



Interactive Family Learning in Support of Early Brain Development Formative Evaluation Report

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Executive Summary

With funding from the National Institutes of Health's (NIH) Science Education Partnership Award (SEPA), the Oregon Museum of Science and Industry (OMSI) is creating a mid-sized travelling exhibition that will promote public understanding of neuroscience research and its relevance to healthy brain development in early childhood.

The formative evaluation detailed in this report builds on findings from the front-end study, advisors' insights, and project activities to produce exhibition component prototypes and test them with target audiences for continued ideation and refinement. The purpose of this report is to support the project team by assessing the extent to which the activities, content, and labels contributed to visitor engagement, understanding, confidence, and future use of one or more strategies outlined in the exhibits. It was important to the project team that the exhibition be developed in collaboration with the communities for whom it is intended; therefore, data for this phase were collected from three audiences, including 1) general museum visitors, 2) Metropolitan Family Service—Ready, Set, Go! families, and 3) early childhood educators. Four methods were used to gather data: observation, interviews, focus group discussions, and surveys.

Analysis of the data collected from the three audiences suggests that the prototypes tested have great potential to meet the project's goals of engaging families and caregivers and communicating messages around brain development and playful interactions. As with any formative evaluation, the purpose is to identify and articulate possible areas for improvement. Given that the formative evaluation was conducted to test only three prototypes during a specific time period and that it included small sample sizes and specific contextual parameters (location, floor plan, time spent on display), findings should not necessarily be interpreted as directly generalizable to other situations or audiences.

Key findings are organized around anticipated outcomes and include:

Family groups engage in playful activities together to learn about research-based practices that enhance early childhood brain development.

- The prototype exhibits successfully captured the desired audience.
- Most visitors observed (67%) completed at least one of the exhibit activities; furthermore, 81% of adults played an active role with the children in their care.
- Activities generally inspired caregivers to engage with their children.
- The exhibit often reinforced or reminded caregivers about the importance of these activities; many reported already doing similar activities at home.

Caregivers understand the importance of family interaction and play in the development of their children.

- Eighty-three percent of respondents felt that the activities in the exhibition communicated the importance of play in the development of their children.
- Many (43%) identified the main message as doing things together with the children and having fun together; fewer (30%) indicated that the main message was related to (brain) development.
- In interviews, caregivers often associated specific activities such as dancing and reading with childhood development.

Caregivers feel more confident in their ability to support their children's development through interactive play.

- Feelings were mixed on whether the activities provided in the exhibition made caregivers feel more confident to support their children's development.

Caregivers plan to use one or more interactive play strategies outlined in the exhibition.

- Caregivers intend to use suggestions from the exhibit labels (75%) and find more opportunities to read (71%), and play music and dance (92%) with their child(ren) after visiting the exhibition.

Based on the formative evaluation, we recommend the following:

- Increased effort should be made to provide more experiences to attract and engage children under the age of two.
- The team should seek ways to better communicate to caregivers that not only are the activities demonstrating the value of playful interactions, but that those benefits are (a) based on research and (b) directly related to brain development.
- Include a graffiti wall or other area in the final exhibition that provides supportive and reassuring messages as well as a forum for caregivers to ask questions and share.
- Provide more suggestions for how caregivers can engage with the child(ren) in their care and/or activities to do outside of the museum.
- Plan for caregiver down-time and capitalize on those opportunities to communicate messaging.

Introduction

The National Institutes of Health's (NIH) Science Education Partnership Award (SEPA) program awarded the Oregon Museum of Science and Industry (OMSI) funding for a five-year project, entitled *Interactive Family Learning in Support of Early Brain Development* (IFL). OMSI, in collaboration with neuroscientists at the Oregon Health & Science University (OHSU), museum professionals, and community partners, is creating a mid-size traveling exhibition, an accompanying website, and complementary programming for use at OMSI and tour sites. The exhibition and programs will (a) promote public understanding of neuroscience research; (b) emphasize its relevance to healthy brain development in early childhood, with a focus on current research on the developing brain up to age 5; and (c) reach a national audience of adult caregivers of young children and their families, with a special emphasis on Hispanic/Latino families. The project is being developed in collaboration with museum professionals and community partners to be bicultural and bilingual (English-Spanish) in order to authentically engage underrepresented Hispanic/Latino audiences. The project will also support the development of educational materials, including an educators' guide for museum staff and early childhood educators and a bilingual take-home guide for parents and caregivers.

This project has four key objectives:

- Foster family engagement with and interest in neurodevelopment during early childhood, especially in adult caregivers
- Foster awareness of how neuroscience research leads to knowledge about healthy development in early childhood
- Inform and empower adult caregivers to enrich their children's early learning experiences
- Reach diverse family audiences, especially Latino audiences

A collaborative, multidisciplinary team of neuroscience researchers, experts in early childhood education, museum educators, and OMSI personnel with expertise in informal science education and bilingual exhibit development are working together to ensure that current science is accurately interpreted and effectively presented to reach target audiences. Furthermore, OMSI has engaged and will continue to engage individuals from target communities to contribute input and recommendations through the evaluation process. Visitors will explore neuroscience and early childhood development through a variety of forms—multisensory hands-on interactive exhibits, graphic panels, real objects, facilitated experiences, and an accompanying website. Following the five-year development process, the exhibition will begin an eight-year national tour, during which it is projected to reach more than one million people.

Formative Evaluation

Front-end and formative evaluation of the IFL exhibition have been conducted by OMSI's Engagement Research and Advancement division; upcoming remedial and summative evaluations will be conducted by OMSI's Engagement Research and Advancement division and J. Sickler Consulting, LLC respectively. The formative evaluation study took place during the Concepting Phase of the project at the end of Year 2 and first week of Year 3 (July and August 2019). Evaluation questions explored during this phase included:

- How engaged are caregivers and children with exhibit components?
- What role(s) do caregivers play during exhibit interactions?

- How well does the exhibit communicate its main messages to caregivers?
- What suggestions do target audiences have for improvements?

This study serves to provide evidence-based recommendations for the next phase of exhibit development. The purpose of the formative evaluation was to support the project team’s testing of three prototypes and to assess the extent to which the activities, content, and labels contributed to the following outcomes:

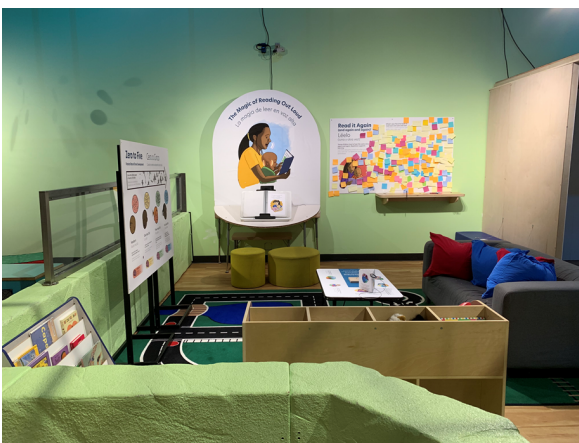
- Groups engage in playful activities together to learn about research-based practices that enhance early childhood brain development;
- Caregivers understand the importance of family interaction and play in the development of their children;
- Caregivers feel more confident in their ability to support their children’s development through interactive play; and
- Caregivers plan to use one or more interactive play strategies outlined in the exhibition.

