

*"The experiences, resources, and interactions provided by libraries and museums build brains and fuel a love of learning." – Growing Young Minds, IMLS*

# BRAIN-BUILDING POWERHOUSES

How  
Museums and Libraries  
Can Strengthen  
Executive Function  
Life Skills

**Families and Work Institute** in partnership with the  
**Institute of Museum and Library Services** and  
**School Readiness Consulting**

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## SUMMARY

Libraries and museums are among our communities' most engaging and trusted learning institutions. They are safe places where children and their families connect, discover and grow together. In these community anchors, the passion and urgency of learning takes root in a child. The experiences and discoveries that they provide build the executive function life skills essential to success in learning and in life.

*Brain-Building Powerhouses: How Museums and Libraries Can Strengthen Executive Function Life Skills* takes a deeper look at how museums and libraries promote executive function life skills and shares the results of an in-depth review and national survey of leaders in museums and libraries serving children and families. The results highlight:

- promising new practices that feature research on the brain and their potential for focusing on executive function life skills in their exhibits and programs; and
- opportunities for positioning libraries and museums as key contributors to the work of promoting executive function skills.

Understanding the power of libraries and museums as learning hot spots for these skills can spur library and museum professionals to understand the science and then tap their creative skills and deep expertise to translate it into fun and engaging activities, programs and exhibits that help children learn how to learn. The power of museums and libraries is great, but the potential is even greater.

## INTRODUCTION

As the U.S. recommits to being a nation of learners, increasing numbers of educators, business leaders, policymakers, parents and others recognize the importance of early brain development and related life skills as foundational for learning and development now and in the future. As the science continues to provide new lessons about the complexities and capacities of the brain, a particular set of skills known as executive function life skills has been found to play a particularly critical role in early childhood as well as later school and life success. Informal learning opportunities offered in museums and libraries can play a pivotal role in promoting the development of these important skills.

### Why Are Executive Function Skills Important?

*Research over the past couple of decades has revealed that executive function life skills are an important predictor of long-term development outcomes — they are an excellent predictor of school achievement, for example, but also predict the likelihood of graduating from college, SAT scores, educational and economic achievement in adulthood, physical health and the like.*

*Educators have become interested in [executive function life skills], recognizing that [they] often provide a better predictor of children's likelihood of success than does IQ, which is the traditional way of assessing individual differences in their relevance for school achievement.*

*Developing those executive function life skills puts children in a position to learn more effectively, more easily, more efficiently!* – Philip David Zelazo, PhD, University of Minnesota<sup>1</sup>

Executive function life skills have been called “the building blocks for the early development of both cognitive and social capacities,”<sup>2</sup> and research shows they continue to play an important role in ensuring success across the life span.

- We know, for example, that self control, one component of executive function, is linked to greater school readiness and school success and is predictive of early math and reading ability independent of intelligence (Blair and Razza, 2007).
- The ability to delay gratification in preschool has been identified as a developmental precursor for this ability in adolescence where it can play a big part in determining students’ high school success (Eigsti et al., 2006).
- Self control developed in the early years is also predictive of positive outcomes for college students, including higher grades, fewer impulse control problems, better adjustment and better relationships (Tangney, et al., 2004).
- Another aspect of executive function life skills, “attention span persistence” in four year olds, has been found to be strongly predictive of whether or not these same children graduated from college when they were 25 years old (McClelland et al., 2012).
- Executive function life skills are increasingly assessed in tests like PISA (Programme for International Student Assessment, OECD) and are an important foundation for the Common Core State Standards — both of which move beyond examining what students have learned or memorized to looking at how students can use knowledge in new and diverse settings.
- Finally, these skills are seen as critical to workforce readiness and success, but there is a mismatch here. Employers report that new entrants to the workforce are often lacking these skills and, instead, have a “fill-in-the-bubble mentality,” are not used to working in teams and don’t have experience in challenging themselves, thus creating a jobs gap that leaves millions of jobs unfilled.

In short, if we are going to make a difference in school readiness, school success, workforce readiness and workforce success, executive function life skills are a strong place to intervene because research shows they can be improved (Diamond and Lee, 2011).

## What Are Executive Function Skills?

At their core, executive function life skills include three brain processes that are essential for goal-directed problem solving. They are:

- *being able to **think flexibly** — being able to think about something from multiple points of view, for example, being able to take somebody’s perspective on a situation;*
- ***working memory** — keeping information in mind, keeping it available in consciousness so that it can be used to guide behavior in the course of problem solving; and*

- **inhibitory control**, which refers to an effortful ability to suppress attention to distracting information and stay focused. – Philip David Zelazo, PhD, University of Minnesota<sup>3</sup>

Based on 15 years of reviewing the research, Mind in the Making (MITM), a program of the Families and Work Institute (FWI), specifies seven executive function life skills that build on these core brain processes. (<http://www.mindinthemaking.org/>) They are:

- 1) **Focus and Self Control:** Children need this skill in order to achieve their goals, especially in a world that is filled with distractions and information overload. It involves paying attention, remembering the rules, thinking flexibly and exercising self control.
- 2) **Perspective Taking:** This skill goes beyond empathy; it involves figuring out what others think and feel, and forms the basis for children's understanding of their parents', teachers' and friends' intentions. Children who can accept other perspectives are also much less likely to get involved in conflicts.
- 3) **Communicating:** This skill involves much more than understanding language, speaking, reading and writing. It drives determination of what one wants to communicate and aids realization of how one's communications will be understood by others. Teachers and employers feel this skill is most lacking today.
- 4) **Making Connections:** Figuring out what's the same and what's different, and sorting these things into categories is at the heart of learning. Making unusual connections is at the core of creativity. In a world where people can Google for information, it is the people who can see connections who are able to go beyond knowing information to using the information well.
- 5) **Critical Thinking:** This is the ongoing search for valid and reliable knowledge to guide beliefs, decisions and actions.
- 6) **Taking on Challenges:** Life is full of stresses and challenges. Children who are willing to take on challenges (instead of avoiding them or simply coping with them) do better in school and in life.
- 7) **Self-Directed, Engaged Learning:** It is through learning that we can realize our potential. As the world changes, so can we, as long as we learn.

## What Children Need to Develop Executive Function Life Skills

The research on brain development and the importance of promoting executive function life skills is clear. We know the early years are critical and that the basis for future development lies in the formation of healthy relationships with caring adults who engage in important "serve and return" — that is, back-and-forth interactions with children. With the publication of Ellen Galinsky's book, *Mind in the Making: The Seven Essential Life Skills Every Child Needs* (HarperStudio 2010), its extensive review of this research and discussion of what works in promoting executive function life skills, we now have a practical guide to what it takes to ensure children have the opportunities, interactions and experiences to develop life skills. Mind in the Making tells us that children develop these important life skills when they have:

- access to rich and stimulating interactions and experiences with caring adults starting from birth;
- support from well-informed adults who can help children set goals as well as strategies to achieve those goals;
- support from adults who can promote and scaffold learning and development of skills;
- opportunities to interact with adults and children in a variety of settings where they can explore;
- ideas and materials to develop new understanding of how the world works;
- exposure to new ideas and perspectives from other children and adults;
- access to materials, experiences and resources that engage children in learning;
- support and encouragement to dig deep and to follow special interests;
- opportunities to take on challenges, test personal limits, make and learn from mistakes in safe and supportive environments;
- opportunities and guidance to practice new skills under development;
- opportunities and sufficient time to plan, experiment, explain, document and reflect; and
- access to resources needed to build knowledge, check facts and gain information.

## How Museums and Libraries Contribute to Promoting Executive Function Skills

Museums and libraries possess all the ingredients and capacity needed to become an integral part of a child's learning life. In addition, as trusted community institutions, libraries and museums can leverage their resources and, in partnership with other organizations, significantly improve their community's "learning quotient."<sup>4</sup> Museums and libraries are experts in immersive, experiential, self-directed and hands-on learning; they are expert providers of many of the hallmarks of such informal learning as project-based and inquiry-based learning, responding to individual interest and abilities, and providing personalized learning environments;<sup>5</sup> and they inspire curiosity and fuel a passion for learning.

