns with the best practices set out in AAM’s compendium on museum and school partnerships, in which the editors advocate for training that allows teachers to guide their own learning (Fortney & Sheppard, 2010, p. 57). The project has three core activities:

Hybrid Teacher Institute: Lumpe (2012) found that elementary teachers that participate in long-term science professional development programs display significant gains in their science self-efficacy but that programs that were less than 14 hours had no effect on student achievement. Therefore, a significant portion of the project’s time and resources will be applied to sustained teacher professional development. The institute’s year-long delivery format will be designed to meet the needs of rural teachers, kicking off with a two-day summer workshop at the museum to build excitement and relationships and then using virtual and in-person workshops during the school year to limit teacher travel time. In addition to training in effective STEM facilitation and curriculum development, institute teachers will participate in ongoing curriculum and instructional coaching via implementation support visits to classrooms and via videoconferencing. The specific services utilized by each teaching team will be determined by a goal-setting exercise during the two-day summer kick-off. Because the

grant cycle begins in the fall, the first year of the grant will deliver teacher professional development workshops but the full institute, which commences in the summer, will only take place in Years 2 and 3 of the grant.
Demonstration Programs: In a 2013 study, Gulamhussein found modeling is an important tool that provides teachers a clear vision of what best practices look like. Previous evaluations have verified that ECHO partner teachers highly value demonstration programs, in terms of their own and their students' learning. Leveraging skills gained in virtual program presentation during the COVID-19 pandemic, this project will double the number of classroom programs delivered to partner teacher classrooms compared to current levels (continuing in-person but adding virtual programs) and convert the museum's temporary"broadcast" studio (a dedicated space outfitted with sound, lighting, and video streaming equipment), into a permanent one. Partner classrooms will also have the option of visiting the museum or participating in a new virtual field trip program.
STEM Curriculum Kits: The Learning Policy Institute characterizes effective professional development as that which "focuses on *specific* teaching strategies associated with *specific* curriculum content (Darling-Hammond et al., 2017)." Following this directive, ECHO work with teachers will focus on the development of STEM curriculum for immediate implementation in their classrooms. This work will be partially supported by STEM curriculum kits furnished by ECHO, whose themes and activities will be informed by institute teachers' preferences. Previous kits have been the most popular part of the outreach program and include phenomenon-based science and challenge-based engineering activities along with sample learning sequence and activity guides that inform teachers' curriculum integration.
Evaluation: Evaluation activities will be led by an external evaluator, Aurora Consulting. Progress toward intended results will be measured through annual teacher surveys and interviews. The evaluator will also lead project staff in formative evaluation of specific programs/products using a tool called Team-based Inquiry that was developed by the National Informal Science Education (NISE) Network. This tool is more fully described in a below section on tracking progress.

What are the risks to the project and how will you mitigate them?

The below risks, save COVID-19, are listed as the most common pitfalls of collaborative relationships in the NISE Network's guide to community relationships (McCarthy & Herring, 2015):

Partners lack time to sustain the relationship.

Providing teacher stipends, leverage summer planning time, and selectively working with school with whom we have matured relationships over time will minimize this risk.

Partners lack clear purpose or common vision.

By empowering teaching teams to create their own growth plans using a custom planning tool, we will increase buy-in and clarity of purpose.

Staff turnover

Working with teaching teams, rather than relying on individual teachers as a key liaison to a given school, will support relationship continuity.

Continuation of the COVID-19 pandemic

Investing in both in-person and virtual delivery will allow the project team to pivot as needed.

Who will plan, implement, and manage your project?

Nina Ridhibhinyo, ECHO Director of Programs and Strategy will be primarily responsible for project administration, evaluation coordination, and project design. She holds a M.S. in informal science education from Oregon State University and received a 2019 New England Museum Association (NEMA) Excellence Award for her diversity, equity, and inclusion; and education program work. She specializes in inquiry science education, interpretive writing, and evaluation.

Elizabeth Nuckols, Group Programs Manager will lead overall project management and coordination of the hybrid teacher institute. She holds a Master's in education from William and Mary and received a 2020 NEMA Award for her work with schools and early childhood education. Her focal areas are teacher professional development and early science learning.
Chris Whitaker, STEM & Exhibit Projects Manager will lead STEM kit development and support the hybrid teacher institute. He received his Master's in math and science education from Lesley University. Prior to joining ECHO, Chris worked in a variety of educational positions, including middle school science educator, high school environmental technology instructor, and U.S. Fish and Wildlife biotech. His focal areas are STEM curriculum and exhibit design and fabrication.
Caroline Frigon, Education Programs Coordinator will assist in the delivery demonstration programs and STEM kits activity guide development. Caroline holds a B.S. in Natural Resources from the University of Vermont (UVM) and leads ECHO's Community STEM Festivals and camp programs. In addition to her work at ECHO, Caroline has worked as an educator with UVM Extension's Watershed Alliance and at the Zoo in the Forest.
Cailee Smith, Public Programs Manager will assist in the delivery demonstration programs. She holds a B.A. in zoology and oversees ECHO's day guest experience, including coordination of volunteers and floor staff. Prior to coming to ECHO, she was an outreach educator at Mystic Aquarium and specializes in science communication.
Travis Cook, IT & AV Systems Manager will outfit the virtual "broadcast" studio. Travis holds a B.S. in IT and manages all the museum's IT and AV systems, in addition to being part of the museum's exhibits team.
Al Onkka, Aurora Consulting will serve as an external evaluator on this project. He has more than 10 years of experience working in informal learning environments as an evaluator, planner, and leadership development expert. Al has significant experience evaluating museum-led in-school programs and teacher development programs.