Methods

Setting and Subjects

The formative evaluation for IFL was conducted in OMSI’s Science Playground, a dedicated area specifically designed for visitors up to six years old and their families/caregivers. Several IFL exhibit components were installed within an enclosed area with signs explaining that they were prototype versions of new exhibits. These components were left open to the public during June, July, and the first weeks of August when data collection was conducted. It was important to the project team that the exhibits be developed in collaboration with the communities for whom it is intended; therefore, data were collected from three audiences: 1) OMSI visitors, 2) early childhood educators and 3) Spanish-speaking families from our project partner Metropolitan Family Service (MFS). OMSI evaluators are trained in culturally responsive research and applied appropriate techniques in data collection procedures. For this study, evaluators honored and respected participants’ culture and preferred language. Two evaluators were native Spanish speakers who provided materials and instructions in English and Spanish. Details on sampling and recruitment, as well as detailed descriptions of each audience, will follow in the Data Collection section. IFL exhibit components included for study were the “Brain Book,” “Reading Area,” “Timeline,” “Read It Again!,” and “Dance Floor/Everybody Dance Now.”

“Brain Book” and “Reading Area”



“Brain Book”

Visitors were drawn in by an image of a caregiver and child reading, as well as an interactive book positioned on a table for easy reading by adults and children. As each page was turned, the image above lit up to illustrate an aspect of early brain development. Text and graphics on each page described the brain-building value of reading aloud to young children. Lighting effects were designed to be

beautiful, magical, fun to watch, and surprising. Sound effects and lighting drew attention to the book.

“Reading Area”

Near the Brain Book, couches and chairs, a table, bookshelves, and bilingual (English-Spanish) board books provided a space for families to read together. The space was comfortable and inviting for adults and young children.

“Timeline” and “Read It Again!”



“Timeline”

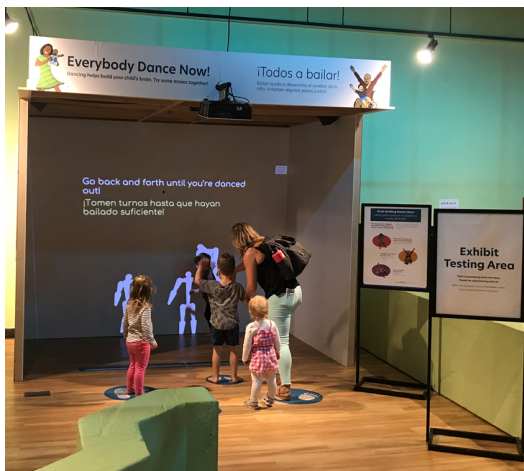
A graphic panel near the reading area showed a timeline for changes taking place in the brain throughout early development.

“Read It Again!”

A board mounted to the wall next to the “Brain Book” explained why children enjoy hearing the same story over and over again, and prompted visitors to post their own favorite books on the wall with sticky notes.

These graphic panels were positioned to be easy to see for adult readers when seated in the “Reading Area.”

“Dance Floor/Everybody Dance Now”



“Dance Floor/Everybody Dance Now”

Visitors entered a semi-enclosed dance space and engaged with lighting effects, a variety of songs/music, and different dance activities. The music and environment were designed to appeal to adults and children—not too bright or too loud. A body tracking system responded to visitor movement/dancing by projecting abstracted silhouettes of visitors’ bodies, which alternated with projected messages to adults. Certain movements triggered a special effect. Printed graphics illustrated suggested activities for adults to do with children.

Data Collection and Analysis

Data collection procedures varied by audience. This section describes each of those audiences, how participants were recruited and selected, when data were collected, what procedures and instruments were used, and how analysis was conducted.

OMSI Visitors

IFL project team members, including designers and managers, were scheduled for 30- to 60-minute shifts to conduct observations of families visiting the prototype area. Observations of 45 family groups were collected between June 28, 2019 and July 25, 2019 during regular open hours. Convenience sampling was used during observations; data collectors observed the space looking for a potential focal family (at least one adult and one child age five or under). If the focal family left the exhibit less than 30 seconds after entering, they were disregarded and a new focal family selected. Focal families needed to appear at ease with the situation and not overly distracted (crying babies, heated conversations, etc.). Data collectors used an observation sheet to record the perceived age and gender of group members, which activities they visited and for how long, roles and actions the caregiver took, engagement levels of the adults and children, and open notes about the interactions. A copy of the observation instrument is included in Appendix A. When the group left, the observer completed their observation form and waited for a new group to enter.

Adult roles and engagement levels are described below.

Adult role:

Observer - Caregiver watches child engaging in the activity.

Leader - Caregiver instructs, directs and/or coaches child in the activity and/or selects which activities to do and when to begin/end.

Co-player - Caregiver engages in the activity alongside the child. Child and caregiver appear as equal participants in the activity.

Facilitator - Caregiver provides suggestions, encouragement, and/or materials without directly engaging in the activity.

Child/Adult engagement scale:

Table 1. Child/Adult Engagement Scale

Engagement Levels	Types of Activity
1	Observed and did not interact directly with activity
2	Started an activity, but did not complete it
3	Completed the activity once (dance to one song, read through the book once, etc.)
4	Repeated an activity <u>OR</u> displayed enthusiastic engagement (e.g. smiling, clapping, joy, hand motions)
5	Repeated the activity <u>AND</u> displayed enthusiastic engagement (e.g. smiling, clapping, joy, hand motions)

As the prototypes progressed and more detailed information was sought, the OMSI evaluation team added survey and interview protocols. Twenty-five semi-structured interviews were conducted and surveys from twenty-six groups collected. Surveys were collected between June 28 and July 30; after completing an observation of a family, evaluators would approach the caregiver and ask if they would complete a survey. Interviews were conducted with visitors between July 28 and August 9. The survey and interview both asked questions about what the group did, what they liked, and how they would improve the experience. In addition, the survey asked for demographic information about the group. For a copy of the data collection protocol, see Appendix B, and Appendices C and D for the survey and interview instruments.

Spanish-speaking Families

In collaboration with Metropolitan Family Service, through their program Ready, Set, Go!, a group of nine parents and caregivers were invited to OMSI to explore the prototypes with their families and to provide feedback on their experiences with the prototypes and activities. Upon their arrival to OMSI, families were greeted in the lobby and guided to the Science Playground area. Caregivers were given a brief verbal introduction to the project, and were handed informed consent forms and clipboards with questionnaires asking about the exhibit prototype activities. Families were given 30 minutes to explore the exhibit and complete their questionnaires, after which the entire group moved to a meeting room to debrief. The project bilingual and bicultural content developer led the discussion. As an icebreaker activity, participants introduced themselves and mentioned their favorite book or song when they were children or that they enjoy with their children. The discussion that followed was organized around the questionnaire prompts.

The discussion was almost entirely in Spanish and was audio recorded; a bilingual and bicultural evaluator took notes during the discussion, and the questionnaires were collected from caregivers once the discussion was finalized. Evaluator notes and caregiver written responses were reviewed and translated, referencing the

audio recording when necessary. A copy of the instruments used with this audience is included in Appendix E. Instruments were written in English and translated to Spanish.