By building on what we now know about brain development and the importance of executive function life skills in children and linking that to the power of informal learning to promote these skills, museums and libraries emerge as potential key contributors to significantly promote understanding and development of executive function skills and, in the process, create vibrant communities of life-long learners. This report provides compelling evidence of the many ways museums and libraries are poised to leverage their assets and commitment to families and children to make the promotion of executive function life skills an integral part of their work.

## The Impetus for This Report

The impetus for this report is the growing acknowledgement of the importance of executive function and recognition of the seminal role that museums and libraries can play. Museums and libraries have expressed strong interest in knowing and then using this research in their work with the public and in their program work, and Mind in the Making continues to document the research on executive function skills and is working with communities around the nation to embed this research in action.

As a result, this report represents a first step in an ongoing effort to explicitly embed what we know about explaining and promoting executive function life skills into museum and library resources and programs.

The report was created by the Institute of Museum and Library Services (IMLS) and Families and Work Institute (FWI) in collaboration with School Readiness Consulting with funding from the Popplestone Foundation. Many of the examples included in this report are project made possible in part by IMLS. For more information go to [www.ims.gov](http://www.ims.gov).

## EXAMINING THE ROLES OF LIBRARIES AND MUSEUMS IN SUPPORTING BRAIN DEVELOPMENT AND EXECUTIVE FUNCTION LIFE SKILLS

The purpose of this report is to learn how museums and libraries can:

- increase understanding of the brain, how it develops and how it really works;
- share research from neuroscience on learning;
- increase awareness that there are specific skills — called executive function life skills — that can help children and adults thrive now and in the future; and
- share innovative ways in which libraries and museums can develop resources and experiences that support explaining and building the brain.

To collect this information, an online survey was sent to members of national library and museum associations. More than 230 libraries and museums — from small rural communities to large metropolitan areas — responded to the request. (See Appendix for summaries and metrics.)

Our analyses of responses reveal that, by their very nature, library and museum programs and services provide the kinds of experiences and information that can be leveraged to promote brain development and executive function life skills. However, the majority of responses reveal that, to date, there have been very few efforts to intentionally integrate the science of promoting executive function life skills into programs and services.

*I recently joined my six-year-old niece for a museums visit. As she combed through a drawer on a display wall, she pulled it out and gleefully exclaimed “OOOHH!*

*More information!”*

– Michael Robbins, US Department of Education in Building the Future of Education, Center on the Future of Museums, 2014

The survey also revealed that museums and libraries are unique in having the raw materials for developing a robust and targeted approach to promoting the development of executive function life skills. They are poised to take the next step. By leveraging key assets and aligning practices with what we know about each of the seven life skills, museums and libraries can become important contributors to children’s learning and leaders in the informal learning field.

Providing resources and services to build knowledge is at the core of what museums and libraries do. These “education powerhouses”<sup>6</sup> provide a wealth of information and experiences designed to increase understanding and skills across a wide variety of institutions and settings. Many of their key assets are devoted to specific content areas including language and literacy, STEM, digital technology and school readiness. Programs are designed to inform and build capacity of families to understand what children need to know and be able to do, and community partnerships provide an important avenue to bringing knowledge to other sectors. In short, libraries and museums are important settings for providing information and content — the “what” of learning. The science of the Mind in the Making seven executive function life skills provides insight and opportunities to address the “how” of learning. By linking rich content and innovative approaches to engaging and inspiring learners with explicit attention to explaining and promoting executive function life skills, libraries and museums will become places where children learn not only content, but also “vital life skills.”<sup>7</sup>

*“Museums and libraries are valuable resources for supporting families in their role as children’s first teacher, providing caregivers with materials and information, and engaging the community in providing enriching experiences for children that support their brain development and lay the foundation for their future success.”*

– Sherri Killins, former Commissioner, Department of Early Education and Care, Massachusetts  
Commonwealth Partners with Boston Children’s Museum to Support Family and Community Engagement in Early Childhood Learning,  
Boston Children’s Museum

## An Overview of This Report

### PART ONE

We begin by describing the six **Key Assets** found in museums and libraries, discussing in general how each can be leveraged to promote executive function life skills.

In **Progress and Possibilities: Examples from the Field**, we provide examples of innovative approaches that are ideal for explicitly addressing the research and science of brain development and executive function life skills.

### PART TWO

Next, we take a deeper look at the **seven executive function life skills** and provide examples of how museums and libraries are developing experiences and resources that could be aligned specifically to each one.



Throughout the report, you will also see **Brain Building Sketches** that describe ways museums and libraries are already thinking about and integrating the science of children’s brain development into their programming.

To facilitate thinking about what it might take to integrate executive function life skills into programs, we include **Profiles** of two institutions that have already started the work.

### **PART THREE**

We conclude with a **Call to Action**, invoking libraries and museums to build on their assets and position in the community to take the lead in bringing the power of informal learning into the forefront of efforts to expand understanding and promotion of executive function life skills as key elements of learning and life success now and in the future.

## **PART ONE: LOOKING AT ASSETS**

### *Six Assets Museums and Libraries Can Use to Promote Executive Function Life Skills*

In considering how programs and services, resources and tools might be more explicitly framed to include a focus on brain development and executive function life skills, six universal and unique assets of museums and libraries emerged. They are:

- 1) proven success and capacity to engage, inform **families** and support them as their children’s first teachers;
- 2) programmatic focus on early **literacy and school readiness**;
- 3) use of **play and inquiry-based approaches** supported by rich collections and materials;
- 4) leadership in the **Science, Technology, Engineering, Math** (including the Arts) STEM/STEAM field;
- 5) innovation and universal **access to digital technology and tools**; and
- 6) capacity and mission-driven development of **diverse community partnerships**.

As you read about these six key assets, consider some of the strategies and actions libraries and museums could take and the resources and tools that could be deployed to more explicitly explain and build executive function capacity.

### **Asset 1: Family Engagement**

The research base for the importance of supportive, responsive adult-child interactions on children’s brain development and executive function life skills is well established. Starting at birth, interactions and playful activities that take place between parent and child help promote these skills.

Through story times, exhibits, collections, special programs and open-ended materials and tools for parents and children to explore together, museums and libraries set the stage for

important interactions and experimentation that support brain development and provide opportunities for expansion into a more explicit focus on executive function life skills.

By jointly solving problems in settings like makerspaces and “tinkering studios,”<sup>8</sup> parents and children become co-learners in a process that builds relationships, encourages communication and sets the stage for the development of important executive function life skills such as Focus and Self Control, Critical Thinking and Taking on Challenges. In makerspaces, low-cost, everyday tools and materials are enhanced through access to technology that helps users learn through the making process. Visitors pursue their own interests in building things and collaborate and share with one another.

When museums and libraries enhance and extend their programming through tips and prompts to help guide exploration and interactions, they provide parents and caregivers with the tools they need to scaffold learning. When they provide follow-up activities — both print and web-based — they help parents and caregivers understand how and why these activities are important and are building their capacity to support children’s learning and development at home. These commonly used practices are ready-made for the inclusion of information and guidance on building executive function life skills.

As trusted community institutions, museums and libraries can also be valuable resources for parent training and information. From informal play-and-learn groups to formal parent training to developing parent leadership and peer networks, museums and libraries are creating multiple pathways for building families’ knowledge, skills and agency. Finally, both onsite and in partnership with such organizations as schools and family service agencies, museums and libraries connect families to other resources and materials.

### **Progress and Possibilities: Examples from the Field**

- At the **Sciencenter** (Ithaca, NY), the Science Together program for parents and caregivers provides information on how children learn as scientists. After a song and a story, adults and children are given materials and tools to explore together. Researchers from the Early Childhood Cognition Lab at Cornell University assist with the program, modeling and sharing developmental research with parents, which enables parents to see behaviors in real time in their own children.
- At the **Patricia and Phillip Frost Museum of Science** (Miami, FL), the staff is developing a parent leadership program that prepares parents to deliver short, hands-on activity and facilitates exploration of museum exhibits with other families in the community. And at the **Boston Children’s Museum** (Boston, MA), parent ambassadors help conduct community outreach to bring new families into the museum.
- At the **Children’s Museum of Manhattan** (New York, NY), a lecture series for parents and caregivers brings content experts to speak with parents on a variety of topics including the importance of play and learning, healthy brain development and learning/developmental milestones.

