Museums Empowered

Sample Application ME-258395-OMS-25

Phillip and Patricia Frost Museum of Science

Amount awarded by IMLS:	$213,641
Amount of cost share:	$217,547

The Phillip and Patricia Frost Museum of Science will provide technology-focused professional development opportunities to museum educators, facilitators, and interpreters at museums throughout Florida. The Frost Museum of Science will collaborate with the Florida Museum of Natural History, Cox Science Center and Aquarium, and Miami Children's Museum and Frost Science, both located in Miami, Florida, to form the Museum Education Tech Collaborative. Museum educators across these four institutions will take part in five full-day training opportunities spanning AI, extended reality, coding, 3D printing and modeling, and robotics. They will pilot the use of these emerging technologies in the learning experiences they design and facilitate at their respective institutions, and co-design a curriculum highlighting potential uses of these technologies in museums created for museum education professionals, by museum education professionals.

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.

Training Museum Education Professionals to Integrate Emerging Technologies into Educator-Led Learning Experiences

Project Justification

Program Goal and Objective

The Phillip and Patricia Frost Museum of Science (Frost Science) requests $243,908 to support the project **Training Museum Education Professionals to Integrate Emerging Technologies into Educator-Led Learning Experiences**. This project aligns with IMLS's agency-level goal of Lifelong Learning and Objective 1.2 to "support the training and professional development of the museum and library workforce". The project focuses on the first program goal: Digital Technology, and objective 1.2: "support staff learning and integration of digital tools and services that enhance access to museum collections".

The goal of this project is to provide technology-focused professional development (PD) opportunities to museum educators, facilitators, or interpreters – hereafter, museum educators – at museums throughout Florida. The project, led by Frost Science, is a collaboration between Florida Museum of Natural History (FMNH), located in Gainesville, Florida; Cox Science Center (CSC), located in Palm Beach, Florida; and Miami Children's Museum (MCM) and Frost Science, both located in Miami, Florida. Together, these institutions will form the Museum Education Tech Collaborative (METC).

A museum educator's understanding of – and confidence in teaching about – emerging technologies can be a barrier to an institution's ability to provide high-quality, meaningful tech-focused programs and experiences. Literature on K-12 educators suggests that those with positive perceptions of their ability to effectively integrate technology, self-efficacy of technology integration, is a significant factor in determining actual technology use and implementation in the classroom (Gomez et al., 2022; Holden & Rada, 2011). Additionally, the rapid pace at which technologies change makes it not only difficult, but quite expensive for institutions to stay relevant and have the latest tools for education. To address these challenges, we propose a two-year-long collaborative PD-centered project for museum educators at institutions across Florida. The PDs, co-designed by educators across partner institutions, will cover five main topics and provide digital tools for each topic: AI, extended reality, 3D printing and modelling, coding, and robotics. To ensure strategies and relevant concepts are shared, the METC will rely on expertise of local partners, encompassing small non-profit organizations to local universities to guide the PD experiences.

A product of this project will be five designed learning experiences – created with museum education in mind – which utilize the knowledge and skills gained during the PD series. The learning experiences may target guests to our museums (often multigenerational family units), camp participants, and students in grades K-5 on museum field trips. Each institution will take the lead designing one learning experience, for a specified audience, using one of the focused technologies. Organizations will be encouraged to think of their audiences, and how each emerging technology would best suit their museum learning experience. The final product will be a "METC curriculum" of museum-based learning experiences, which highlight emerging technologies, and were designed by museum educators which will be publicly shared with museums interested in technology integration.

Advancing the Strategic Plan

Fostering a public understanding of and confidence in emerging technologies is embedded within the Frost Science mission. To bring this mission to life, there is an inherent need for the museum education staff to have in-depth knowledge of – and confidence in – using and teaching with various technologies. While ensuring museum educators at each institution have extensive understanding of technologies seems achievable in theory, in practice can feel near-impossible. Museum education staff design, develop, and facilitate various learning experiences, spanning a wide array of scientific disciplines and technologies (Rende et al., 2021; Tran, 2007). This makes taking the time to commit to learning or understanding a new technology for the purpose of a new program or learning experience quite difficult. If funded, this proposal will provide museum educators with the agency, training, and resources needed to advance the museum's mission.