Early Childhood Educators

A group of ECE professionals were invited to OMSI to explore the prototype exhibit space and to provide feedback on what they saw. An email was sent to a list of 260 educators that had been compiled by OMSI's Early Childhood Engagement Manager through prior collaborations. Educators interested in participating replied via email and 15 were selected to participate based on their availability. Of those, 12 participated in a brief exploration of the exhibits and a subsequent 45-minute focus group. Upon arrival at OMSI, similar to the Ready, Set, Go! families, educators were given a brief introduction to the project and handed a clipboard with some questions about the exhibit. They were given approximately 20 minutes to explore and engage with the exhibit components and make notes. The entire group gathered in a conference room, and OMSI evaluators led a guided discussion based on the questions on the sheet they were provided.

The discussion was audio recorded; evaluators took notes during the discussion and question sheets were collected from the educators after the discussion. Evaluator notes and participants' written responses were reviewed, referencing the audio recording when necessary, and a summary of the comments and suggestions prepared for the project team. A copy of the instruments used with the ECE focus group is included in Appendix F.

Analysis

Closed-ended responses from observations as well as all data from surveys, interviews, and focus groups were entered into a spreadsheet for analysis. Descriptive statistics for closed-ended items were generated through the use of IBM SPSS Version 24; emergent coding was used to categorize and summarize open-ended responses from the focus groups, interview, and survey. Open-ended notes and comments from observations were discussed during project team meetings.

Data

Demographics

Based on the data collected, the typical family group visiting the space was three people with one adult aged 26 to 35 years old and two children aged between two and seven years old. On the survey, most visitors identified as White/Caucasian (17 of 25) and not of Hispanic origin (22 of 25). Overall, visitor groups observed ranged from two to four individuals and contained approximately twice as many females as males in both the adult caregiver and child categories. Caregivers ranged in age, though a majority (29 of 38) were coded in the age category of 26 to 35 years old. The most common age category for children was 2–4 (23 of 55). Though ages ranged from birth to 14, over 70% of children were between ages two and seven.

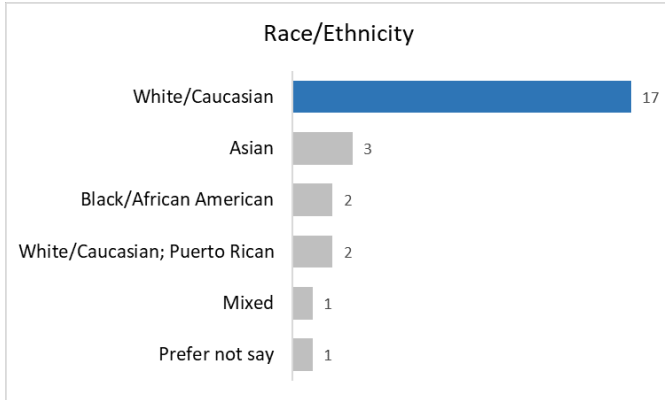


Figure 1. Race and Ethnicity Chart.

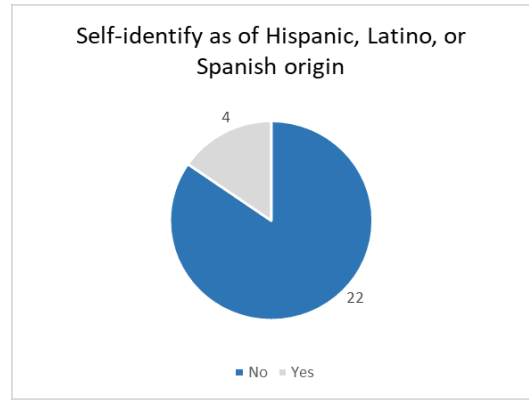


Figure 2. Hispanic, Latino, or Spanish Origin Chart.

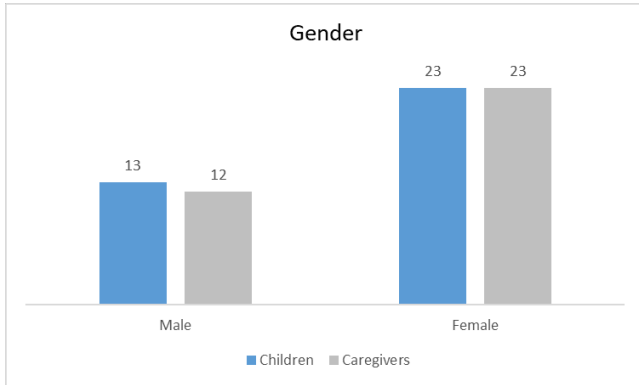


Figure 3. Gender Chart.

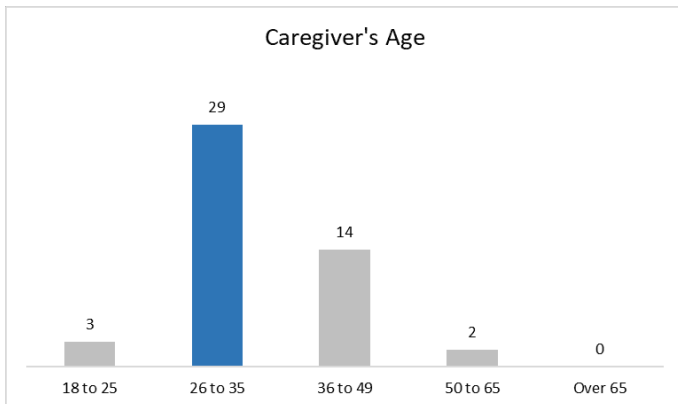


Figure 4. Caregivers Age Chart.

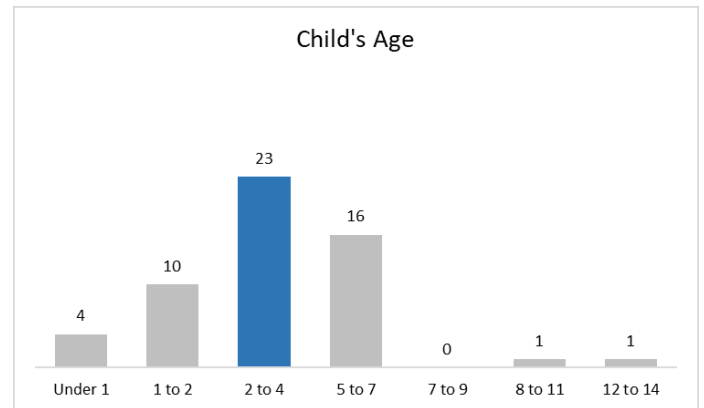


Figure 5. Child's Age Chart.

Nearly all of the caregivers were engaged in some way with the exhibit activities and with the child(ren) in their care. The level of engagement by both adults and children was rated by observers. Caregivers averaged

a rating of three out of five, meaning that on average, caregivers completed an activity provided in the exhibit components at least once. Child engagement was rated slightly higher with a mean of 3.3 out of five. On average, caregivers were observed performing between one and two actions; the most frequent adult actions observed were *Looking at panels* and *Talking or Gesturing*. Similarly, on average, caregivers took one or two roles including *Observer*, *Leader*, *Co-player*, and *Facilitator*.

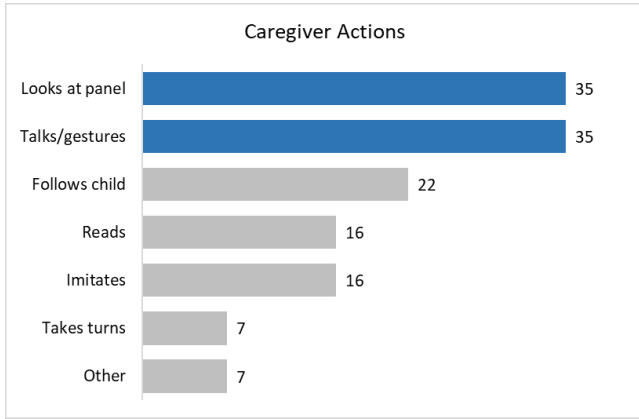


Figure 6. Caregivers Action Chart.