When and in what sequence will your activities occur?

Comprehensive activity sequencing is provided in table format as part of the "Scheduleofcompletion" document. Below is the conceptual progression of the entire project.

Pre-grant:

- Review of best practices/existing models, project design, staff preparation, partner recruitment.

Phase 1 (September '21 - June '22):

- Project launch, front-end evaluation, definition given to management/tracking systems, relationship building, program prototyping.
- Delivery of discrete professional development workshops, in-person and virtual demonstration programs, and loan and testing of preliminary STEM kits.

Phase 2 (July '22 - June '24):

- Formative evaluation, product revision/refinement, ongoing activity execution.
- Launch of full year-long teacher institute, delivery of in-person and virtual demonstration programs, and STEM kit distribution.

Post-grant:

- Summative evaluation, reporting, ongoing fundraising from private donors, dissemination, recruitment of next cohort.

What time, financial, personnel, and other resources will you need to carry out the activities?

Total ECHO staff time for this project is allocated at 1.1 full-time equivalency (FTE) and is distributed across 6 staff members. In addition, project delivery will be supported by an external evaluation firm whose services account for 10% of the project budget. Fifty-four teachers will provide support through their

participation in curriculum development, professional development activities, and delivery of STEM activities. $36,000 has been budgeted in teacher support in recognition of this work. Additionally, $10,800 is allocated to produce STEM curriculum kits for partnering teaching teams and $5,000 to set-up a permanent virtual learning "broadcast" studio at the museum.

How will you track your progress toward achieving your intended results?

Bimonthly project team meetings will allow continuous progress tracking against goals and deliverables, as articulated in the provided "Scheduleofcompletion." ECHO uses the Google suite for integrated project management, including its GQueue task management app, and employs a formal, outcome-based project management guide. Audience contact counts are standardized through our Veevart management system. Evaluation by Aurora Consulting will address key questions about program implementation, process, and progress against outcomes. To accomplish this, Aurora will conduct annual teacher interviews and surveys, and facilitate 3 formative evaluation workshops with project staff based on the National Informal Science Education Network's (NISE) Team-based Inquiry evaluation tool, which the project's evaluation firm helped develop (Pattison, Cohn, & Kollman, 2014). NISE describes Team-based Inquiry as "a practical approach to empowering education professionals to get the data they need . . . to improve their products and practices . . . . The TBI process involves an ongoing cycle of inquiry: question, investigate, reflect, and improve." TBI workshops will focus on ongoing improvement of project products.

How and with whom will you share your project's results?

Key staff on this project are active members of multiple state, regional, and national communities of practices (CoP) with whom we will share results and work through implementation challenges related to this project. FourScienceVermont is a consortium of Vermont's four science and nature centers. Its education affinity group meets regularly to share knowledge and collaborate on strategic projects that serve Vermont. Two key staff are members of the Real World, Real Science CoP for science centers located in Northern New England. This CoP hosts an annual in-person meeting and quarterly virtual meet-ups, and focuses specifically on school programs. ECHO staff are also regular presenters at the annual New England Museum Association conference, which allows sharing of knowledge with museums across disciplines, as well as participants in the New England Outreach Network, which hosts an annual pre-conference intensive as part of the Association of Science-Technology Center conference and a very active online list-serve. Additionally, ECHO has a close relationship with the NISE Net and regularly presents in its webinar series. Most recently, we presented a lesson learned from the museum's pilot virtual learning series in October 2020.

3. Project Results

What are your project's intended results and how will they address the need, problem, or challenge you have identified?

STEM in Motion 2.0's short-term aim is to improve teachers' pedagogical skill and confidence in their ability to teach STEM in order to improve student outcomes over the long-term. It will address the need to close the STEM achievement gap by focusing on teachers, the most influential school-related factor in student achievement (Rice, 2003). It will do this by responding to the common shortfalls in professional development design and leveraging new opportunities in virtual program delivery.

How will the knowledge, skills, behaviors, and/or attitudes of the intended audience change as a result of your project? What data will you collect and report to measure your project's success?

Project staff will work with an external evaluator, Aurora Consulting, to measure project outcomes through annual teachers surveys and interviews. Surveys and focus groups will assess progress against the following project outcomes, using the described measures:

K – 5th grade teachers feel increased self-efficacy in facilitating STEM learning experiences.

