Play Labs
Summative Evaluation

Prepared for

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Table of Contents

Executive Summary

With funding from the Institute of Museum and Library Services (IMLS), The Oregon Museum of Science and Industry (OMSI) advanced their 20-year vision through research and development (R&D) activities designed to better understand strategies for helping caregivers learn about the role of play in their very young children's development and to build capacities engaging more caregivers in such learning activities, particularly caregivers from populations underrepresented in STEAM (Science, Technology, Engineering, Art, and Math) activities. Play Labs R&D activities directly benefited three Adventures created for Play Labs and are positioned to indirectly inform other OMSI projects that engage caregivers of very young children.

Play Labs R&D built upon strategies that were successful for engaging caregivers in OMSI's long-tenured Science Playground, a learning space for 0- to 6-year-olds and their families. Successful strategies in Science Playground include having researchers of developmental psychology share their research activities with families by engaging them as participants in the research. Another successful strategy in Science Playground is supporting peer learning among caregivers, primarily when parents to talk to each other while children play. Strategies like these were intended to inform the development of a new space in the museum, located within the museum's emerging Center for Innovation, which would provide more early childhood learning spaces in the museum and bridge children's transitions into the all ages areas. While this new area for 4- to 8-year-olds and their families was being built, the first two of three Play Labs Adventures were tested in a temporary space in the Center for Innovation.

Evaluation of the Adventures included gathering input from visitors using team-based inquiry to inform changes to the Adventures and using professional evaluators to assess whether the Adventures achieved the intended outcomes. Adventure Three benefited from lessons learned during Adventures One and Two. Adventure Three also benefited as the first Adventure located in the new permanent space for 4- to 8-year-olds and their families, called the Curium. Because of these benefits, the evaluation of the Adventure Three outcomes is the focus of the Play Labs Summative Evaluation in this report. This report begins with two reflection sections—the first reflection describes how building stronger partnerships across the Play Labs Adventures has supported OMSI's early childhood experiences (ECE) initiatives. The second reflection discusses design strategies related to conveying the big idea across Adventures.

Evaluation activities revealed that Adventure Three did achieve the intended outcomes for caregivers. That is, the majority of caregivers captured the big idea, *Families playing together is a research-proven way for adults to build observation and parenting skills while children build design-thinking skills*, as evidenced by either:

1. **Playing with** children in ways such as co-player, facilitator, or helper;
2. **Trying behaviors/roles** that allow them to observe children's play as skill-building;
3. **Contributing (oral or written)** to synchronous and asynchronous dialogue related to the big idea; and
4. **Verbally recognizing** that playing together is a valuable way to support their child.

The team is using their understanding of building stronger partnerships with various stakeholders to learn about supporting the development of caregiver learning:

1. Community partners encouraged OMSI to explore how children are caregivers' first teacher.

2. Researchers and interns increased OMSI's knowledge of STEAM learning and our capacity for team-based evaluation.
3. Staff strengthened their skills in rapid and iterative prototyping and communicating clear educational messages to caregivers.

Through experimentation and evaluation in all three Adventures, the team learned that strategies which work well in this new space for 4- to 8-year-olds and their families include helping caregivers learn about supporting the development of the child:

1. From the child first, with other supporters like peers and researchers, as secondary sources;
2. Through play with the child — as co-players, facilitators, or observers; and
3. By promoting that playing together is a way to support child development in STEAM learning.

The team is using their lessons learned from Play Labs adventures to inform areas such as:

1. Launching the Curium space for 4- to 8-year-olds and their families within the Center for Innovation;
2. Development of un-facilitated exhibits that center caregivers as the primary learners;
3. Professional development workshops across the state for educators of very young children;
4. Exploration of designing OMSI's own tangible technology; and
5. Advancing and exploring technological best practices in ECE.

Project Introduction

The Play Labs project started as an early research and development (R&D) project in OMSI's overarching strategic initiative to invest in early childhood education (ECE) to increase OMSI's value for families and promote inclusion of underserved audiences. Play Labs has been a crucial first step in OMSI's strategic initiative to build staff capacity to develop diverse experiences and deeper learning for children 0-8 years old and in particular, their caregivers.

The Institute of Museum and Library Services (IMLS) provided funding to begin R&D on Play Labs with the expectation that Play Labs would continue beyond the grant period. Play Labs was a series of three pop-up, experimental play experiences (called "Adventures") that supported 1) young children's (0-8) need to learn through open-ended play, 2) caregivers' need to understand and facilitate their children's development, and 3) OMSI's need to provide more accessible, meaningful experiences for families with young children.