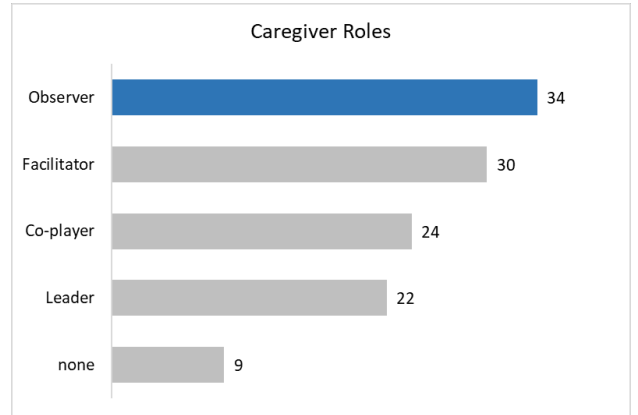


Figure 7. Caregivers Roles Chart.

Groups were observed visiting between one and three activities during their stay, though it was noted that some groups returned to the space after leaving and/or had visited the space prior to being observed. Observation protocols did not account for groups that returned to the space; data analyzed was for a single visit to the space and did not include any prior or subsequent visits. The most frequently visited activity was "Dance Floor." Only three of the groups observed did not visit the "Dance Floor" area.

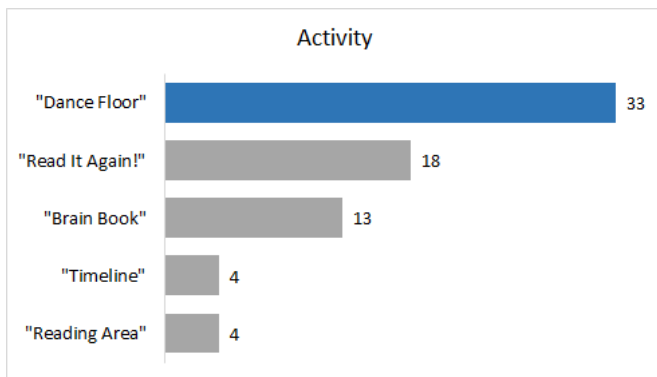


Figure 8. Activity Chart.

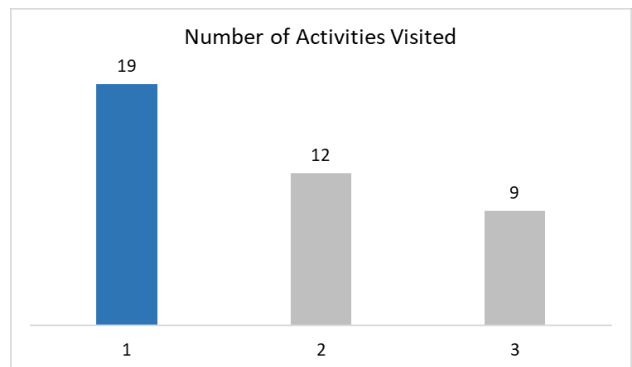


Figure 9. Number of Activities Visited Chart.

Visitor Survey

On the survey, caregivers were asked to rate various statements related to the goals of the exhibition on an agreement scale from 1- *Disagree strongly* to 5- *Agree strongly*. Caregivers indicated that the exhibit activities inspired them to engage more with their child(ren) and agreed that the activities communicated the importance of play in the development of their child(ren). To a slightly lesser degree, caregivers reported that the activities made them feel more confident, gave them new ideas about how to interact, and provided fresh information about brain development.

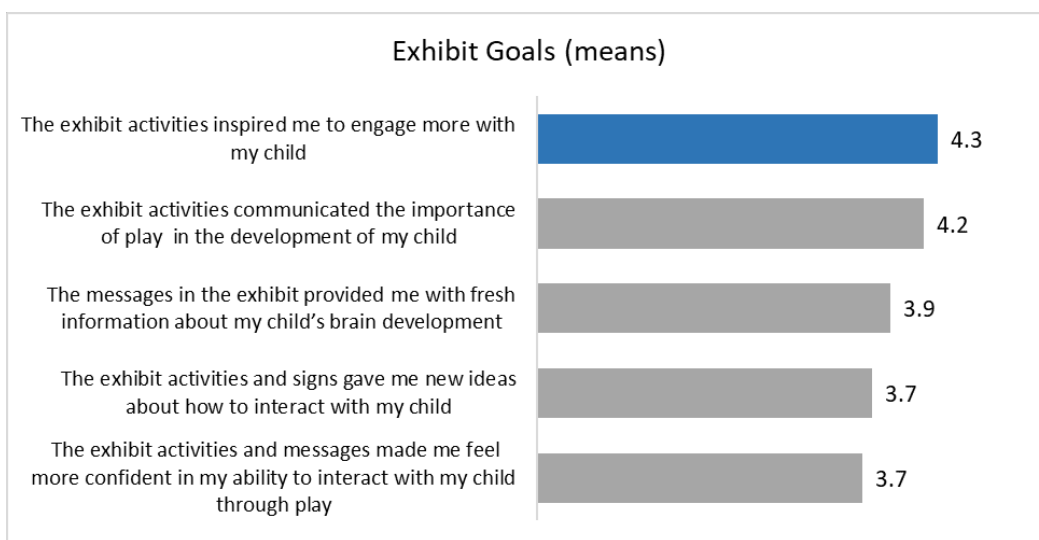


Figure 10. Exhibit Goals Chart.

A similar set of items on the survey asked about the impacts of the exhibit activities. Caregivers generally agreed that they were more inclined to use suggestions from signs, read more, and play music and dance with their child(ren) after visiting the exhibit than they were before.

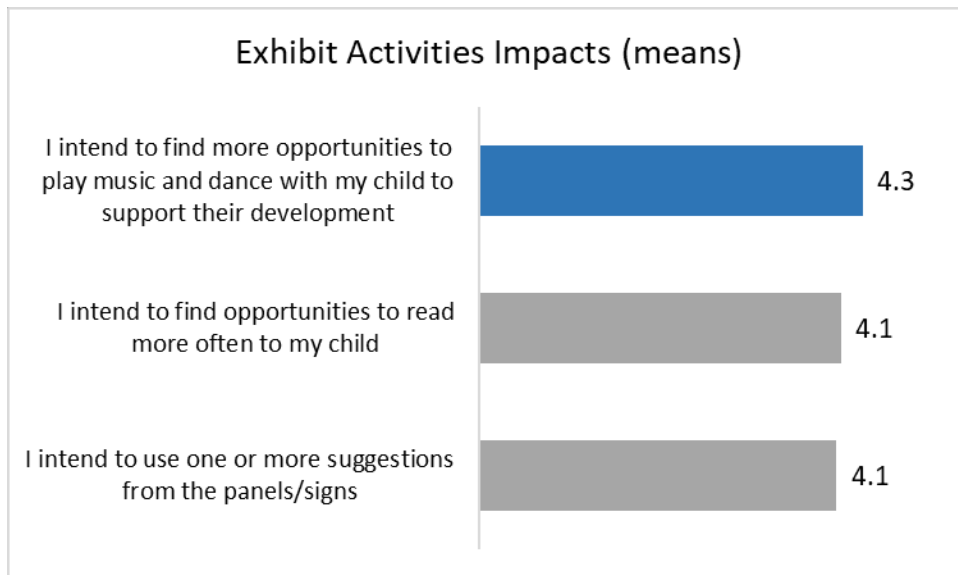


Figure 11. Exhibit Activities Impacts (means) Chart.

