



**Museums for America  
Sample Application MA-10-13-0220-13  
Project Category: Learning Experiences**

**Minnesota Children's Museum**

Amount awarded by IMLS:	\$150,000
Amount of cost share:	\$444,735

Attached are the following components excerpted from the original application.

- Abstract
- Narrative
- Schedule of Completion

# Minnesota Children's Museum

*Smart Play*

## Project Abstract

With \$150,000 in funding from the Institute of Museum and Library Services' Museums for America program, Minnesota Children's Museum will embark on planning and prototyping for a new Science, Technology, Engineering and Math (STEM) gallery. This gallery will be a centerpiece of the Museum's upcoming expansion and renovation. To realize this project, we will work with many partners, including the Gyroscope exhibit design firm, numerous divisions within the University of Minnesota and locally-based 3M.

Minnesota Children's Museum's current galleries were created when the Museum was built in the early 1990s. Through a renovation and expansion project, we seek to expand these spaces to keep pace with growing attendance, as well as updating experiences to reflect current research on the role of play in developing 21<sup>st</sup> century skills. The STEM gallery is one of the most crucial new galleries planned for the Museum, given our nation's heightened focus on developing STEM skills in our children. Support from the Museums for America program would be invaluable in advancing our capacity to undertake this project and meet the education needs of our community.

The new STEM gallery will foster inquiry and problem solving among our community's earliest learners. In the gallery, children will learn and practice scientific principles such as observation, classification, measurement, collection and hypothesizing. Throughout the gallery, children will build, sort, count and develop other STEM skills. The gallery will also use interactive technology to deepen the exploration of STEM concepts.

This two-year project will include the design and prototyping of the STEM gallery. We will test elements within our current gallery spaces and use the results of these evaluations to inform the overall project. By the end of the project in September 2015, we will have a fully developed and tested plan to create a uniquely interactive and playful STEM learning experience for our community's children.

Our primary goal for the planned expansion is to continue the growth of one of Minnesota's leading institutions for children and families. Through this project, we will expand our own understanding and best practices around designing playful learning experiences for children and families, especially in the area of STEM learning. We seek to enhance early childhood development in our community by engaging parents in their children's learning and promoting open-ended, child-directed playful learning.

Development of a new STEM gallery represents a quantum leap forward for Minnesota Children's Museum as we strive to play a key role in preparing children for skilled leadership in the 21<sup>st</sup> century.

**Museums for America Narrative – Learning Experiences**

**1. Project Justification**

**What do you propose to do?**

With \$150,000 in funding from the IMLS Museums for America program, Minnesota Children's Museum will plan, design and prototype elements of a new Science, Technology, Engineering and Math (STEM) gallery, a centerpiece of the Museum's upcoming expansion and renovation. Minnesota Children's Museum's current permanent galleries were created when the Museum was built in the early 1990s. We seek to expand these spaces to keep pace with growing attendance, as well as redesign experiences to reflect current research on the role of play in developing 21<sup>st</sup> century skills. Given our nation's increased focus on developing STEM skills in our children, the STEM gallery is an essential element within the expanded Museum. Support from the Museums for America program will allow the Museum to expand our understanding of best practices for informal STEM learning experiences for young children, and develop, design and prototype gallery elements.

**What need, problem, or challenge will your project address?**

STEM literacy is critical to success in the 21st century. In a recent post, Dr. Richard Larson of MIT discussed why everyone—especially non-tech types—should have some working knowledge in the STEM area:

*“A person has STEM literacy if she can understand the world around her in a logical way guided by the principals of scientific thought. A STEM-literate person can think for herself. She asks critical questions. She can form hypotheses and seek data to confirm or deny them. She sees the beauty and complexity in nature and seeks to understand. She sees the modern world that mankind has created and hopes to use her STEM-related skills and knowledge to improve it.”*

Minnesota Children's Museum's new STEM gallery will foster inquiry and problem solving among our community's earliest learners. The gallery will integrate exploration of the natural and physical sciences with technology, engineering, and math. It will engage children and families in foundational skills that lead to STEM literacy, such as predicting and drawing conclusions, thinking mathematically, recognizing cause and effect, thinking creatively and experimenting to solve problems, and communicating ideas. Through a mix of whole-body, playful learning experiences and the use of interactive technology, the gallery will provide opportunities for children to build concepts and deepen their exploration of STEM concepts.