Measure 1: Teachers report increased self-efficacy in surveys.
Measure 2: Teachers share feelings of increased self-efficacy during focus group interviews.
K – 5th grade teachers increase the quantity of STEM learning opportunities in their classrooms.
Measure 1: Teachers report increased STEM learning opportunities in their classroom in surveys.
Measure 2: Teachers provide examples of new STEM learning opportunities they have integrated into their classroom during focus group interviews.
K – 5th grade students in rural areas have an increased interest in STEM.
Measure 1: Teachers report their students have demonstrated increased interest in STEM in surveys.
Measure 2: Teachers provide examples of students' increased interest in STEM in focus group interviews.
Museums educators have increased skill in facilitating virtual learning.
Measure 1: Museum educators describe increased skill during formative evaluation workshops as observed and reported by an external evaluator.

What tangible products will result from your project?

Project Activity	Tangible Products	Intended Audience
Hybrid Teacher Institute	-2 two-day summer workshops at museum -6 one-day school-year workshops (location TBD) -6 virtual evening workshops -108 in-classroom implementation support visits -1 goal-setting tool -Ongoing virtual curriculum/instructional coaching	-K - 5th grade teachers
Demonstration Programs	-108 in-classroom programs -108 synchronous, virtual programs -54 field trips (option of in-person or virtual) -1 virtual "broadcast" studio	-K - 5th grade teachers -K - 5th grade students
STEM Curriculum Kits	-18 kits including: -Phenomenon-based and engineering activities -Sample learning sequence and activity guides	-K - 5th grade teachers -K - 5th grade students
Evaluation	-3 teacher surveys -3 teacher focus groups -3 project team formative evaluation workshops	-Project staff -Museum community
Project Administration	72 project team meetings 3 annual reports	-Project staff -IMLS

How will you sustain the benefit(s) of your project?

In addition to the above changes in attitudes, skills, and awareness, project benefits will be sustained through ongoing collaboration between partner schools and ECHO and the future deployment of project assets and services to expanded settings. This project is a key component of ECHO's strategic plan and top priority for our philanthropic supporters, as evidenced in the findings of our 2016 planning study and secured support from local companies, including Cabot Creamery and GlobalFoundries. Tangible products, including the virtual "broadcast" studio, STEM curriculum kits, new virtual classroom programs, and teacher professional development workshops will also furnish benefits into the future.

STEM in Motion 2.0 Schedule of Completion—Leahy Center for Lake Champlain, Inc. d/b/a ECHO

Schedule of Completion

Year 1 Activities	September	October	November	December	January	February	March	April	May	June	July	August
Hybrid Teacher Institute	Year-long institute planning/participant recruitment; ongoing delivery of discrete professional development workshops; development of teacher goal-setting tool										Cohort-1 2-day summer kick-off	
Demonstration Programs	Build virtual “broadcast” studio		Virtual program and field trip planning/delivery of in-person programs			Delivery of in-person and virtual programs/field trips				Refine programs based on formative evaluation		
STEM Curriculum Kits	Front-end evaluation to inform kit themes; development of activities/guides; ongoing loans of existing kits to schools										Distribution of kits to Cohort 1	
Project Evaluation	Kick-off meeting with external evaluator	Evaluation instrument development			Team-based inquiry workshop 1			Annual teacher surveys/focus groups			Evaluation report 1	
Project Administration	Every other week project team meetings											

Year 2 Activities	September	October	November	December	January	February	March	April	May	June	July	August
Hybrid Teacher Institute	Implementation support visits	School year PD workshop	Implementation support visits	Virtual evening PD	Implementation support visits	Virtual evening PD	School year PD workshop	Implementation support visits	Cohort 1 Complete		Cohort-2 2-day summer kick-off	
Demonstration Programs	Delivery of in-person and virtual programs/field trips									Refine programs based on formative evaluation		
STEM Curriculum Kits	Build second set of kits, updating based on formative evaluation										Distribution of kits to Cohort 2	
Project Evaluation	Evaluation instrument refinement				Team-based inquiry workshop 2			Annual teacher surveys/focus groups			Evaluation report 2	
Project Administration	Every other week project team meetings			Annual Report 1	Every other week project team meetings							

Year 3 Activities	September	October	November	December	January	February	March	April	May	June	Post-grant
Hybrid Teacher Institute	Implementation support visits	School year PD workshop	Implementation support visits	Virtual evening PD	Implementation support visits	Virtual evening PD	School year PD workshop	Implementation support visits	Cohort 2 Complete		Cohort 3
Demonstration Programs	Delivery of in-person and virtual programs/field trips									Refine programs based on formative evaluation	Ongoing program delivery to classrooms
STEM Curriculum Kits	Build third set of kits, updating based on formative evaluation										Ongoing kit development and distribution
Project Evaluation	Evaluation instrument refinement				Team-based inquiry workshop 3		Annual teacher surveys/focus groups				Evaluation report 3; ongoing use of team-based inquiry and evaluation instruments
Project Administration	Every other week project team meetings				Annual Report 2	Every other week project team meetings					Final Report