- At the **Valley Community Library** (Peckville, PA), a Family Place Library,<sup>9</sup> such resource specialists as early interventionists and pediatricians are available during informal parent-child play groups to answer questions, offer suggestions and provide resources and information on children’s development.
- At the **Providence Public Library** (Providence, RI), a unique interactive early learning environment, the Chace Children’s Discovery Library, provides activities designed to promote self-directed play as well as encourage the engagement of children and adults in activities together.
- The **Please Touch Museum** (Philadelphia, PA) is developing an interactive mobile communications app and website that will support families through the kindergarten transition. Resources include a readiness checklist, activity calendar and parent-child activities.

Family Place Libraries™ are specifically focused on family engagement and support. These full-service libraries are also research-based family centers providing early childhood information, parent education, and early literacy and socialization experiences that can be used to build executive function life skills. The Family Place model has been replicated in more than 375 libraries in 26 states and continues to expand.<sup>10</sup>

## BRAIN BUILDING SKETCH

### Science Museum of Minnesota: The Wonder Years – The Science of Early Childhood Development

The Science Museum of Minnesota in partnership with the University of Minnesota and Public Agenda has created a research-based interactive exhibit focused on “the big things that happen in little brains.” The Wonder Years exhibition reveals how children learn from the world around them. Through videos and opportunities to interact with young children, the exhibition highlights the importance of relationships in healthy development. An area designed for young children and their families and caregivers encourages storytelling and creative play. Researchers working on the floor of the gallery show how they study young children and come to understand child development. A final area explores implications of the science and invites visitors to consider how individuals and the community can support children’s healthy development.

## Asset 2: Support for School Readiness and Early Literacy

Given the recognized importance of many of the executive function life skills for children’s success when they enter school, libraries and museums can play important roles in using existing programs and resources to make families more aware of the skills and how to support their development in children.

Museums and libraries play a number of key roles in supporting children’s school readiness and early literacy development. By engaging families early and often, they are helping to instill commitment and equip them with the tools they need to support learning and development.

For families with infants and toddlers, given the dearth of programs for very young children, museums and libraries often fill the gap in available resources by offering programs and spaces intentionally designed to provide stimulating and age-appropriate experiences so important for present and future learning. For preschoolers and their families, programs and resources are designed to build skills and knowledge children need to thrive and help them successfully transition to kindergarten. Nationally replicated research-based early literacy programs such as Every Child Ready to Read and Mother Goose on the Loose (MGOL) are designed specifically to provide parents and caregivers with knowledge and skills to support early language and literacy development for their children now and when they enter school.

### BRAIN BUILDING SKETCH

*Mother Goose on the Loose* is an award-winning early-literacy program for children from birth to age three with their parents or caregivers. The program is based on research which shows that children learn best through routine and repetition in a nurturing environment. *Mother Goose on the Loose* uses a variety of activities, such as rhymes, songs, puppets and instruments to foster speech development, motor coordination, self-confidence and sensitivity to others. The program integrates findings from brain research, best practices from library story times and multiple theories of learning. Nursery rhymes are used to create nurturing play experiences that foster experimentation, creative thinking, scaffolded learning and practice of self-regulation skills.

### Progress and Possibilities: Examples from the Field

- The **Children’s Museum of Houston** and the **Houston Public Library** (Houston, TX) have launched the Family Literacy Involvement Program (FLIP) designed to increase learning by circulating literacy kits that include a book and hands-on activity guides to build literacy skills. These research-based kits are now used in cities across the country. An evaluation study showed significant impact on home reading practices and parental understanding of children’s skills and interests.
- At the **Columbus Metropolitan Library** (Columbus, OH), a comprehensive “Young Minds Initiative” has been launched focusing on kindergarten readiness, third grade reading and high school graduation. As part of its ongoing early learning work and in partnership with the Columbus Public Schools and Learn4Life, the SPARK school readiness initiative links home visiting for four year olds with transition programs and ongoing support in kindergarten and beyond.<sup>11</sup>
- The **Walters Art Museum’s** (Baltimore, MD) play-based, content-focused activities and programs follow a growth trajectory and are designed specifically to “grow with families” by offering a scaffold series of learning opportunities across developmental stages. In this way, families are able to understand and observe early learning as it progresses and build their own skills to help children succeed now and in the future.

## BRAIN BUILDING SKETCH

The [Arizona State Library, Archives and Public Records](#) has provided “Brain Boxes” to libraries across the State to train parents and caregivers to use strategies for brain development and school readiness. Library staff receive training for working with families and introducing them to the “A,B,C Method” of supporting children’s brain development (Attention, Bonding, Communication).

### Story Times, Book Collections and Displays

**While story times are traditionally and most frequently offered at libraries, a number of museums are also incorporating story times and related activities into their programming for young children that could be expanded to promote executive function life skills.**

Through story times and related programs, children and their parents and caregivers have opportunities to listen and learn new concepts, words and skills. Activities support the Mind in the Making skill of Focus and Self Control as well as the skill of Making Connections.

Most story times provide such age-specific programming as:

- lapsits for infants that include interactive games, songs and movement supporting parent-child interactions known to promote earliest brain development;
- stories, songs and nursery rhymes — and related theme-based activities — and interactive games for toddlers and parents that build listening skills, early language and such new social skills as taking turns and following simple directions;
- Preschool story times that often have a special focus on school readiness and transition to kindergarten and include activities linked to state standards; and
- K-2 book clubs that engage children in deeper discussions encouraging the Mind in the Making skills of Perspective Taking and Critical Thinking.

Theme-based story times often include extended support activities that provide additional opportunities to address brain building and executive function life skills. Research shows that interactive story times have the greatest impact on children’s learning.<sup>12</sup> A number of libraries use dialogic reading techniques to engage children in thinking and talking about the stories they hear. (Dialogic reading engages children in back and forth questions and responses with an adult to expand comprehension and language.)<sup>13</sup> The use of repetition has also been linked to learning and brain development, leading to a recent shift in story time practice designed to enhance abilities to make connections and build new concepts.<sup>14</sup>

StoryWalk® is being used to promote language and literacy development represent another opportunity to incorporate a focus on executive function skills into existing programs. StoryWalk® places a children’s story (a deconstructed book, page by page) along a popular walking route in the community. Conceived as a way to combine physical activity with learning, StoryWalk® helps build interest in reading while encouraging healthy activity for both adults and children.

Book collections, book bundles and displays are also used as a way to provide information and drive users to books related to specific interests and topics. Collections and displays provide opportunities to include information on how the Mind in the Making executive function life skills, such as Making Connections, Perspective Taking and Communicating, are promoted through books. A number of libraries are offering titles specifically aligned to the seven executive function life skills and offering free book tips developed by the Mind in the Making team in collaboration with First Book to promote these skills while reading and talking about children's books. (<http://mindinthemaking.org/firstbook/>)

### BRAIN BUILDING SKETCH

**Every Child Ready to Read® @ your library®** is based on the principle that reading is an essential life skill. Traditionally, early literacy programs at libraries have focused on children. Story times and other programs might model strategies that parents can use to develop early literacy skills, but parent education is not typically the primary intent. Teaching parents and other caregivers how to support the early literacy development of their children is the basis of Every Child Ready to Read® @ your library®. Based on current research on learning and reading, the program builds skills and knowledge through five interactive activity areas: talking, singing, reading, writing and playing.

### Asset 3: Play and Inquiry-Based Programs

**A key avenue through which children can develop and practice executive function life skills is play. This is another avenue for a more explicit focus on executive function skills in the future.** Studies show that through open-ended, self-directed and guided play, young children can learn to regulate their behavior, lay the foundation for later learning in math and science, figure out complex negotiations in social relationships, build a repertoire of problem-solving skills,<sup>15</sup> learn to communicate effectively and build capacity to take on challenges.