Need Addressed

The Association of Science and Technology Centers (ASTC) identified accelerating pace of change in science and technology a 2024 global trend which should be considered by informal institutions. Emerging technologies are rapidly shifting and requires a great deal of time and understanding to adequately teach others to use, creating a potential challenge when considering staff turn-over, cost of technologies and building a strong workforce. This proposal attends to these challenges by intentionally and meaningfully training museum educators to use emerging technologies (AI, extended reality, 3d printing and modeling, coding and robotics), provides opportunities to learn from experts in the field, and allows institutions to integrate these technologies into their programmatic offerings.

Additionally, this proposal seeks to explore and hopefully increase the perceptions museum educators have of their ability to integrate technology into their practice. Gomez and colleagues (2022) determined that formal K-12 educators technology integration self-efficacy increased after continuous professional development interventions. Moreover, Kent & Giles (2017) found that technology integration self-efficacy is a meaningful predictor of formal K-12 educators' willingness and ability to engage their learners through twenty first century instruction. By exploring this construct in the museum education ecosystem, we can address the need of building a strong, technology-minded workforce as well as keeping pace with a rapidly changing digital world.

Primary Audience

The primary audience of this project will be approximately 30 museum educators at five institutions across Florida. Individuals from each institution will take part in the planning and coordination of the PD experiences and provide time for staff to attend each PD session. This will ensure that each PD aligns with the mission and goals of each institution while also attending to increasing proficiency in technology integration and creating opportunities for meaningful reflection on the use of these technologies in informal education programming.

Museum educators need a strong sense of task-specific self-efficacy, to meet the unavoidable obstacles inherent within the framework of instructing using digital tools (Gomez et al., 2022). Therefore, we hope to provide opportunities for museum educators to create positive perceptions of their ability to effectively use and integrate technology into their practice at their respective institutions. This will hopefully create a

long-term impact on the participating museum educator's self-efficacy beliefs, resulting in a more well-rounded workforce, ready to take on new and emerging technologies.

Ultimate Beneficiaries

There are two ultimate beneficiaries of this project: 1) the museum education staff who will take part in the program, who are also the primary beneficiaries and 2) the participants of learning experiences facilitated across the five institutions. The participants of programs will include K-12 aged children, multigenerational family units, tourists, and community groups. Each organization serves a unique subset of the population in Florida. Both Miami and Gainesville, Florida comprise of majority low-income and under-resources communities.

MCM primarily serves early learners and families. Frost Science serves multi-generational family units. Both institutions are in in Miami, Florida, a primarily minority-serving city where the population identifies as 72% Hispanic or Latinx and 15% as Black or African American. 20% of the population live below the poverty line in Miami (The Census Bureau, 2023). FMNH serves the community in the "college town" of Gainesville, Florida where the population identifies as 22% Black or African American and 12% as Hispanic or Latinx. 29% of the population in Gainesville live below the poverty line (The Census Bureau, 2023). Lastly, CSC serves the community of Palm Beach, Florida, where the population identifies as 24% Hispanic or Latinx and 18% as Black or African American. 12% of the population in Palm Beach lives below the poverty line (The Census Bureau, 2023).

Project Work Plan

Activities

The proposed will have four phases: Phase I: professional development (PD) planning, Phase II: Professional development execution, Phase III: learning experience design and facilitation, and Phase IV: dissemination of museum education technology curriculum.

Phase I: Professional development planning. Institutions will coordinate the dates, times, and locations of the professional development opportunities. The product of phase I will be five scheduled full-day PD opportunities for museum educators across partner institutions to receive an immersive experience using each of the identified emerging technologies.

Phase II: Professional development execution. The five PDs will commence, and museum educators will reflect on practices learned to prototype the design of learning experiences at their institutions using the technologies. After each full-PD day, each attendee will 1) reflect on their experience through filling out a reflective survey and 2) have the option to meet in the "metaverse" during "METC meet-ups" once a month during the months where there is no in-person PD. Metaverse meetings refer to virtual meetings held within digital, 3D environments, allowing participants to interact using avatars in a simulated space. Using the verse to meet virtually, as opposed to Teams or Zoom, will increase use of the extended reality headsets, allowing the museum educators to become more proficient in its use.

Phase III: Learning experience design and facilitation. The museum educators will design a learning experience, represented in a lesson plan or activity guide, using one of the technologies they learned about for one of the established programs at their institution. This process is meant to be iterative in nature and

should allow for educators to test, brainstorm, and explore when creating a learning experience which best fits their institution.