Researchers and educators know that playful activities benefit the development of the whole child. As children play, they develop critical cognitive, emotional, social and physical skills. The skills and proficiencies children learn and refine through play in the early years set the stage for their future learning and success from the kindergarten classroom to the workplace.

As the IMLS report *Museums, Libraries, and 21<sup>st</sup> Century Skills* notes,

*Built on a foundation of deep content mastery, [21<sup>st</sup> century skills] are the new workforce requirements for maintaining U.S. global competitiveness and ensuring each person's personal and professional success. Competencies like critical thinking, global awareness, and media literacy are no longer simply desirable—they are necessary... Being a successful 21<sup>st</sup> century learner and citizen requires these proficiencies as the necessary foundation.*

Incorporating what is known about 21<sup>st</sup> Century Skills along with children's approaches to learning, Minnesota Children's Museum has identified seven key proficiencies on which all Museum experiences will be based:

- **Confidence:** Children exhibit persistence, willingness to try new things and take appropriate risks
- **Creativity:** Children imagine, improvise, reinvent and innovate.
- **Critical Thinking:** Children are curious, set goals, solve problems and reflect.
- **Control:** Children focus, regulate emotions, behaviors and actions, and make reasonable choices.
- **Communication:** Children express thoughts and ideas, listen and empathize.
- **Collaboration:** Children cooperate, share and engage in teamwork.
- **Coordination:** Children exhibit fine and large motor skill competence, including precision, strength, balance and endurance.

Throughout the Museum, areas of conceptual knowledge such as STEM will provide the context within which children's development of these proficiencies can occur. We believe this focus on learning outcomes will result in powerful new approaches to playful learning in the new Museum space.

### **Who or what will benefit from your project?**

Millions of visitors will benefit from the new STEM gallery over the exhibit's anticipated life span of 10-15 years. We anticipate the planned expansion will help us increase service from our current level of 432,000 annual visitors to over 550,000. These visitors include families, schools and community groups. Minnesota Children's Museum's visitorship includes more than 13,000 household memberships, fifth largest in the nation.

Minnesota Children's Museum particularly aims to increase learning opportunities for children who face the greatest educational disparities. We see an enhanced emphasis on STEM education as an important method of engaging diverse and low-income communities in dynamic early childhood learning. Growing levels of child poverty in Minnesota and the nation's worst achievement gap between white students and those of color indicate a profound need for learning experiences that will transcend socio-economic conditions. In the most recent year, the Museum's *Play for All* access program served a total of 122,952 visitors, or 28% of our total. This includes the following initiatives:

- **Free All Play memberships** are available by application, for families at or below 130% of the federal poverty level. In 2012, All Play memberships reached 2,629 families. Enrollment forms are available in English, Spanish, Hmong and Somali.
- **School and Community Field Trips** brought 57,111 students and adults to the Museum, with sliding fees based on the number of children qualifying for free or reduced price lunch.
- **Target Free 3<sup>rd</sup> Sundays** serve as an entry point for many families. This free monthly program welcomed 29,845 visitors in fiscal 2012.
- **Passport to Play** admission passes are available at public libraries, reaching 9,676 visitors.
- **Head Start and Early Childhood Family Education Partnerships** bring program participants to the Museum for free family nights. Additionally, the Museum's education staff also conducts regular workshops on play for teachers and parents through these community programs.