Vigorous physical play contributes to the development of such important processes as inhibitory control, working memory and cognitive flexibility and the skills they support, such as Focus and Self Control. Research links dramatic or pretend play to the development of executive function skills,<sup>16 17</sup> creative problem solving and language development.

With a variety of materials, artifacts, resources and tools, as well as print and digital media, museums and libraries possess the raw materials needed to

*The unique environments that children's museums provide—with opportunities to interact with children and families very different from your own, in a setting that encourages critical thinking, making connections and problem solving—are perfect for providing a strong foundation in executive function skills.*

– Jenni Martin, Director of Education  
Children's Discovery Museum of San Jose

create rich, inquiry-based, child-directed play experiences that can support brain development and executive function life skills.

Play in museums and libraries takes many forms. Children’s museums are designed to offer divergent, hands-on playful experiences that encourage discovery and exploration. However, recognizing the value of playful experiences in contributing to brain development, libraries and museums of all types — including science, history and art museums, nature centers and zoos — are increasingly incorporating play spaces and play-based programs into their regular offerings.

To ensure they provide experiences that can effectively expose children to new ideas and information and help build life skills, museums and libraries are using research on play and its impacts to design interactive exhibits, programs and experiences that contribute directly to specific developmental outcomes.

### **BRAIN BUILDING SKETCH**

The Sara Lee Schupf Family Center for Play, Science and Technology (SciPlay) at the **New York Hall of Science** (New York, NY) leverages children’s play for science learning and teaching. Based on the belief that a child’s ability to engage in natural play and playfulness steers him or her to specific activities and supports creativity, the program uses research-based strategies to foster play and playfulness in the teaching and learning of complex scientific concepts. The program is developing resources that draw on (a) children’s physical play as the basis for teaching about complex physics concepts and (b) the use of playfulness as a pedagogical approach for introducing science ideas to children and allowing them to engage in mental play (imagination) across informal and formal settings.

### **Progress and Possibilities: Examples from the Field**

- At the **Naper Settlement** (Naperville, IL), a mission-driven outdoor “playscape” was created that included opportunities for physical play (blockhouse fort and climbing structures), socialization and imaginative play (trading post), discovery and exploration (splash pad/water play). Signage, sensory gardens and animal footprints help make connections to the past.
- The **New York Hall of Science** (New York, NY) has a science playground (SciPlay) that uses such playground elements as slides, see-saws, sand pits and fog machines to invite visitors of all ages to explore scientific principles of motion, balance, sound, sight, simple machines, as well as sun, wind and water.
- A number of children’s museums engage children in pretend play in interactive exhibits replicating real life and familiar settings. The **Kohl Children’s Museum** (Glenview, IL) includes a sandwich shop and a grocery store. To assist adults in appropriate interactions and effective active participation that scaffolds learning, a guide provides cues and suggestions for encouraging and expanding play.

- At the **Knox Public Library** (Knox, PA), story times and extra activities guide children into remembering the stories they have heard. Stories are read, acted out and there is a question time at the end. Hands-on accessories are available for the children to touch and act out the stories. They create their own versions of the story and tell the main idea in their own way.
- At the **Lawrence Hall of Science** (Berkeley, CA), a “Design Thinking through Play” project for children from ages four to seven offers hands-on learning activities to promote innovation, design thinking and 21st Century Skills. Outcomes include a framework for developing play-based design experiences for young children in museums, a set of engineering design activities and a facilitator’s guide.
- The **Brookfield Zoo** (Brookville, IL) developed a model for formal and informal early childhood educators in the Chicago metropolitan area to promote children and family learning (nature play, exploration and scientific inquiry) within urban environments. In collaboration with the Forest Preserve District of Cook County and the Mary Crane and El Valor Head Start centers in Chicago, Brookfield Zoo trained early childhood educators in its established nature play curriculum; facilitated networking opportunities between participants and organizations; and hosted a two-day symposium for 150 early childhood educators at the end of the project. This partnership can serve as a replicable model for zoos, nature preserves and Head Start programs throughout the country to increase opportunities children have to play, explore and learn in nature.

## Asset 4: STEM/STEAM Programs

### *STEM/STEAM: Science, Technology, Engineering, (Arts), Math*

**Young children’s inherent curiosity leads them toward inquiry, which is at the core of STEM/STEAM learning and offers another important avenue for developing a more intentional focus on executive function life skills.** Informal learning settings are particularly well-suited to boosting STEM learning and increasing public understanding of its importance. Research supports the notion that learning experiences in libraries and museums positively influence science learning in school, attitudes toward science, pursuit of science-related occupations and engagement in lifelong science learning (Bell et al. 2009).<sup>18</sup> STEM experts focused on the status of engineering education in K-12 schools are calling for the development of engineering “habits of mind”<sup>19</sup> that include systems thinking, creativity, optimism (ability to take on challenges), collaboration, communication and ethical considerations — all closely aligned to executive function skills and well-supported in museum and library experiences.

STEM/STEAM programs and activities are being developed for children of all ages, providing important early learning opportunities to build the foundational skills as well as offering challenging and open-ended opportunities for school-age children across grade and ability levels to gain new insight and build skills. While science museums have taken the lead in developing exhibits, resources and programs targeting STEM/STEAM learning, children’s and other museums, zoos, nature centers, aquaria, etc. as well as libraries are making purposeful additions to their programming to integrate science-based learning experiences into programming.



From small scale exhibits, learning centers and STEM-based activities to broad-based approaches to programming and public engagement, museums and libraries represent an important piece of the STEM/STEAM movement in both formal and informal settings. Respondents described the provision of wooden unit blocks and Legos in both open-ended play spaces and through “Block Parties” and “Lego Clubs” facilitated by trained adults to scaffold learning new concepts, build skills and enhance language development. Robotics programs — from introducing small programmable robots (BeeBots) and robotic kits to young children and families to hosting robotics competitions for middle and high school students — are being added to museum and library programs. Special science events and out-of-school science workshops and classes are common offerings and provide opportunities to focus on specific executive function life skills. Activities related to story times in libraries and exhibits in museums are frequently science-based. Field trips are used to introduce groups of children to special STEM/STEAM-based experiences and to provide information and professional development to teachers.

*Learning experiences across informal environments (such as science centers, zoos and public libraries) positively influence science learning in school, attitudes toward science, pursuit of science-related occupations and engagement in lifelong science learning.*

– Bell et al. (2009) in Dusenbery, 2013

### **Progress and Possibilities: Examples from the Field**

- At the **Patricia and Phillip Frost Museum of Science** (Miami, FL), a researched-based comprehensive preschool science curriculum as well as teacher professional development and a family engagement program is being implemented. The Early Childhood Hands-On Science curriculum (ECHOS) is sequenced to progressively introduce critical thinking skills.
- At the **Denver Museum of Nature and Science** (Denver, CO), the new Discovery Zone, based on the notion that “kids do what scientists do,” is focused on providing opportunities for practicing science process skills throughout the interactive space. The preschool Science Sprouts program provides simple take-home activities that include explanations of how and why activities support learning.
- The **Maryland Department of Education** (Baltimore, MD) has launched Sparks: Ignition Grants for Libraries. In partnership with Future Makers and several Maryland public libraries, the Maryland State Department of Education’s Division of Library Development and Services (DLDS) will teach children ages four to seven the basic principles of programming through the use of Primo, an open-source robotics platform. With Primo, children use blocks to create algorithms that guide a robot through a maze. This will establish a foundation for learning more advanced programming skills later on, set early learners on the path to fluency in computer science and establish a stronger mindset in computational thinking through play and experimentation.
- The **Oklahoma Department of Libraries** (Oklahoma City, OK) is supporting the expansion of STEM learning opportunities in libraries through its Lego® STEM grants for purchase of Lego Education packs and through its “The Kid IS the Rocket” grants to support locally designed STEM programs in libraries.