Phase IV: Dissemination of museum education technology curriculum. The cohort of museum educators will revise and combine their curricula to be shared across institutions. Curricula will also be made freely available online for other museums interested in integrating technology into their institution's learning experiences.

Project Planning, Implementation, and Management

The project will be managed by the principal investigator, Analisa Duran, Knight Senior Director of Science Education at Frost Science. The project will be co-planned and implemented collaboratively by an individual at each partner institution. These individuals will be the liaisons between the collaborative and their respective organizations and provide insight from their experiences and expertise.

- Alberto Lopez-Torres, Museum Education Manager, Florida Museum of Natural History (FMNH)
- Chris Plait, Director of Education, Cox Science Center (CSC)
- Rosalind Landeros, Director of Guest Experiences, Miami Children's Museum (MCM)

Additionally, the project will rely on content experts who will assist in the planning and implementation of each PD.

- Jason Mckenna, VP of Education, Vex Robotics
- Sully Jackson, Founder, Jackson Academy
- Shahin Vassigh, Ph.D., Professor, Florida International University, Robotics and Digital Fabrication Laboratory
- Tom Merrick, University of Miami, Associate Director of Extended Reality

Required Resources

We are requesting $243,908 dollars to be split between the four museums, with Frost Science using 70% of the annual awarded funds and CSC, MCM and FMNH, acting as a sub-awardee, using 30%.

The project will take two years and involve the efforts of at least 30 staff members across all four institutions (8-10 per institution) along with the expertise of five different organizations or universities. Phase I and Phase II of the project will be the most time-intensive for all institutions, as developing attending five PD experiences in-person while also attending optional meetups in the verse requires time investments. Doing this well requires the appropriate expertise. While each of the museum leads will be part of the design and timing of the PD experiences, we will rely heavily on our external partners, whose time and resources will be required.

We are also requesting financial resources to obtain the technologies needed for each institution to train on, design, and facilitate learning experiences with. This proposal will fund the following or equivalent for each participating institution: Bamboo Lab 3D printers, Surface Pro laptops, Meta Quest headsets, and Vex Robotics sets.

Project Team Organization

Prior to hosting the PD experiences, educators from each institution will complete a survey, outlining their current needs, understanding, audiences, and goals in terms of emerging technologies. Additionally, leaders from each institution will meet regularly (dependent on need) to ensure each organization's needs are being recognized. This will guide the design of each PD experience as well as ensure the voices of all those involved in the project are heard. Additionally, each institution will have the option to host at least one PD, which will offset the cost of travelling to the same institution for each of the five PD days. If an institution does not have the resources to host one, Frost Science is prepared to host all PD days. Lastly, "METC meet-ups" will occur regularly in the verse, allowing team members to use extended reality devices on a regular basis while meeting with colleagues from partner institutions. This will provide an opportunity to discuss challenges, small wins, and ideas prior to the next in-person PD.

Risks and Mitigation

Information overload: We run the risk of information overload for the museum educators involved. We will mitigate this by spreading the PD experiences out over the course of a year. This will give museum educators time to reflect on what they learned and test their ideas for learning experiences prior to the next meeting.

Rapidly changing technologies: As technology is constantly changing, we run the risk of becoming outdated in a matter of years. We will mitigate this risk by working with content experts to suggest the most relevant technologies to use for this project.

Time commitment: Being a part of the METC is a time commitment by each institution. Participation indicates each institution's dedication to growth and interest in integrating technology into their designed learning experiences. Being aware of the large time commitment this project entails, while listening to each other's concerns on the topic, is key to mitigating this risk.

Autonomy of programmatic needs: True collaboration, while beneficial, is not without its challenges. Institutions may desire agency to decide which type of learning experience and technologies will be most aligned with their mission, audience, and values. For this reason, we will actively provide autonomy to organizations by engaging in creative discussions and brainstorming sessions.

Tracking Progress

As stated in the performance measurement plan, we will record the number of museum educators who attend each PD and the number of museum educators who attended the virtual meetups to get an accurate count of project staff impacted. We will also use the reflections which are completed at the end of each PD to qualitatively measure the effectiveness of the experiences as well as use them as a formative assessment to improve the next scheduled PD experience. We will record the number of individuals engaged in the learning experiences at each individual institution. Twice per year, we will assess our expenses for program supplies (technology tools) and staff time allotted for attending the PDs, piloting experiences, and designing learning experiences. Every six months, our Principal Investigator will assess the fit between our proposed Schedule of Completion and actual activity completion dates. Should there be any discrepancies, the PI will work with the cohort to bring tasks/activities up to speed.