Visitor Interviews

Evaluators sought to shed light on visitors’ understanding of the exhibit’s main messages, caregivers’ perceived role in the exhibit, activities that were most enjoyable or relatable and provided learning opportunities, and suggestions for improving the prototypes.

Big idea and message

Nine respondents out of 25 mentioned that the main message is related to development (of those, only three specifically mentioned brain development) and how caregivers can support that development through interactions and doing things with their children. The rest of the responses related to doing things together (five responses), having fun with children (three responses), encouraging independent exploration (two responses), motivating reading (one response), encouraging new things (one response), stimulating child development (one response), sharing area with other kids (one response), and caregiver education (one response).

Similarly, when caregivers were asked what they would tell a friend the exhibit is about, eight respondents mentioned that the exhibit was about dancing, while there were seven responses that mentioned reading (four visitors mentioned both reading and dancing). The rest of the responses mentioned the exhibit was about movement, play, language, and spending time with their children.

Enjoyable

The most enjoyable experience reported by respondents was the “Dance Floor,” with 22 respondents identifying this as the most enjoyable activity. Visitors stressed that they enjoyed the interactive parts of the “Dance Floor;” in addition, respondents also mentioned that it was fun to watch their kids dancing, moving, and observing the shapes projected onto the screen. The remaining three out of 25 respondents mentioned

that they enjoyed the “Reading Area” most. Specifically, they appreciated the comfort of the sitting area, familiarity of the books, access to bilingual books, and the height of the furnishing around the area.

Adult roles

Caregivers who mentioned enjoying the “Dance Floor” indicated that they saw their role as a blend of leading, facilitating, and co-playing in the experience and activities. In these roles, caregivers saw opportunities to scaffold their child’s experiences through introducing, modeling the activities, providing initial ideas, and then letting their children figure it out from there. Four caregivers mentioned that they saw the roles as co-players as showing kids how to do the activities or by doing activities with them. Two caregivers, both of whom indicated they enjoyed the “Reading Area” the most, mentioned their role as child-led co-player by allowing their children to lead the activity. The third caregiver who selected the “Reading Area” as their favorite activity mentioned that their role was to provide opportunities for their kids to engage and socialize with other kids.

New information and takeaways

Only six out of 25 visitors reported that they learned something new through the exhibit. Some respondents who indicated they did not learn something new attributed this to already being aware of early childhood development information (three respondents) or they did not read the labels as they had different goals for their visit (three respondents). Sixteen respondents mentioned that they already do or practice some of the activities, like reading and dancing at home or during specific events. From those respondents, four mentioned that the activities in the exhibit reinforce what they already do with their children. One respondent mentioned their intention to incorporate shadows into their dancing. Two respondents mentioned the idea of getting additional books and bilingual books.

Suggestions

Respondents’ suggestions were mostly focused on the “Dance Floor” and included aspects that were confusing or that they thought could be improved. Visitors provided recommendations regarding specific areas of this exhibit prototype such as signage, animation on the screen, and the position of the mirror behind the line where visitors and kids should stay if they wanted to interact with the projected image. Respondent comments suggested making the “Reading Area” more inviting, including by adding seating areas for kids that are made of soft materials and having stuffed animals available.

Spanish-speaking Caregivers Focus Group

Through the facilitated discussion and written responses, caregivers from Metropolitan Family Service provided insights regarding content, relevance of the information and activities from their cultural perspective, and suggestions for the exhibit prototypes. It should be noted that the Ready, Set, Go participants were in a program that focuses on some similar concepts about parenting and child development. In engaging with the prototypes and doing it together as a group, they may have come prepared with highly active learning mindsets. Their responses perhaps leaned toward the ones we had hoped to hear because the experience was tied to their Ready, Set, Go program.

Content

When asked to assess the clarity of the exhibit area's main purpose (informing and empowering caregivers to enrich their children's early experiences through playful interactions), the majority of participants responded that it was very clearly communicated (average was 4.4 on a scale from 1- *Not at all clear* to 5- *Perfectly clear*).

Caregivers from this group found the "Reading Area" and messages in that area useful and interesting because they reinforced their existing knowledge, and in some instances, taught them about the importance and benefits of reading for early childhood development. A participant mentioned realizing the connection of reading out loud and brain development. Other responses stressed that the information provided in the "Brain Book" related to reading is not only beneficial for their children's development, but it also brings them closer to their children and reinforces the caregiver-child connection. A respondent mentioned the "Timeline" signage as useful in explaining developmental stages and the importance of his role as caregiver through these stages.

One caregiver from the MFS focus group stated:

"I liked the area where they explain the importance of reading - when you read the functions of children brain activates. As one reads more the brain develops more. A spider web is made [in the brain]. My daughter says "I feel you pay attention to me, you give me happiness in my heart, mama when you read me" reading is a connection of love"

Another caregiver from the MFS focus group mentioned in relation to the "Brain Book":

"Reading because is in the wooden book. [One] turns the page around and see the child's neurons and what is captured in the brain and that is recorded there forever. And the time one is there, one hugs their child.....How interesting to read. It created proximity when one reads [to their child]"

Relevance

Families found the dancing area and the "Reading Area," including the "Brain Book", relevant to their lives. Dancing is something that some caregivers mentioned they do in their family. Two caregivers mentioned that they use music at home to help their children sleep and also because their children naturally enjoy dancing. Since reading is something that most caregivers mentioned they already do at home, the exhibit reinforced the importance of this activity. Caregivers mentioned that reading is part of their routine.

One caregiver stated:

"My daughter likes the bedtime story. She learns new words and one learn more. Reading becomes and routine and habits. it is fun to change voices and when his father invents some new story and our daughter realizes that!"

Suggestions

Most of the suggestions from the caregivers were related to adding additional activities to enhance the exhibit. For the “Dance Floor,” two caregivers mentioned they would prefer to have prompts of movements to follow up and instructions by audio that accommodates children’s levels according to age or development. Other caregivers provided suggestions regarding the labels and stressed the importance of having two languages more differentiated by color. One caregiver mentioned that in addition to the “Brain Book,” she would like to see an interactive brain that caregivers and children can touch and interact with. Some caregivers also mentioned the need of having activities and materials that are more relatable for them. For example, two caregivers mentioned the opportunity to include activities and/or books that mention their customs and traditional food such as corn tortillas.

Early Childhood Educators Focus Group

Twelve early childhood educators from diverse organizations across the Portland metro region (Appendix G) visited the Science Playground to observe and test the exhibit prototypes. Educators provided insights regarding the main messages, content, relevance of the information for caregivers, and suggestions for the exhibit prototypes.

Main message

The majority of the educators (seven out of 10 responses) indicated that the main message that the exhibit was trying to communicate was related to brain development. Along this line, educators mentioned how activities and interactions with caregivers influence early childhood brain development.