### STEM/STEAM Museum-Library Partnerships:

- In a partnership between **The Franklin Institute** and **The Free Library of Philadelphia** (Philadelphia, PA), LEAP into Science engages children and families in science and literacy by integrating hands-on science activities with children’s literature. These parent-child workshops include take-home bookmarks and exploration cards with suggestions for extending science and literacy learning at home. Since 2011, this program has expanded to 10 additional cities nationwide, consisting of partnerships between museums, libraries, community centers, after-school programs, public television stations and nonprofit organizations.<sup>20</sup>
- At the **Museum of Innovation and Science** (Schenectady, NY), in collaboration with the **Mohawk Valley Library System**, the museum will deliver STEM programs, astronomy content and tabletop experiment stations to library visitors. The project is designed to bring STEM awareness and interest to underrepresented groups.

### Asset 5: Digital Technology, Makerspaces and Design Labs

**Museums and libraries have embraced the opportunities that have come about through new digital technologies. They see them as important tools for expanding public access and developing new models and programs to increase learning and offer another way to create a more specific focus on executive function life skills.**

New technologies enable libraries and museums to combine the strengths of their physical collections with the potential offered by digital technologies.<sup>21</sup> Museums and libraries are utilizing digital technologies to create virtual access to their collections; they are building technology into their physical spaces to expedite and enhance onsite learning experiences; and they are creating their own digital resources, tools, games and applications to support learning and engagement. New child-centered technologies such as touch-screen computers pre-populated with educational games and activities, interactive whiteboards, “scan-and-play” and “touch-and-play” stations provide opportunities for young children to begin to link content learning to building digital skills. Story times in many libraries include such tech components as the use of recordings or animation linked to stories and videotaping children acting out a story they have heard. For older children, museums and libraries are engaging small groups of children in such activities as developing stop-motion animation and programming robots. The availability of technology has expanded student group ability to access museum resources through virtual field trips that can be linked in real time to museum staff members, who guide the experience. Follow up e-newsletters provide ongoing follow up to onsite exhibits.

*Museums, libraries and the learning ecosystem can be community hubs that help expand Internet access and digital literacy. Internet-based resources and collaboration tools can facilitate learning projects. Digital tools such as badges (openbadges.org) recognize and document students learning and can be used to grant school credit for learning that happens in museums.*

– Building the Future of Education: Museums and the Learning Ecosystem (2013)

Finally, libraries and museums across the country are leveraging their digital and other resources to create makerspaces in their buildings. Makerspaces are part of a growing movement of immersive, hands-on spaces where people can tinker, invent, collaborate, experiment, create and learn. Also known by other names, these spaces generally feature a diverse assortment of materials, supplies, tools and technologies for people to use as they explore and create. “These experiences foster experimentation, invention, creation and exploration through design thinking and project-based learning.”<sup>22</sup> By combining art, science, technology and tools, makerspaces provide natural opportunities for a more explicit focus on promoting executive function life skills.

### **Progress and Possibilities: Examples from the Field**

- The **Fayetteville Free Library** (Fayetteville, NY) offers a Fabrication Space, a Digital Creation Space and a special program for young children. Little Makers is a free play area in the Children’s Room with toys and bi-monthly programs that encourage children five to eight years old to imagine, create and build. The goal of Little Makers is to develop critical thinking skills, problem solving and STEM skills through activities focused on electricity and electrical circuits, astronomy and meteorology.
- At the **Children’s Museum of Houston** (Houston, TX), the 21-Tech system enables museum facilitators to use tablets and apps to help visitors expand/extend learning in the exhibits. XCL, another museum project provides a mobile app for families to select specific museum components and access related questions, challenges and at-home activities. The museum has also developed the O Wow STEM video series in partnership with a local television affiliate. The program airs weekly and includes click-throughs to the Museum’s website, promoting opportunities for Self-Directed, Engaged Learning.
- At the **New York Hall of Science** (New York, NY), the “Noticing Tools™” apps — designed for middle school math and science — allow students to create and document design projects and share with others. Apps focus on such topics as motion, force and proportion.
- The **Idaho Commission for Libraries** established the “Make It @ the Library” project to support the creation of makerspaces in libraries. The program includes hands-on training on tools and technology and includes programming that incorporates engineering design, robotics and 3D printing.
- The **Children’s Museum of Pittsburgh** and its university, museum and library partners are working together on a national program to build a field-wide understanding of making in museums and libraries. The museum is developing a framework and suite of resources including hands-on professional development experiences and a community of practice.
- The **Center of Science and Industry (COSI)** (Columbus, OH), in partnership with the Columbus Idea Foundry and the Columbus Museum of Art, collaboratively developed and implemented a “maker” educational program at STEM (Science, Technology, Engineering and Math) high schools and within their own organizations that focus on collaboration, risk-taking, creativity and personalized learning.

## Asset 6: Community Partnerships

**Museums and libraries are important community anchors and, as such, play a key role in creating and sustaining community-wide efforts focused on supporting outcomes for children and families that could be expanded to include more attention to executive function life skills.**

When libraries and museums partner with other community agencies and institutions, they create new pathways and open up new possibilities for connecting with families and children, and they expand the range and accessibility of their important resources and services. As part of an infrastructure of informal learning organizations within a community, libraries and museums can also add to the repertoire of available out-of-school opportunities for families and children. In many cases, they represent one of a few options available to low-income families. In every case, museums and libraries are well equipped to deliver important brain-building and brain-explaining resources and tools through community partnerships that expand and sustain access.

Survey respondents described a rich variety of outreach strategies and partnerships that connect a number of targeted and special populations and community-based agencies with their resources and services. While few specifically offered information and activities focused on brain development and executive function life skills, these partnerships present natural opportunities to adapt offerings to bring information on explaining the brain to new audiences and offering activities to enhance executive function life skills.

Libraries and museums reported taking their resources and services to hospitals and doctor's office waiting rooms, homeless shelters, jails and food banks. They have established partnerships with early intervention agencies, United Ways, business organizations and WIC centers.

The **Franklin Institute** has been offering a professional development workshop titled "Understanding the Brain: Becoming a Learning Scientist" for teachers preK-12th grade, principals, administrators and even superintendents. They have also offered it to out-of-school time educators. They aim to provide a foundational understanding about the brain and how neuroscience research translates to strategies for teaching and learning. Onsite and offsite supports and programs for schools and early education programs were frequently mentioned and included such experiences as story times, travelling exhibits, staff training, parent education programs, guided field trips and support for kindergarten transition. Partnerships with institutions of higher education included hosting research projects, training students and inviting student-led activities for

*We've been offering a professional development workshop titled "Understanding the Brain: Becoming a Learning Scientist" for teachers preK-12th grade, principals, administrators and even superintendents. We've also offered it to out-of-school time educators as well. We aim to provide a foundational understanding about the brain and how neuroscience research translates to strategies for teaching and learning, while highlighting our exhibit, Your Brain.*

– Julia Skolnik, The Franklin Institute

children and families. Museum and library staff also sit on local education and community development councils and hold leadership positions in state and national organizations.

More than thirty museums and libraries are part of the **National Living Laboratory Initiative**. The purpose of this project is to assist researchers and informal science educators in collaboration efforts that foster public awareness, engagement and understanding of the scientific study of children’s learning and development. Developed at the Museum of Science, Boston with support from the National Science Foundation, Living Laboratory educates caregivers about child development topics by immersing families in the process of scientific discovery at their local museum. The Maryland Science Center, the Madison Children’s Museum and the Oregon Museum of Science and Industry have adapted and implemented the Living Laboratory model in their own early childhood exhibitions and serve as National Living Laboratory “Hub Sites,” disseminating information and resources about the model to other museums and academic institutions nationwide.

## **BRAIN BUILDING SKETCH**

### **Community Partnerships in Boston**

Massachusetts has launched a public awareness campaign titled “Brain Building in Progress.” To support that effort, during Brain Building in Progress Week, the **Boston Children’s Museum** (Boston, MA) creates special programming aligning activities, exhibit spaces and resources with a theme related to brain building. A statewide family engagement effort in libraries and museums across Massachusetts has been launched as part of its Race to the Top-Early Learning Challenge (RTT-ELC) grant. A partnership between the Boston Children’s Museum and the Massachusetts Library Association—a statewide strategy to increase capacity of museums and libraries to support children’s development through family engagement and early learning opportunities—is in place. This initiative represents an important opportunity to expand parent understanding of brain development and how they can support it. The effort aligns directly to the state’s Brain Building in Progress initiative.