Project Results

Results

We expect to see an increase in participating museum educators' perceptions of their ability to design and facilitate learning experiences in their institutions using emerging technologies. Attending to the self-efficacy beliefs of museum educators directly relates to the challenge of rapidly changing technologies and an apparent lack of museum educator confidence or proficiency in leading or teaching technology-focused learning experiences.

These perceptions of self are "a necessary condition for technology integration" (Wang et al., 2004, p. 242). In terms of integrating technology into informal science education experiences, self-efficacy is concerned with the museum educator's perceived ability to incorporate digital tools into designed experiences as well as facilitate meaningful instruction using applicable digital tools (Ertmer, 2005; Holden & Rada, 2011). By using the Technology Integration Confidence Scale (TICS) (Browne, 2011) before and after the PD experiences, we can better understand the perceptions museum educators have of their ability to integrate technology into their practice and determine if continuous PD and autonomy to design learning experiences increases these perceptions.

The literature which explores the outcomes of the technology-focused learning experiences reports that the application of technology can promote academic performance and cognitive load, lead to intrinsic motivation, and increase attitudes towards technologies (Chen et al., 2023; Chu et al., 2019; Xu et al., 2023). While this proposal does not seek to explore the specific learning outcomes of participants of the designed learning experiences, we hope to design formative assessments embedded in the learning experiences which can highlight the potential achieved learning outcomes.

Change to Primary Audience

By using the Technology Integration Confidence Scale (TICS), we can measure participating museum educator's perceptions of their ability to integrate technology into their practice prior to the PD and any changes after the PD. We expect to see an 80% increase in technology integration self-efficacy for museum educators.

Organizational Growth and Systemic Change

The proposed activities will directly result in systemic change at each institution as it relates to their capacity to facilitate or offer educator-led technology-focused experiences. Science museums and centers, as well as children's museums, like those collaborating on this proposal, are looked to as places where people can engage in novel and memorable experiences. Additionally, such institutions are looked to as trusted sources of information and access to new and emerging technologies (Xu et al., 2023). The museums and centers collaborating on this proposal will not only have access to emerging technologies they did not have before, but they will be engaged in continuous professional development. These PDs will provide a space for learning best practices, building proficiency, and supporting each other's goals and ideas. Moreover, the proposed activities will result in more confident educators, who feel capable of connecting learners to emerging technologies.

Products and Accessibility

Through a collaborative effort from partner institutions, we will produce educational content and materials for five informal science learning experiences. This content will be trained on and reflected upon during phase I, prototyped during phase II, and finalized in phase III. These materials can include but are not limited to:

- 3D modelling activities for public programs
- Robotics-focused camp experiences
- AI themed family learning experiences
- Extended reality outreach programs
- Coding after school activities

The finalized learning experience type and associated technology used will depend on the METC team's needs (identified in Phase I), audiences and institutions.

Sustaining Project Benefits

To ensure the sustainability and accessibility, the educational content will be adjusted to be utilized by each organization and generalized to be disseminated as a resource which any organization interested in teaching and learning about emerging technologies can use at no cost. We plan to use platforms such as the Association of Science and Technology Centers (including presenting at the ASTC conference) and the National Informal Science Education network to freely share resources with other museum educators and institutions. Additionally, the knowledge and skills acquired by museum educators throughout the course of this project will continue to have a positive impact in informal learning institutions through each institution's programs long after this project has concluded. Lastly, the collaborative relationships formed during this project between these four partnering institutions will open a door to opportunities for our educators to collaborate with and support one another on future programs.

Schedule of Completion

Year One (2025 - 2026)												
Activity	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug
Begin meetings with collaborating institutions												
Coordinate with community partners/content experts												
PD 1 (in-person)												
Reflection (virtual)												
PD 2 (in-person)												
Reflection (virtual)												
PD 3												
Reflection (virtual)												
PD 4												
Reflection (virtual)												
PD 5												
Reflection (virtual)												
Pilot learning experiences												

Year Two (2026 - 2027)												
Activity	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug
Create designed learning experience/educational program (each institution)												
Facilitate learning experience/educational program (each institution)												
Share designed learning experience with all MET-C institutions to use at their facilities												
Co-create general “curriculum” to be used at varying institutions												
Disseminate curriculum to science museums, centers and children’s museums												
Share resource at ASTC conference												