Content

Overall, educators found activities such as the “Brain Book,” “Reading Area,” “Dance Floor,” and graphics very useful and interesting for achieving the exhibit’s goal. Respondents stressed the value of reinforcing the importance of reading and the links to brain development, building up this activity through repetition, and reading the same books multiple times. They also appreciated having bilingual books available. Similarly, educators found the graphics very informative; in particular, educators felt that the “Timeline” is a good strategy to show caregivers how the brain develops as children grow.

Relevance for caregivers

The majority of educators agreed that reading is a relevant activity for caregivers of children ages 0–5. On this topic, they suggested adding more strategies such as books without words, books with different languages, softer books for younger kids, auditory books that narrate stories, and sensory reading strategies for younger children who may have difficulty sitting still.

Suggestions

Suggestions from the educators were centered around the dancing and reading areas and incorporating more sensory activities and materials for very young children. For the dancing area, educators suggested adding additional materials such as scarves, musical instruments, and cards that could prompt additional movements for caregivers to practice with their children. Participants also provided suggestions for improving the dancing area by adding a wider variety of music, songs, and examples of other body movements, in addition to dancing.

For the “Reading Area,” educators suggested adding a wider variety of books such as audio books; one educator mentioned including messages for caregivers inside the books. Educators also suggested incorporating manipulatives such as felt boards or puppets to encourage storytelling by visitors. Two educators mentioned the importance of including sensory activities and materials for little kids that allow them to explore the exhibit area while providing opportunities for working on gross motor and cognitive skills. One participant suggested incorporating the books mentioned by visitors on the *Read it Again!* writing wall into the reading area.

Findings

Analysis of the data collected from the three audiences suggests that the prototypes tested have great potential to meet the project’s goals of engaging families and caregivers and communicating messages around brain development and playful interactions. This section synthesizes data from the multiple sources outlined above to explore the extent to which the prototypes addressed anticipated outcomes of the exhibit—specifically, that caregivers (a) engage in playful activities with children, (b) understand the importance of family interaction and play in the development of their children, (c) feel more confident in their ability to support their children’s development through interactive play, and (d) plan to use one or more interactive play strategies outlined in the exhibition. Additionally, this section includes information regarding suggestions provided by the participants in the study.

Family groups engage in playful activities together to learn about research-based practices that enhance early childhood brain development

The prototype exhibits successfully captured the desired audience: caregivers with children aged five and under, though most of the children observed were at least two years old. Twenty-six of the 45 groups observed visited more than one activity. Nearly all the visitors observed were engaged with the exhibit activities; furthermore, adults generally played an active role with the children in their care. Adults were often observed taking on the roles of *Facilitator* and *Co-player* as a means to get their child to engage with the activities, then often switching to *Observer* to watch their child; caregiver descriptions of their perceived role from interviews is consistent with the observation data. Most respondents expressed on the survey that the activities inspired them to engage with their children. Adults were observed reading panels, talking, dancing, and reading with their children.

There is less compelling evidence that visitors learned about research-based practices that promote early childhood brain development. Only six of the 25 adults reported learning something new at the exhibit. This is supported by survey items asking about “fresh” and “new” information which were rated lower than those asking about the activities “inspiring” adults to engage more with their child and communicating the importance of play. Most reported that while the exhibit reinforced or reminded them about the importance of these activities, they already do similar activities at home. Responses from MFS caregivers suggest that the “Reading Area” messages were useful and interesting because they reinforced (and in some instances provided new information related to) the importance and benefits of reading for early childhood development.

Caregivers understand the importance of family interaction and play in the development of their children

Most participants in the ECE group identified the main message of the exhibit being related to brain development and found the activities provided in the exhibit very useful and interesting for achieving the exhibit's goal. Similarly, MFS families felt that the exhibit's main goal of "informing and empowering caregivers to enrich their children's early experience through playful interactions" was clearly communicated. However, few of the interviewed visitors indicated that the main message was related to (brain) development. They did, however, identify messages such as doing things together with their children and having fun together. While few of the caregivers interviewed mentioned brain development, those surveyed agreed with a statement that the activities in the exhibit communicated the importance of play in the development of their children.

Although most visitors did not explicitly link the exhibition to research-based practices that promote early childhood brain development, some visitors did associate the specific activities such as dancing and reading with childhood development. One visitor described how dancing supported the important role of music and movement for the brain while having fun. Another mentioned that she enjoyed the "Dance Floor" because of the feedback it [the projection on the wall] provided; she enjoyed observing her daughter realizing that the projection on the wall was her. Participants from interviews also mentioned the importance of reading books to their children for early brain development.

"The information learned about reading that is important from the first months of a baby. It was very clear and I understood that implementing more reading helps in the development of neurons successfully and therefore from that greatly affects the child's future."

Caregivers feel more confident in their ability to support their children's development through interactive play

Responses from visitors surveyed were mixed on the statement asking if the activities provided in the exhibit made caregivers feel more confident to support their children's development. While most (14) did *Agree* or *Strongly agree* with this statement, nearly as many were neutral (8) or disagreed (3). It is not clear whether there were not increases in confidence reported because there was not clear or sufficient messaging presented, or because caregiver already felt a sense of confidence in their abilities.

Although focus groups were not asked specifically about confidence, discussions with the MFS focus group suggest that since the information presented reinforced activities that caregivers were already doing with their children, they felt a sense of pride or confidence. Recognizing activities that they are already doing builds or reinforces confidence for Latino families or families who primarily speak Spanish at home. Since reading is something that most caregivers mentioned they already do at home, the exhibit reinforced the importance of this activity. Caregivers mentioned that reading is part of their routine.

Caregivers plan to use one or more interactive play strategies outlined in the exhibition

Caregivers generally agreed they intend to use suggestions from the exhibit signs and find more opportunities to read, play music, and dance with their child(ren) after visiting the exhibit. There were some responses that hinted that visitors planned to use ideas from the activities provided in the exhibit, such as incorporating shadows in their dancing and getting additional books, including bilingual books.

Limitations

It must be noted that the above findings should not be interpreted as “generalizable.” Small sample sizes and a constrained subject pool dictate that findings are specific to the individuals involved. Furthermore, other contextual parameters such as the number of exhibit components tested and changes to those elements during data collection make it impossible to draw conclusions beyond this study. Finally, testing was done exclusively within Science Playground; this space has frequent repeat visitors and is enclosed, which may provide caregivers with a sense of comfort and security that may not be found in other areas of the museum.

Conclusions and Recommendations

Based on the findings outlined above, the IFL exhibit prototypes are largely successful at eliciting the anticipated outcomes for the exhibition. The data suggest that there are areas where the team should consider additions or changes to better meet project goals. While suggestions and recommendations are made for the exhibit components, it is also understood that there will be complementary programming that will contribute further to achieving the project goals.

Activities for children 0 to 2

Increased effort should be made to provide more experiences to attract and engage children under the age of two. While the activities tested engaged children 2–7, there were very few families with younger children. Adding elements to the “Dance Floor” that demonstrate how one might “dance” with an infant, high-chair style seats where infants could be buckled in to watch a caregiver dance and/or a separate, smaller area for crawlers could encourage more participation involving children under two. Likewise, books specifically designed for infants, high-contrast images or decor and/or puppets or other manipulatives that could be part of story-telling could enhance the infant experience in the reading area.