### **Progress and Possibilities: Examples from the Field**

- At the **Bethlehem Area Public Library** (Bethlehem, PA), the Lehigh Valley Society for Neuroscience provides an annual story time with activities on brain development and function and an all-day BRAIN PARTY. The party offers more than 30 stations where adults, teens and children can explore all aspects of the brain through hands-on activities.
- The **Dayton Society of Natural History** (Dayton, OH) partners with a network of community family service providers and educational institutions to link messaging about cognitive development. Partnership activities include family nights and events promoting skills and resources for kindergarten readiness, family cafes, a state-licensed museum preschool, and a number of community and family focus groups informing exhibition design.

- The **New Children’s Museum** (San Diego, CA) has established a “pARTners in Creativity” program in partnership with regional social service agencies to provide free, regular, guided, hands-on visits to the museum for children who otherwise would not have access to the museum.
- At the **Denver Museum of Nature & Science** (Denver, CO), staff from the Children’s Discovery Zone offer a training program for early childhood educators titled “Simply Science.” Professional development is also offered to educators in partnership with the state Quality Rating and Improvement System (QRIS) and as part of an initiative through the mayor’s office (“5 by 5”) that links Head Start children and families to city cultural institutions.
- At the **Children’s Museum of Manhattan** (New York, NY), a community feedback loop with selected partners has been established in which CMOM brings research-based experiences in the form of signage, programs and professional development to the community and, after receiving feedback on impact, revises content to fit community needs.
- The **Kalamazoo Public Library** (Kalamazoo, MI) hosts a “Party in the Park” — a one-hour story time for 1,500 preschoolers and their caregivers. Community leaders partner with the library to serve as readers.
- The **Library of Virginia** has established a partnership with the Science Museum of Virginia to create science resource hubs in libraries and to deliver STEM training to libraries and other community-based agencies and institutions.

## PART TWO: LOOKING AT THE SEVEN EXECUTIVE FUNCTION LIFE SKILLS

### *Resources and Programs Directly Aligned to Each of the Seven Executive Function Life Skills*

Survey respondents were asked to identify examples of how their programs and resources were aligned to each of the Mind in the Making seven executive function life skills. The examples that follow including information from the surveys as well as online searches and describe exemplary programs being offered in museums and libraries that reflect some of the key elements included in the development of executive function life skills. Each represents a platform for creating a more intentional and targeted focus on promoting specific skills. As you read, consider some of the strategies and actions libraries and museums could take and the resources and tools that could be deployed to more explicitly explain and build executive function capacity.

#### **1. Focus and Self Control in Museums and Libraries**

*Children need the skill of Focus and Self Control to achieve their goals, especially in a world filled with distractions and information overload. It involves paying careful attention, using working memory, thinking flexibly and exercising self control.*

- **What one program is doing:** The **Carnegie Museum of Natural History** (Pittsburgh, PA) is adapting traditional spaces and exhibits to encourage more careful looking and

interactions among visitors. The “Seeing as a Scientist” project is a design-based research initiative that is developing and testing gallery “interventions” that have the potential to increase scientific observation skills for families and children. The Museum is piloting some quick changes and additions to dioramas. Visitors are observed to measure the degree of engagement in scientific observation (deliberate looking in order to understand visual evidence), an essential skill for science learning. Interventions will be evaluated to determine success in providing necessary support for families to establish a shared focus and two-way, science-based conversations.

## 2. Perspective Taking in Museums and Libraries

*Children build perspective-taking skills when they have opportunities to learn more about themselves and others and, in the process, begin to develop compassion and empathy. They learn about their world by “standing in someone else’s shoes” and experience what life might be like in other places and times. As a result, children come to understand and respect diverse perspectives and increase their ability to reflect on their own thoughts and ideas.*

- **What one program is doing:** The **USS Constitution Museum** (Boston, MA) developed a research-based, hands-on exhibit providing visitors of all ages the opportunity to learn about the origins of the “USS Constitution.” Intergenerational audiences can engage in participatory activities and learn through the lens of the people who dreamed, designed, built, launched and outfitted the ship in the 1790s. The integrated exhibit and program project expand the museum’s capacity to serve families by creating a memorable, engaging and informative exhibit and integrated programs. The project will spark a cross-disciplinary appreciation for the ship’s innovative design and construction, including the STEM (science, technology, engineering and mathematics) concepts inherent in America’s history and foster emotional and personal connections.

## 3. Communicating in Museums and Libraries

*Communicating is much more than understanding language, speaking, reading and writing — it is the skill of determining what one wants to communicate and realizing how that communication will be understood by others. To build communication skills, children need opportunities to verbally share thoughts and feelings, to understand the power of print as a way to communicate, see the power of nonverbal communication and develop the ability to “read” the emotions and perspectives of others.*

- **What one program is doing:** The **Children’s Museum of Chicago** (Chicago, IL) has developed a multimedia “Story Hub” that allows museum visitors to create and share video documentaries of their museum experiences. Through recorded narration and photographs, children and families capture what they saw and learned at exhibits throughout the museum. After the visit, videos can be accessed from the Internet. The project is based on research that shows that learning is more complete when experiences can be processed verbally, reflected upon and shared.

#### 4. Making Connections in Museums and Libraries

Children make connections by sorting, categorizing, comparing and matching materials and objects. They can use questioning to look for connections in books and with artifacts, and they can look for unusual ways to connect materials or ideas to make something new. Connections are made through step-by-step exploration of a variety of materials and representations.

- **What one program is doing:** The **Brooklyn Botanic Garden** (Brooklyn, NY) expanded its informal education programming through the creation of “Living Classrooms,” designed to provide opportunities for visitors to engage with plants and learn how they connect to their lives. Program elements include comprehensive self-guided materials for families and children, the use of dialogue-based techniques by program staff, and new activities and experiences in its drop-in Discovery Program. “By placing the learner at the center and delivering re-imagined programs, the garden will help visitors connect plant science, conservation, sustainability and ecosystem to the context of their own lives so that they might be inspired to become active stewards of the environment.”

#### 5. Critical Thinking in Museums and Libraries

Children are developing critical thinking skills when they pose questions, plan, decipher, compare, hypothesize and formulate their own theories to test in order to determine what information is accurate and reliable. They need opportunities to discuss and design, and space, time and materials to extend learning on their own.

- **What one program is doing:** **Anythink Libraries** (Adams County, CO) across the District provide engaging spaces for learning and creativity. Studios located within libraries are described as “creation labs” where people connect with each other and with tools in hands-on participatory learning that combines creative programming and technology and provides opportunities to pose questions and explore outcomes. One Studio functions as a Digital Learning Lab where students work independently or engage with community artists in workshops that emphasize critical thinking and the development of 21st Century Skills. Students have access to a variety of video, audio, visual and interactive tools. Another Studio in the District operates a makerspace addressing interests from textiles to robotics to do-it-yourself (DIY) crafts and offering access to tools and supplies such as 3-D printers, a digital photo lab, cameras and sewing machines.

#### 6. Taking on Challenges in Museums and Libraries

Children will develop skills in Taking on Challenges when exposed to opportunities to stretch their thinking and physical abilities. Experiences that provide safe spaces for making mistakes, coping with consequences and persisting will help them develop these skills and build confidence in themselves and, ultimately, see their roles in the community and their ability to affect change.

- **What one program is doing:** The **Westport Library Association** (Westport, CT) and partners have introduced a makerspace model for libraries that integrates the culture of interactive making into traditional library practices and programming. Offerings include opportunities for hands-on, self-directed maker experiences, workshops and makers in



residence who support workshops and innovation labs on topics including robotics, LED quilt creations and home electronics repairs. Interactive Innovation Stations introduce concepts and techniques for children to do innovative thinking. “It will be an environment where people can experiment, take calculated risks and work collaboratively.”