Current members and attendees, including the *Play for All* participants described above, have been central to the early phases of expansion planning. General Mills, a long-time Museum supporter, has generously provided pro bono assistance in market research. Their team has been assisting with surveys and focus groups to ensure that data, impressions and ideas from current Museum users are incorporated into project planning. (Selections from their 2010 and 2012 research are included as supporting documents.) Of a list of potential exhibit components, the two that rose to the top were "*Engineering and Technology: tinker, invent, and solve...*" and "*Science: explore natural phenomena and materials ...*" Exhibits that incorporated animals, water play and nature were

also highly ranked. These options were popular among both current attendees and non-attenders, demonstrating a clear community priority for these content areas.

### **What are the intended results of your project?**

We strive to create an exhibit experience with measurable impact on STEM learning that can benefit the global children's museum field. When this project is complete, Minnesota Children's Museum will have a comprehensive plan and design for the STEM gallery, along with fully prototyped elements. This will set the stage for the construction of the gallery.

The ultimate goals of the STEM gallery align closely with IMLS goals for Learning Experiences grants. Through playful learning in the Museum's new gallery, we will advance early childhood development in our community, preparing children to be full participants in our world, through quality, inclusive, accessible services for informal learning.

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

For more than 30 years, Minnesota Children's Museum has embedded research on play, creativity and child development into its interactive learning environments and programs. The Museum's 2011-15 strategic plan aims to reach even more children through three goals:

- I. Expand Reach through Decentralized Growth
- II. Champion the Essential Role of Play in Early Learning
- III. Strengthen and Sustain the Museum's Core

The STEM gallery project advances the organization's second and third goals. The STEM gallery will incorporate recent research on both STEM education and learning through play. The Museum expansion is the central strategy to the third goal, bringing exhibits and programs to more children and families in our community.

## **2. Project Work Plan**

### **What specific activities will you carry out?**

At the time of this proposal, Minnesota Children's Museum is in the midst of a Master Planning process for the overall Museum expansion. Development of the STEM gallery will build on the outcome of the Master Plan. At this early stage, our three primary goals for the gallery are:

- To provide holistic, engaging, and inquiry-based STEM experiences for children and families;
- To incorporate the most current research in early learning and STEM education;
- To leverage technology in enhancing the learning experience for both children and adults.

The early vision for the new gallery integrates exploration of the physical sciences (light, water, energy) combined with discovery of the natural sciences (animals, habitats, weather), along with opportunities for children to practice math and engineering skills. Integrating these disciplines will present STEM concepts in a natural and tangible manner, while also fostering curiosity and creative problem-solving. Capitalizing on the philosophy of place-based learning, immersive STEM-based environments will provide the context for inquiry-based experiences. For example, at a model of the Mississippi River, children could explore the properties of water, as well as examine the river as a form of energy and an important part of the region's biodiversity. One component under consideration for the new gallery is a connection to the outdoors. Surrounded by plants and filled with discovery stations—such as water features, elements playing with light and shadow, a worm composting bin, and a sensory garden—an active, year-round connection to the outdoors can provide the basis for deep and engaging experimentation and inquiry.

A key component of the new gallery will be to leverage new technologies to deepen the exploration of STEM concepts. For example, a kinetic light sculpture—larger-than-life and full of fantastic colors—could seamlessly blend creativity, science and math as visitors construct light patterns along one wall of the gallery. As each visitor builds on the previous visitor's creation, a new light pattern continuously emerges on the digital canvas. We will explore ways to connect gallery experiences with visitors' home lives and other real-world applications, in addition to expanding opportunities for communicating with adult caregivers and educators about children's learning and development.

Throughout the gallery, exhibit components will be designed to encourage adults to explore STEM alongside their children. Visitors will be given specific suggestions for encouraging and extending inquiry experiences at home and in the community.

### **Who will plan, implement, and manage your project?**

The Museum's expansion is led by President Dianne Krizan, Vice President of Learning Innovation Barbara Hahn, Director of Exhibits Jennifer Spitzer and other key leadership staff in exhibit development, external relations and visitor services. Gyroscope, Inc.—an award winning, museum planning, architecture and exhibition design firm located in Oakland, California—has been engaged to help Minnesota Children's Museum staff envision the new STEM gallery, as part of overall exhibit planning for the expanded Museum. Their projects include the California Science Center, the Bishop Museum, Chicago Children's Museum, Austin Children's Museum, Bay Area Discovery Museum, Renton History Museum and Exploration Place.