Explicit Messaging

While connections between the prototype activities, playful interactions, and early childhood brain development were implied and/or recognized by visitors, few made those connections explicit when asked. It is recommended that the team seek ways to better communicate to caregivers that not only are the activities demonstrating the value of playful interactions, but that those benefits are directly related to brain development. Furthermore, one goal of the project is to help caregivers better understand that the benefits of rich, play-based interactions and the suggestions provided within the exhibit are based on current scientific research. ECE participants suggested adding the phrase “research shows...” to exhibit text and using quotes from researchers to help make the connection between the activities, the advice, and research.

Supportive Reassurance

Few respondents indicated that the activities and messages made them feel more confident about their ability to interact with their child through play. It is unclear from the data, however, whether that finding is due to insufficient or ineffective messaging, or an already high level of confidence in the caretakers surveyed. While familiarity with the activities may boost the confidence of some caretakers, reassuring, commiserating, and encouraging caregivers through text and images may serve a similar purpose. The project team has discussed including a graffiti wall or other area that provides caregivers with a forum for asking questions

and sharing experiences. It is recommended that this type of space is included in the final exhibition and that supportive and reassuring messages are present.

Activity Prompts

While the data collected suggest that most caregivers were engaged at the exhibits and would likely follow up with similar activities, providing more suggestions for how to engage with the child in their care and/or activities to do outside of the museum would increase these further.

Caregiver Down-Time

Observations suggest that caregivers often move to an *Observer* role after getting their child engaged with an activity; it also appears that they are more likely to read text when they are not directly involved with their child. It is recommended that the team plan for caregiver down-time and capitalize on those opportunities to communicate messaging.

Exhibit Suggestions

Specific suggestions from participants for improving the activities and exhibits are listed below; these were mentioned across participant groups and are not an exhaustive list, but rather a compilation to inform the team as they continue development of the exhibition.

- Add a wider variety of music, songs, and cards that could prompt additional movements for caregivers to practice with their children.
- Add additional materials such as scarves and musical instruments to the “Dance Floor.”
- Incorporate manipulatives such as felt boards or puppets to encourage storytelling in the “Reading Area.”
- Include more sensory materials for little kids that allow them to explore the exhibit area while providing opportunities for working on gross motor and cognitive skills.
- Incorporate titles mentioned by visitors in the “Read it Again!” writing wall into the “Reading Area.”
- Include pictures of book covers at the “Read it Again!” writing wall.
- Provide a parallel space for children to post near the “Read it Again!” writing wall.
- Make seating in the “Reading Area” more comfortable.

Appendix A: Observation Form – Caregivers in Museum

Observer: _____

Group Number: _____

Date: _____

Age child < 1 _____ 1-2 _____ 2-4 _____ 5-7 _____ 8-11 _____ 12-14 _____ 15-17 _____

Age adult 18-25 _____ 26-35 _____ 36-49 _____ 50-65 _____ 66+ _____

Activity: Dance Floor Timeline Brain Book Read it again Reading Area Other graphics Time start: _____ Time end: _____	Activity: Dance Floor Timeline Brain Book Read it again Reading Area Other graphics Time start: _____ Time end: _____	Activity: Dance Floor Timeline Brain Book Read it again Reading Area Other graphics Time start: _____ Time end: _____
<p>Adult Behaviors observed:</p> <input type="checkbox"/> Looks at projection/panels <input type="checkbox"/> Imitates projection <input type="checkbox"/> Reads the book <input type="checkbox"/> Follows child’s lead <input type="checkbox"/> Talks/gestures with child <input type="checkbox"/> Talks to others <input type="checkbox"/> Takes turns with child <input type="checkbox"/> Other: _____ <p>Adult role: circle all that apply observer co-player leader facilitator other: _____ none-not paying attention</p> <p>Child engagement 1 2 3 4 5</p> <p>Adult engagement 1 2 3 4 5</p>	<p>Adult Behaviors observed:</p> <input type="checkbox"/> Looks at projection/panels <input type="checkbox"/> Imitates projection <input type="checkbox"/> Reads the book <input type="checkbox"/> Follows child’s lead <input type="checkbox"/> Talks/gestures with child <input type="checkbox"/> Talks to others <input type="checkbox"/> Takes turns with child <input type="checkbox"/> Other: _____ <p>Adult role: circle all that apply observer co-player leader facilitator other: _____ none-not paying attention</p> <p>Child engagement 1 2 3 4 5</p> <p>Adult engagement 1 2 3 4 5</p>	<p>Adult Behaviors observed:</p> <input type="checkbox"/> Looks at projection/panels <input type="checkbox"/> Imitates projection <input type="checkbox"/> Reads the book <input type="checkbox"/> Follows child’s lead <input type="checkbox"/> Talks/gestures with child <input type="checkbox"/> Talks to others <input type="checkbox"/> Takes turns with child <input type="checkbox"/> Other: _____ <p>Adult role: circle all that apply observer co-player leader facilitator other: _____ none-not paying attention</p> <p>Child engagement 1 2 3 4 5</p> <p>Adult engagement 1 2 3 4 5</p>
<p>Notes:</p> 		

Appendix B- Data Collection Protocol

Materials

- Consent sign
- Study Purpose (English & Spanish)
- Observation forms
- Survey forms
- Pens, clip boards, stop watches (if needed)

Initial Set Up

Start approximately 2-5 minutes before data collection.

Set up consent sign: the sign should not block access to the exhibit and be visible for visitors as they enter the area.

Keep study purpose copies handy.

Data Collection Protocol

Sampling:

Data collector will observe the space and will look for a potential focal family (at least one adult and one child) together. If the focal family leaves the exhibit less than 30 seconds after entering, disregard and select a new focal family. Focal families should appear at ease with the situation and not overly distracted (crying babies, heated conversations, etc.)

Talking points:

If visitor asks why we are observing, make sure you say it is for research purposes to improve the quality of OMSI's visitor experience, this day we are focusing on families and children. If a visitor was not aware they were being observed and wishes not to be included in the evaluation, record the time and a description in the notes section of observation form and assure them their interaction will not be included in the study. If they want more information they can contact: Carla Herran, Lead Evaluator at 503.797.4000 X4537 or Heartland IRB at 866.618.HIRB

Observations:

Fill out the top portion of the observation sheet including your initials. Record the number, and estimated age and gender of family members. For each age category, put a number followed by an 'm', 'f' or 'x' to indicate the number of males, females and uncertain or gender non-specific in that age category (2m,1f would indicate two males and a female in a single age category). The unit of analysis is adult caregivers with children 0-5; while notes should be kept regarding who within the group does certain activities, the coding should be done with the caregiver(s) in mind.

Once you have selected your focal family, circle the activity they start with and record start time. Note the behaviors you observe, the role the adult is taking and notes about interesting, surprising or compelling

behavior. When the family moves to another activity, record the time end, engagement levels and move to a new data collection box.

Adult Behaviors Observed

Check all the behaviors that apply during the time the caregiver is at the specific exhibit/activity.

Adult role: Circle all that apply for the activity

Observer - Caregiver watches child engaging in the activity

Leader - Caregiver instructs, directs and/or coaches child in the activity. Selects which activities to do and when to begin/end.

Co-player - Caregiver engages in the activity alongside the child. Child and caregiver appear as equal participants in the activity.

Facilitator - Caregiver provides suggestions, encouragement materials without directly engaging in the activity.

Child/Adult engagement Scale: Circle a number on the scale that best fits the description for both the adult and child.