## 7. Self-Directed, Engaged Learning in Museums and Libraries

*[Self-Directed, Engaged Learning] may be the most important for creating lifelong learners and the place museums and the community can have the most impact. (Kim Kiehl, 2015)*

*Children become self-directed and engaged learners when they are socially, emotionally and intellectually involved in settings that foster independence, responsibility, flexibility, creativity, collaboration and playfulness.*

- **What one program is doing:** The Tinkering Studio at the [Exploratorium](#) (San Francisco, CA) is primarily an R&D laboratory on the floor of the Exploratorium. “A studio workshop for playful invention, investigation and collaboration, the Tinkering Studio provides visitors with opportunities to become deeply engaged in an investigation of scientific phenomena, and make something that fully represents their ideas and aesthetics. In the Tinkering Studio, visitors are invited to explore a curiosity-driven exhibit, chat with a featured artist, or investigate a range of phenomena with staff artists, scientists, educators and others by participating in a collaborative activity. A large, eclectic assortment of materials, tools, and technologies are provided for people to use as they explore and create.”

### Putting It All Together: Voices from the Field

*During our story times, we address Focus and Self Control by talking about appropriate ways to participate during the session. We practice ways to be in the group and listen carefully. We also focus on Communication by intentionally asking questions about the story. I also ask children to share their thoughts with their parents as well as with other children in the group. I have used a “Think, Pair, Share” model for them. All of the questions I ask encourage them to Make Connections with their world and the world around them as well as use their Critical Thinking skills. (Survey Response: [Redwood Falls Public Library](#), Redwood Falls, MN)*

*Our exhibits and programs are open-ended. We encourage visitors to see what they can discover and share those discoveries with others. Often children need assistance in focusing on a process of investigation as they build their self-regulation skills. Our educators are trained to assist with that in a manner that at the same time is also supportive of each learner’s self-direction. We assist people with Making Connections as well as through images, analogous experiences, through honoring the celebration of prior knowledge and through the opportunities for personal meaning making instead of providing didactic information. Making Connections may be at the heart of learning. (Survey Response: [Explora](#), Albuquerque, NM)*

*In our “early childhood corridor,” we use three exhibits in particular (although these happen all over the museum) to teach these skills. In PlaySpace, babies and toddlers learn Focus and Self Control. There are so many things that are new in the space that most children under three*

can't go on automatic. They are paying attention and focused and learning Self Control as they play at the train table. Sharing in the museum helps kids learn Perspective Taking. I've seen many children comfort one another when they are upset. This happens in our Climb which is a challenging three-story maze. Children help each other when they realize someone may not understand where to go next or how to get down. They learn to "read" emotional faces and body language. Communicating — the museum is a language-rich environment with many opportunities for children to talk to their own family and new friends. Making Connections and Critical Thinking happen in our Art Studio, during special programs that require attention and focus and making new knowledge connections. Taking on Challenges happens often when children have brand new experiences. Maybe this is in the Climb, in the Art Studio or in a new Gallery. We work very hard to create safe, trusting spaces so that children can bring all their skills and open hearts to the experiences they are having while visiting. Children recognize here what they have a passion for and what they want to do over and over and over. That happens in the Japanese House, blowing bubbles and participating in our little theatre. (Survey Response: [Boston Children's Museum](#), Boston, MA)

### **Making Executive Function Life Skills an Integral Part of the Mission: Two Profiles**

- At the [Koch Family Children's Museum of Evansville \(cMoe\)](#) (Evansville, IN), community facilitators who have been trained with the Mind in the Making modules conducted an audit of the programs offered across its galleries to identify opportunities to more explicitly link information about the seven executive function life skills to current programming. The result: selected exhibitions now include explicit information about how the activities and experiences they provide are directly supporting children's development of specific life skills. Print materials provide further explanation and guidance for adults. The museum is looking for ways to expand to other exhibits as well as provide helpful signage at the museum entrance to guide visitors to spaces where they will find information and activities designed to explain and build each skill.
- At the [Portland Children's Museum](#) (Portland, OR), a series of pilot parent-child playgroup workshops for low-income caregivers and families were used to examine how best to use the Mind in the Making seven executive function life skills to create new frames for adults to observe children at play. Sessions included open-ended discussions facilitated by trained Mind in the Making facilitators around the research supporting each skill. Parents were then encouraged to engage with their children in interactive play. Sessions ended with guided reflections of what the participants observed and learned. Additional resources designed to more broadly disseminate information include a bookmark listing the seven executive function life skills, signage designed with references to skills, each with a QR code that links to a resource guide for parents that includes examples of ways to support each skill at home.

## **The Smithsonian Early Enrichment Center**

### ***Linking informal and formal learning to promote children’s learning of the executive function life skills:***

The Smithsonian Early Enrichment Center (SEEC) has built its curriculum around the 19 museum and research facilities of the Smithsonian and the community surrounding Washington, DC. There, early childhood educators, museum educators, artists and scientists work collaboratively. SEEC has incorporated the seven executive function life skills into their daily programming and experiences for children, as well as into their outcomes for children leaving the program. As a functioning lab school, they share this approach with teachers, showing them how to use museums and how to re-create a museum experience in the classroom when access is lacking. They also help museum staff to better understand the needs of young children and their families. The work of the SEEC provides a tangible example of the many ways museums and libraries can build on their rich resources to more directly provide opportunities for children to develop important learning skills. At SEEC, they say: “We want children to leave us as people who bravely pursue life and knowledge,”

NB: Descriptions of children’s development of each of the Seven Essential Life Skills in the previous section were adapted from a presentation on the work of the SEEC.

## **PART THREE: WHERE DO WE GO FROM HERE?**

### **Conclusion**

Museums and libraries are well positioned to move the informal learning community ahead as leaders in the work to promote the development of children’s executive function life skills. By tapping into what libraries and museums do best and aligning current practices with ways to foster the skills, museums and libraries will become a critical part of children’s learning lives and bring to the forefront the power of informal learning.

To take this next step, libraries and museums can begin by intentionally leveraging their unique assets to embed resources and approaches that illustrate and encourage the development of the seven executive function life skills. They can systematically align what research and science tells us about the development of executive function life skills and how children learn with program planning and resource development.

*How to incorporate executive brain functions into planning visitor and learning experiences may not be immediately obvious. Nevertheless, museums [and libraries] currently use many strategies to develop experiences that encourage self-regulation. Museums prepare the environment; engage visitors; prepare staff and volunteers to give cues and hints; encourage social interactions among visitors; and invite extensive physical and cognitive interactions with objects and phenomena. These approaches, and more, point toward the abundant and varied opportunities museums [and libraries] have to act on their missions, benefit their audience and serve their communities by deliberately taking advantage of the capacities executive brain functions offer.*

**What are you doing in your museum to strengthen executive functions and the skills they use?** – Jeanne Vergeront, Museum Notes

## **Families and Work Institute: Expanding the Work and Taking Action**

Museums and libraries make learning come alive in our communities. But more can be done to bring their resources and experiences in line with current efforts to build a cadre of informed and proactive leaders in communities across the country who are using research-based approaches to deepen that learning. Five key steps can drive a community-focused process that can effectively and collaboratively advance understanding of executive function and the seven life skills.

1. Grow a deeper understanding of the research and science surrounding children’s learning and the development of executive function life skills.
2. Embrace a recognition of the importance of addressing the “how” of learning and expand it across the entire community.
3. Intentionally leverage assets and invest resources in exhibits, collections, programs and approaches that focus explicitly on executive function and the seven executive function life skills.
4. Develop concrete tools and strategies to inform and engage families and children in the learning process and the development of executive function life skills.
5. Embed a priority to develop executive function life skills into all aspects of the operations: planning, facilities, staff training, communications, guest services, etc.

The work has already begun.