Additionally, we will engage a variety of consultants and experts:

- After the Master Planning process is completed in spring 2013, the Museum will seek proposals from exhibit design firms to create specific plans for each of the new permanent galleries. The firm engaged would begin work on the STEM gallery in October 2013.
- A STEM content consultant will be engaged during the Preliminary design phase to bring a deep understanding of informal science learning in early childhood to the exhibit project. Working closely with Museum development and design staff, the consultant's primary responsibilities will include researching content as it relates to children's development of science inquiry and problem-solving skills, and adults' understanding of their critical role in children's STEM learning.
- A multi-media consultant will be identified and engaged beginning in the Preliminary design phase, and will remain on the project through the technology programming and production phase of the gallery.
- An evaluation consultant will be identified and engaged in the Preliminary design phase to develop protocols and lead the prototyping and testing.
- Minnesota Children's Museum's newly formed Research Advisory Council is providing strong input on the latest in child development research for the Museum. Dr. Megan Gunnar, Department Chair and Director of the Institute of Child Development at the University of Minnesota and a Regents Professor, chairs the Council. She serves along with eight practitioners and researchers from the University's Institute of Child Development and Center for Early Education and Development. (The full Research Advisory Council roster is included as an appendix). We also anticipate engaging the University of Minnesota's highly regarded STEM Education Center in a project advisory capacity.
- We are fortunate to have 3M, one of the world's great STEM innovators, headquartered in our community. 3M has committed lead funding for the STEM gallery, including the cost share for this request. We are also engaging 3M employees in a one-day workshop around key STEM concepts and exhibit design considerations, as well as in a long-term advisory and review role on the project.

### **When and in what sequence will your activities occur?**

The timeline for the STEM gallery is as follows:

#### *Activities prior to proposed IMLS grant period*

- March 2013 –Master Plan completed in partnership with Gyroscope
- Spring & Summer 2013 – Internal planning; volunteer and advisor engagement begins

#### *Activities during proposed IMLS grant period*

- October 2013 – Begin gallery planning; engage STEM, multi-media and evaluation consultants
  - Preliminary development and design and prototyping (October 2013 – March 2014)
  - Detail development and design and prototyping (April 2014 – September 2014)
  - Final design (October 2014 – April 2015)
- Summer 2015 – Break ground on museum expansion (costs not included in this proposal)

#### *Activities to follow proposed IMLS grant period*

- Fall 2015 – STEM gallery production begins; Fall 2016 – STEM gallery installation begins;
- Spring 2017 – New museum opening

During the grant period, the project team will undertake complete development and design of the new gallery—the environments, the interactives and the messaging for adults. Building on the gallery concept and working within the Museum's well-defined exhibit development and design process, the team will move through the Preliminary, Detail, and Final design phases during the 24-month grant period. Each phase of work will further define and refine the exhibit experiences and designs, resulting in a detailed interpretive plan.

During **Preliminary development and design**, the team will conduct further research into key concepts and experiences in STEM, developing specific strategies and interactives to best meet goals—especially focusing on best practice in inquiry-based science. Members of the project team will attend conferences such as the Association of Science Technology Centers annual convenings, along with visiting specific museums and exhibits to help inspire and guide development and design, including San Francisco's Exploratorium, Children's Creativity Museum and the California Academy of Sciences; Telus Spark in Calgary; Museum of Mathematics, in New York and Liberty Science Center in New Jersey. We will engage content experts to guide and review development throughout the process. We will begin early prototyping of exhibit components, testing for audience engagement, usability, and effective content and message delivery. Near the end of this phase, the plan will be reviewed by the Advisory Board, as well as other professional colleagues. The team will also undertake an internal review, inviting other Museum staff to comment on the plans. Feedback will inform the next phase of development and design.