Play Labs Project Intent

The Play Labs Adventures were founded in the idea that providing play-related evidence-based resources to caregivers is one of the most effective mechanisms for ensuring a child's well-being and long-term success. Interventions with caregivers are expected to be particularly valuable when designed to emphasize the importance of play and encourage more playful interaction with their children. These interventions have been found to shift parental approaches and beliefs in a way that helps the next generation escape poverty and improve long-term economic status (World Bank, 2015; Gertler et al.; 2013; White, 2012).

Each Play Lab Adventure was developed with input from child development experts, community partners, OMSI members, informal science education program and exhibit professionals, and psychology college student interns to highlight a specific aspect of child development. Interpretative materials encouraged caregivers to observe their children playing and to learn more about the highlighted type of playing. Interpretive materials encouraged caregivers to observe their children playing as a way to learn more about the child's cognitive and creative development.

OMSI partnered with Impact NW, a social services agency with early childhood and family services to support families impacted by poverty, abuse, neglect, malnutrition, and delayed development, an organization that shares our goal of supporting caregiver learning and view play and caregiver interactions as integral to positive and healthy child development. Caregivers and staff from Impact NW learned along with us and provided input on the development and feedback on the experience of the three Adventures.

Purpose of this Document

This document is the report of results from OMSI's Play Labs Summative Evaluation. The purpose of the Summative Evaluation is to assess the ways and extent that Play Labs achieved the intended project goals and caregiver impacts. The evaluation study employed a utilization-focused approach to facilitate the design of efficient evaluation activities that result in meaningful findings and actionable recommendations for the project team (Patton, 2008). The study incorporated both quantitative and qualitative evaluation methodologies to capture diverse data and the complexities of the various environmental contexts and interpretation strategies implemented throughout the project (Cobb, Confrey, DiSessa, Lehrer, Schauble, 2003; Friedman, 2008). The focus of this summative evaluation report is on the evaluation of Adventure Three, the Bee Bots experience in The Curium, intended for 4- to 8-year-olds and their families.

Team-Based Inquiry (TBI) and Evaluation Activities

TBI and evaluation activities were conducted for each Play Lab Adventure and included: 1) front-end conversations with caregivers from Impact NW and OMSI membership; 2) formative evaluation activities using TBI; and 3) final evaluation activities led by professional evaluation staff using observations, semi-structured interviews, and post Play Labs surveys.

Target Audience

The goal of all three Adventures was for young children and their caregivers to benefit from Play Labs' developmentally-appropriate, open-ended, active play experiences and the complementary interpretative and instructional materials/programs, but the primary target audience was the caregivers. Caregivers participating in the evaluation activities included three groups: 1) general admission visitors who engage primarily with unfacilitated interpretive materials or informal activities with OMSI staff or researcher partners, 2) underserved caregivers in STEAM from Impact NW, and 3) OMSI members with young children. Adventures One and Two focused on engaging caregivers with children 0-8 years old. Adventure Three focused on engaging caregivers with children 4-8 years old.

Brief Adventure Descriptions

During the grant period, OMSI completed three Adventures – three- to six-month experiences for very young children and their caregivers. The three Adventures featured activities called Bloops, Block-O-Sphere, and BeeBots, respectively. The Adventure One experience was stationed in the Center for Innovation from mid-March 2017 until mid-June 2017. In Adventures One and Two, the Bloops and the Block-O-Sphere, the team's intent was to help caregivers observe their children's creative and social development through play. In Adventure Three, the BeeBots, the team's intent was to help caregivers observe their children's design-thinking skills through play.

Adventures One and Two focused on the creative and social development of 0- to 8-year-olds as the evidence-based science content occurred in a temporary space, and relied heavily on wall signage as the primary way to engage and communicate with caregivers.

In addition to benefiting from lessons learned during Adventures One and Two, Adventure Three also benefited from a new, permanent, early childhood space called the Curium, which was specifically designed to house Play Labs. The Curium was intended to engage 4- to 8-year-olds and their caregivers. Play Labs Adventure Three had a designated, semi-enclosed space with three walls in The Curium. In this semi-enclosed space, caregivers engaged with their children and other caregivers, but rarely with staff.

	Adventure One	**Adventure Two**	**Adventure Three**
Experience	Bloopodome	Block-o-sphere	BeeBots
Timeline	Mid-March 2017 to mid-June 2017	Late September 2017 to mid-January 2018	June to October 2019
Location	Center for Innovation	Center for Innovation	Curium

Figure 1. Descriptions of experience, timeline and location

Adventure Improvement Processes

As an R&D project, the IMLS-funded activities included a plan for gathering data to inform improvement of the Play Labs Adventures. The team used logic model and data collection techniques to document the relationships between the experience objectives, experience characteristics, and measurable outcomes. Lessons learned from each Adventure is apparent in these logic models [See appendices A, B, C], the experience designs, the data the team documented through professional inquiry (referred to as Team-Based Inquiry) and evaluation activities. Because Adventure Three benefited from the Lessons learned in Adventures One and Two and from the new, permanent space for 4- to 8-year-olds and their families, Adventure Three is the primary focus of this summative evaluation report. This report also provides reflections that include all three Adventures. The sections of this report are:

- Building stronger partnerships to support OMSI's ECE initiatives;
- Reflection on design strategies related to conveying the main messages of the experience;
- Evaluation of Caregiver Learning Outcomes in Adventure 3;
- The implications for OMSI's ECE initiatives; and
- Future research questions for Play Labs.