Museum professionals and librarians are rethinking and reshaping their work to highlight and promote executive function life skills and, in doing so, are becoming community learning leaders. Today, more and more libraries and museums are accessing Mind in the Making training and positioning themselves as community hubs for growing the pool of informed supporters

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and facilitators of the seven executive function life skills. They also offer new or repurposed experiences designed to explicitly inform and promote executive function life skills within their own institutions. To meet the expanding interest and demand for the professional development needed to meet this new opportunity for communities, Mind in the Making and the Boston Children’s Museum are developing training for museum staff that aligns the Mind in the Making modules with existing Standards of Engagement for museum staff. Such standards can become a model for the museum field and for all community-based institutions seeking to leverage resources to engage children in everyday learning.

We are on the cusp of a new quantum leap in learning, where community institutions — buoyed by a deep understanding of the research and science of children’s learning — will expand possibilities for all of the nation’s children. Museums and libraries — already so well positioned to advance this work — have the potential to be the pioneers, leading the way forward.

## APPENDIX

### Survey Results

#### *How do museums and libraries provide information and experiences to increase understanding and support for brain development?*

**Museums:** The majority of museums cited the use of exhibits (89%) and special programs or group experiences (93%) as the primary ways they provided information to explain and opportunities to support brain development. Less frequently utilized were the provision of resource guides and follow-up activities explicitly linked to brain development and scaffolding or embedding information throughout the museum.

**Libraries:** Most libraries (92%) reported that information was delivered through such programs as story times and related activities as well as take-home information for families. Libraries were less likely to provide information or experiences through computer-based resources or displays. Only 33% reported scaffolding or embedding brain-related information throughout the library.

#### *How do museums and libraries provide services and resources focused specifically on the seven executive function life skills?*

**Museums:** All skills are being supported in some way through open-ended, inquiry-based experiences and programs. Making Connections (94%); Self-Directed, Engaged Learning (89%); Critical Thinking (89%); and Taking on Challenges (85%) were most frequently identified, while Perspective Taking; Focus and Self Control; and Communicating were not as highly rated across all types of museums.

**Libraries:** All seven skills were identified as being supported primarily through story times and other special programs. Most frequently cited were Communicating (84%); Making Connections (77%); and Focus and Self Control (76%). Taking on Challenges and Perspective Taking were less frequently addressed.

#### *How are libraries and museums preparing staff to address issues of brain development and executive function life skills in their planning and interactions with children and families?*

**Museums:** Nearly 75% of museums report offering staff training that includes information on brain development and learning. Only half of the respondents, however, felt staff had the capacity to converse with families and children about brain development. All respondents said their staff interact with families and children in ways that helped build skills.

**Libraries:** Responses were similar to those submitted by museums, with 50% offering staff training that included information on brain development and learning, but only 46% rating staff as able to converse with families and children on the subject. Again, staff were rated high (94%) on the ability to interact in ways that helped build skills.

#### *How are museums and libraries addressing outreach and partnership building with other community agencies and institutions?*

**Museums:** Most frequently cited partnerships were public schools, K-12 (96%) and preschools and child care centers (92%). Museums also report high rates of partnerships with cultural organizations including libraries and other museums (89%). Still above 50% — but less frequently identified — were out-of-school programs (75%), informal child care providers (67%), and other child- and family-service organizations (64%).

**Libraries:** Overall, libraries reported having fewer community partnerships. Like museums, partnerships with schools (86%) and preschools (90%) were most common, followed by connections to informal child care providers (57%), out-of-school programs (51%), other cultural organizations (50%), and other community-based child- and family-service programs (45%).

(Note: These numbers may not accurately capture the many ways libraries and museums are connecting their services to other community-based organizations and initiatives. See discussion of innovative partnerships below for a more in-depth description of this work.)

### *How are museums and libraries leveraging community partnerships to expand and disseminate understanding and capacity to support brain development and executive function life skills?*

**Museums:** The mechanism used most often is the delivery of museum-based services and programs to other community organizations and agencies (87%). Museums also reported high rates (70%) of offering professional development opportunities to community partners as well as disseminating information and conducting outreach to establish new partnerships.

**Libraries:** Most libraries (80%) increase understanding by assisting community partners and patrons with selecting books and other library resources to use with children and families. Other common mechanisms include offering programs and services offsite and disseminating information (69%). Fewer libraries (34%) reported offering professional development opportunities to community partners.

## ENDNOTES

- <sup>1</sup> Interview with Ellen Galinsky, June 10, 2014.
- <sup>2</sup> Center on the Developing Child. (2011). *Building the Brain's Air Traffic Control System: How Early Experiences Shape the Development of Executive Function*. Working Paper 11. Cambridge, MA: Harvard University
- <sup>3</sup> Interview with Ellen Galinsky, June 10, 2014.
- <sup>4</sup> Semmel, M. (Accessed Online April 2015). *Advancing 21st Century Learning: The Role of Museums and Libraries*. Podcast transcript: [www.p21.org/news-events/p21blog/1095-advancing-21st-century-learning-the-role-of-museums-and-libraries](http://www.p21.org/news-events/p21blog/1095-advancing-21st-century-learning-the-role-of-museums-and-libraries)
- <sup>5</sup> Ibid.
- <sup>6</sup> Center for the Future of Museums. (2014). *Building the Future of Education: Museums and the Learning Ecosystem*. Washington, DC: American Alliance of Museums.
- <sup>7</sup> Kiehl, K. (March 13, 2015). *Promoting Executive Functions: Mind in the Making Seven Essential Life Skills Every Child Needs*. 2015 Teaching & Learning Conference Session. Washington, DC.
- <sup>8</sup> The Tinkering Studio. San Francisco, CA: The Exploratorium. <http://tinkering.exploratorium.edu>
- <sup>9</sup> Family Place Libraries. [www.familyplacelibraries.org](http://www.familyplacelibraries.org)
- <sup>10</sup> Ibid.
- <sup>11</sup> Institute of Museum and Library Services. (2013). *Growing Young Minds: How Museums and Libraries Create Lifelong Learners*. Washington, DC: Institute of Museum and Library Services.
- <sup>12</sup> Reading Rockets. Arlington, VA: WETA Public Television. [www.readingrockets.org](http://www.readingrockets.org)
- <sup>13</sup> Whitehurst, G.J. (1992). *Dialogic Reading: An Effective Way to Read to Preschoolers*. (Accessed Online April 2015). Reading Rockets: <http://www.readingrockets.org/article/dialogic-reading-effective-way-read-preschoolers>
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- <sup>15</sup> White, R.E. (2013). *The Power of Play: A Research Summary on Play and Learning*. St. Paul, MN: Minnesota Children's Museum.
- <sup>16</sup> Ibid. Vygotsky, L. in White, R.E.
- <sup>17</sup> Leong, D.J. & Bodrova, E. (2012). Assessing and Scaffolding Make Believe Play. *Young Children*, 67 (1), pp.28-34.
- <sup>18</sup> Dusenbery, P.B. (January/February 2014). The STEM Education Movement in Public Libraries. *The Informal Learning Review*, 124. Denver, CO: Informal Learning Experiences, Inc. [www.lpi.usra.edu/education/stemlibraryconference/events/ILR\\_STEM\\_Library\\_Paper.pdf](http://www.lpi.usra.edu/education/stemlibraryconference/events/ILR_STEM_Library_Paper.pdf)



<sup>19</sup> Katehi, L., Pearson, G. & Feder, M. (Fall 2009). The Status and Nature of K-12 Engineering Education in the U.S. *The Bridge on K-12 Engineering Education*, 39 (3). Washington, DC: National Academy of Engineering.

<sup>20</sup> Institute of Museum and Library Services. (2013). *Growing Young Minds: How Museums and Libraries Create Lifelong Learners*. Washington, DC: Institute of Museum and Library Services.

<sup>21</sup> Clough, W. (2013). *Best of Both Worlds: Museums, Libraries, and Archives in a Digital Age*. Washington, DC: Smithsonian Institution.

<sup>22</sup> Institute of Museum and Library Services. (June 2014). *Talking Points: Museums, Libraries, and Makerspaces*. <http://www.ims.gov/assets/1/AssetManager/Makerspaces.pdf>