During **Detail development and design**, we will produce design plans of environments, components and interactives. We will embark upon planning for props and costumes and exhibit text development, and continue prototyping. The team will review plans with accessibility consultants to ensure that designs maximize opportunities for all visitors. Near the end of this phase, the Advisory Board will once again review the plans in order to inform the final design.

During **Final design**, we will fully detail and finalize design plans of the environments, components and interactives, edit and finalize exhibit graphic text, and plan for props and costumes. This work will result in a final interpretive plan, to include final designs, a gallery walk-through describing the gallery experience and each interactive, and an exhibit graphic design template.

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

IMLS funding of \$150,000, along with \$444,735 in cost share from 3M will allow Minnesota Children's Museum to begin the exhibit design for the STEM gallery. Full funding for the gallery's construction will come

through the Museum's capital campaign. We are currently in the leadership fundraising stages, with \$3.5 million raised toward a goal of \$14 million in contributed funds. We anticipate that the remainder of the \$28 million project budget will come from local and state public funding. We are actively in conversations with city and state officials about securing these funds. Based on funding, our current timeline points to opening in 2017.

**What resources will your institution contribute to the project?**

Minnesota Children's Museum is devoting significant time and funds to our expansion plans. Recently, representatives of the Museum's education and exhibits team attended the Colloquium on P-12 STEM Education, an interactive national forum hosted by the University of Minnesota STEM Education Center. This event explored the newest research in STEM education, bridging the gap between research and practice to implement effective practices for STEM education. Significant staff time, Board leadership and community commitment will be crucial to the success of the capital campaign and the Museum renovation project.

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

Early on, the team will begin iterative prototyping of interactives, testing for audience engagement, usability, and effective content and message delivery. We will accomplish this through a combination of intensive prototyping sessions with focus groups, as well as by bringing prototypes out onto the Museum floor to test with visitors in a spontaneous and less formal environment. These two approaches will ensure that we garner specific feedback needed to design effectively, but also provide flexibility to try a number of approaches, modifying prototypes quickly to respond to visitor feedback. The Museum has a full-service production shop onsite, ensuring the capability to make needed modifications to prototypes and put them back on the floor for re-testing. An evaluation consultant will be engaged during Preliminary design phase to assist the team in refining a set of prototyping protocols and processes, and assist the team in gathering and analyzing data.

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

The STEM gallery will be open to the public in 2017. We will share the progress of the gallery's design and construction with our peers in the Museum field, our members, donors and other stakeholder groups.

**Organizational Budget Note**

The budget surpluses (2010 & 2012) and deficit (2011) shown on the program information sheet are due to the Museum's two-year cycle of funding from the State of Minnesota. These funds are recorded in the year received and then released from restriction as projects are completed.

**3. Project Results**

**What knowledge, skills, behaviors and attitudes do you expect to change and among whom?**

A key strategy in the expansion project is to make children's learning more apparent, both to the children themselves, and to their parents and other caregivers. Through children's interactions in the exhibits and programs, as well as through messaging to adults, our aim is for adults to recognize that playful learning is occurring not only within the Museum's exhibits and programs, but also at home and in the community. We also want adults to understand how play contributes to brain development and 21<sup>st</sup> century learning, and identify how to support and promote it at home.

Minnesota Children's Museum recently worked with the University of Minnesota to produce a research summary describing how play impacts children's learning. The full summary and bibliography are enclosed as appendices, but the relevant section on STEM learning is excerpted below. These are the types of knowledge, skills, behaviors and attitudes that we intend to address through the STEM gallery.