Engagement Levels	Types of Activity
1	Observing at most - not interacting directly with activity.
2	Started an activity, but did not complete it.
3	Completed the activity once. Dance to one song, read through the book once, etc.
4	Repeated an activity <u>OR</u> displayed enthusiastic engagement (smiling, clapping, joy, hand motions).
5	Repeated the activity <u>AND</u> displayed enthusiastic engagement (smiling, clapping, joy, hand motions).

Survey:

After the focal family leaves the exhibit area, approach an adult, introduce yourself and ask if they will take a few minutes to complete a survey. Ask if they would prefer to fill in it in English or Spanish. Be available in case they have questions.

Interviews:

When the family/ group who was previously observed spending time at the exhibit leaves the exhibits, the evaluation team will approach the group and ask an adult for a brief interview.

“Hi, my name is _____; I work here at OMSI. We’re talking to people about their experiences with these activities and would love to hear your thoughts. Would you be willing to take a few minutes to answer some questions?”

- a. *If definite no*: “No problem. Thanks very much for your time anyway, and have a nice day.”
- b. *If yes*: “Great, thank you so much! It should only take approximately 10 minutes, there are not right and wrong answers. Your participation is voluntary and you can stop at any time.”

If participant appears unsure: “I’d *really* appreciate hearing your thoughts and input – it won’t take long at all, and you can absolutely leave in the middle if you need to! What do you say? (*Proceed as directed above for “yes” or “no”*)

If visitors agree, ask questions, prompting for clarification when necessary. When they have finished answering the questions, thank them again and return to the observation area.

Survey:

After a group is observed offer the survey and ask if they would prefer to fill it in English or Spanish. Be available in case they have questions. Introduce yourself:

“Hi, my name is _____; I work here at OMSI. We’re asking people to complete a survey about their experiences with these activities. Would you be willing to take a few minutes to answer these survey questions?”

- a. *If definite no*: “No problem. Thanks very much for your time anyway, and have a nice day.”
- b. *If yes*: “Great, thank you so much! It should only take approximately 5 minutes, there are not right and wrong answers. Your participation is voluntary and you can stop at any time.”

Appendix C: Survey Form – Caregivers

1. How much do you agree with these statements about this exhibition?

	STRONGLY DISAGREE	DISAGREE	NEUTRAL	AGREE	STRONGLY AGREE
The exhibit activities inspired me to engage more with my child	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The exhibit activities communicated the importance of play in the development of my child	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The messages in the exhibit provided me with fresh information about my child's brain development	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The exhibit activities and signs gave me new ideas about how to interact with my child	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The exhibit activities and messages made me feel more confident in my ability to interact with my child through play	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

2. In what ways might you use some of the exhibit activities outside of the museum?

3. After experiencing *this exhibit*, how much do you agree with these statements compared with how you felt before you visited it?

	STRONGLY DISAGREE	DISAGREE	NEUTRAL	AGREE	STRONGLY AGREE
I intend to find more opportunities to play music and dance with my child to support their development	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I intend to find opportunities to read more often to my child	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I intend to use one or more suggestions from the panels/signs	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

4. For the purposes of the exhibit, one of the target audiences are Spanish-speaking families. Do you self-identify as of Hispanic, Latino, or Spanish origin? Yes No I don't know

5. With which racial or ethnic group do you identify? *(Please select all that apply.)*

- American Indian or Alaska Native Asian Black or African American Native Hawaiian or other Pacific Islander
- White or Caucasian I don't know Other_____ Prefer not to say

Appendix D: Interview Form-Caregivers

Interviewer:

Date:

Age child 0-1____ 1-2____ 2-4____ 5-7____ 8-11____ 12-14 ____ 15-17____
Age adult 18-25 ____ 26-35____ 36-49____ 50-65____ 66+____

What about this experience did you enjoy most?

(circle one if mentioned: Dance Floor Brain Book Reading area Timeline Read it again
Other graphics)

What did you enjoy most about [response from Q.1]?

What role do you think adults could or should play in that activity?

What would you tell a friend this exhibit is about?

What would you say the main message or big idea of this exhibit is?

Did you learn or realize anything new at this exhibit?

Yes No

i. If yes, probe – what did you learn or realize?

What, if anything, do you think you will do as a result of the activities or messages in the exhibit?

Is there anything about this exhibit that is confusing or hard to understand?

Is there anything you would change or add to...

[Select the most appropriate: better communicate the main message, engage more caregivers, encourage interactions with children]?

Appendix E: Interview Form – Metropolitan Family Service (MFS) Ready, Set, Go!

Date:

1. **El propósito de esta exhibición es informar y empoderar a los o las cuidadores as de los niños para enriquecer las experiencias de estos a través de actividades recreativas divertidas. ¿Cuán claro le parece que la exhibición informa esto?**

Nada claro	Algo claro	Es claro	Muy claro	Perfectamente claro

2. **Considering the purpose of the exhibit, describe one thing about the content that you found interesting, exciting or useful. (think about one or more activities in the exhibit)**

3. **We are interested in your unique cultural perspective. Considering that, what information or activities did you find especially relevant or applicable to your family life? Was there anything that did not make sense or resonate with you?**

4. **What suggestions do you have for changes or additions to make this exhibit better?**

Formative Debrief Form- to use after families interacted with exhibit Metropolitan Family Services – Ready, Set, Go! Caregivers

Thank caregivers for visiting the exhibit. Ask them to introduce themselves and let us know their favorite song, book, or story when they were children.

Then follow up with these questions.

- Considering the content of the exhibit, please tell us one thing that you found interesting, useful, or exiting?
- We are interested in your perspective – what activities are relevant or relate to your family, in particular for you as a caregiver.

- Finally, what changes or suggestions do you have to make this exhibit better? (prompt for the current activities, or complementary activities, signs, some words, graphics?)

Appendix F: Questionnaire Form – Early Childhood Educators (ECE)

1. What do you think is the main message or idea OMSI is trying to communicate with this exhibit?

2. The purpose of this exhibit is to inform and empower adult caregivers to enrich their children's early brain development through playful interactions. Considering that, describe one thing about the exhibit that you found effective and useful in achieving that goal.

3. Based on your experience as an early childhood educator, what suggestions do you have for changes or additions to make this exhibit more effective in communicating about early brain development and playful interaction with caregivers?

Interview Form to use after ECE interacted with exhibit. Thank educators for visiting the exhibit. Ask their permission to record the conversations again. Ask them to introduce themselves and let us know their favorite song, book, or story when they were children.

Then follow up with these questions.

- Considering the content of the exhibit, please tell us one thing that you found interesting and useful?
- We are interested in your perspective as an educator - what activities do you think are relevant or can resonate with caregivers of children 0-5?
- Finally, what changes or suggestions do you have to make this exhibit better? (prompt for the current activities, or complementary activities, revisions to wording or images in exhibits)
- Optional---One of the goals is to communicate to caregivers that the information in the exhibit is based on brain development research; what strategies and suggestions do you have to help communicate this to caregivers? (prompt- assuming they are busy and with children)

Appendix G: Early Childhood Educators (ECE) Organizations

Approximately 30 early childhood educators were invited to participate in a focus group session based on the available date for the study. From that, only 12ECE participated in the focus groups session. The organizations they represented were:

- Concordia University
- Albina Head Start
- Immigrant and Refugee Community Organization (IRCO)
- St. James CDC
- 211info
- Growing Seeds Crystal Springs
- Rising Star Chinese School
- Mount Hood Community College