*Recently, the field of education has experienced a push to develop the STEM (Science, Technology, Engineering, and Math) skills that are important to success in the 21<sup>st</sup> century. Through play with objects – blocks, sand, balls, crayons, and paper – children begin to understand logical scientific thinking, such as the concept of cause and effect. They also practice mathematical skills such as measurement, quantification, classification, counting, ordering, and part-whole relations (Gelfer & Perkins, 1988; Ginsberg, Inoue & Seo, 1999; Piaget, 1962; Ness & Farenga, 2007). The informal understanding children gain through experimentation, observation, and comparison in play lays the foundation for higher-order thinking and later learning of formal STEM concepts (Bergen, 2009; Ginsberg, 2006; Shaklee et al., 2008 as cited in Fisher et al., 2011; Tepperman, 2007).*

*Free play provides rich opportunities for children to experiment with mathematical concepts. Ginsburg, Pappas and Seo (2001; see also Sarama & Clements, 2009) found evidence of mathematical activity during almost half of their observations of preschoolers' play. Specifically, they noted that children spent 25% of their time exploring patterns and shapes, 13% comparing the magnitude of objects, 12% on enumeration, 6% exploring transformation, 5% on spatial relations such as direction and distance, and finally 2% on the classification of objects into groups. Even without specific adult guidance in the moment, children's free play is rich with STEM lessons.*

### **How will you measure success in achieving your intended results?**

In Preliminary design, the team will develop measurable outcomes for the gallery, and tools for measurement, analysis, interpretation and use of findings. This work will build on evaluation capacity efforts the Museum has undertaken during the past several years, and will establish a protocol for the development of all other galleries. Engaging the expertise of the evaluation consultant, the Research Advisory Council, as well as project advisors, the team will:

- develop and refine visitor outcomes that align with recognized STEM impacts such as Project 2061's *Benchmarks for Science Literacy* and the National Research Council's *A Framework for K-12 Science Education*; and
- during the early stages of prototyping, refine our set of prototyping protocols and processes, resulting in a new set of tools for internal exhibit evaluation.

### **What project results will be of value to the field?**

Minnesota Children's Museum is a leader in the field, as one of the nation's largest and most innovative children's museums. Our organization is the largest producer of national traveling exhibits for children's museums, reaching nearly 15 million to date. We expect that many of the lessons learned in creating the STEM gallery will be of interest to our peers. We will share our framework, many aspects of the design and the research findings with our colleagues in the field.

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

Our intention is to build ongoing research into the exhibits and galleries. Engaging the expertise of the Research Advisory Council, the team will develop ways to incorporate research into the exhibits, and make ongoing changes based on findings.

As Minnesota Children's Museum plans the renovation of our physical space, we are carefully planning for how the expanded museum will be supported and maintained. 3M has committed to being a major gallery partner for the STEM gallery, providing initial capital support for the project, ongoing operating support and considerable employee engagement. We are working to establish similar partners throughout the Museum, to ensure that these spaces are maintained throughout their lifespan, allowing them to reach millions of children.

**STEM Gallery Design Project – Project Timeline**

Task Name	Start	Finish
<b>Preliminary Development &amp; Design</b>	<b>10/01/13</b>	<b>3/31/14</b>
Research	10/01/13	3/31/14
Site Visits	10/01/13	3/31/14
Begin Prototyping	10/01/13	3/31/14
Advisor Review	3/1/14	3/31/14
Internal Review	3/1/14	3/31/14
<b>Detail Development &amp; Design</b>	<b>4/1/14</b>	<b>8/31/14</b>
Continue Prototyping	4/1/14	8/31/14
Produce Design Plans	4/1/14	8/31/14
Plan for props & costumes	4/1/14	8/31/14
Exhibit Text Development	4/1/14	8/31/14
Accessibility Review	8/1/14	8/31/14
Advisor Review	8/1/14	8/31/14
<b>Final Design</b>	<b>9/1/14</b>	<b>2/28/15</b>
Finalize Design Plan	9/1/14	2/28/15
Finalize Exhibit Text	9/1/14	2/28/15
Finalize Plan for Props and Costumes	9/1/14	2/28/15
Produce Graphic Design Template	9/1/14	2/28/15
Completed Interpretive Plan	3/1/15	9/30/15
Completed Designs	3/1/15	9/30/15