Building Stronger Partnerships to support OMSI's Early Childhood Education Initiative

This section identifies how strong partnerships build capacity, deepen learning, and generate skills to actively engage adult caregivers. OMSI staff envisioned an ECE exhibit experience that engaged caregivers as the primary learning audience. OMSI staff observed strategies from OMSI's long standing Science Playground, a large space that engages children (0-6) and their caregivers. It was informally observed that caregivers would often verbally engage with other caregivers and staff within the space to learn about child development and parenting strategies. Science Playground often invites new caregivers to engage more deeply with the content, exhibit experience, and staff to develop knowledge, awareness, and confidence to support their children's development. It was through research and evaluation and co-development with researchers, artists, caregivers, and community organizations that OMSI staff began to explore alternative strategies to replicate a similar inviting, intimate, and educational experience for caregivers and their children in Play Labs Adventures.

Community Partners

To build capacity, OMSI staff and researchers hosted "Play Labs Groups" for OMSI members and for underserved audiences participating in parent groups organized by community partner, Impact NW. Play Labs Groups focused on the benefits of play and how caregivers can support their children's development. These groups explored ways of engaging caregivers as primary learners and informed the development process of all three Play Labs Adventures. There was a total of six Play Labs groups (one for members and one for Impact NW families in each of the three adventures). During Play Labs Adventure One, Two, and Three, evaluators conducted two focus groups with Impact NW families to learn how they observe, help, and play with their children. Caregiver input from the community was instrumental in strengthening the design of all three Play Labs Adventures. It was through this community that we learned that caregivers allow their children to lead play time and therefore are their first teachers of child development.

Researchers, Interns, and Artists

OMSI staff worked with researchers, interns, and artists to co-create the Adventures with the intention of creating Play Labs Adventures for diverse audiences. OMSI staff partnered with two researchers at Lewis and Clark College, Dr. Jennifer LaBounty and Dr. Erik Nilsen to determine adult-aimed content for each Adventure. Researchers from Lewis and Clark also helped OMSI identify two students per Adventure to act as project interns. Interns participated in program planning, data collection, and data analysis in the form of TBI (Team-Based Inquiry). Interns were integral to planning, collecting, and analyzing data quickly, iteratively, and collaboratively with the project team. OMSI staff also partnered with the Regional Arts and Culture Council (RACC) to identify a local artist to create the first Adventure, the Bloopodome. OMSI added the RACC partnership to the project launch to ensure a diverse pool of artist applicants. Additionally, RACC managed selection processes for art collaborations, which could increase OMSI partnerships with the art community in Portland and build capacity to be intentional about including the art in STEAM (Science, Technology, Engineering, Art, and Math).

During Adventure One, Dr. Nilsen's research became the focus. The content for this experience emerged from the expertise and abilities of a local artist, Michael Yager. Yager's work in electronics and robotics was a good fit for Dr. Nilsen's research around creativity and divergent thinking. Yager transformed a space in the Turbine Hall, OMSI's home to physical sciences, into the Bloopodome. The Bloopodome was full of Bloops, which were small foam robots that reacted by buzzing and blinking lights when exposed to light, proximity to other Bloops, or when placed in certain parts of the room.

During Adventure Two, Dr. LaBounty's research on social development was featured. The project team used Science Playground "Blue Blocks" to create the Block-O-Sphere. Block play inherently incorporates social interaction, whether you choose to observe another builder, cooperate, compete, play side-by-side, add onto another's creation, and so much more. Signage for this project focused on the different social skills and types of play emerging across the early years, and invited adults to observe their child's play style in that setting.

During Adventure Three, the project team partnered with Dr. Nilsen again, to focus on design-thinking to explore and communicate another aspect of Dr. Nilsen's research on tangible technology. Additionally, the team returned to the exploration of creativity and divergent thinking through the BeeBots, programmable robots that resemble bees.

Staff Influence on Adventures

Ultimately, the project team gained skills in rapid prototyping, team-based evaluation, and iterative improvement of public-facing exhibits. These skills enabled the team to communicate children's abilities to caregivers in exhibit-based programs more intentionally and to use a strengths-based approach to collaboration with partners to accomplish more than OMSI could alone. OMSI will continue to partner with Lewis and Clark College to share current developmental research with caregivers visiting OMSI's early learning spaces. OMSI also anticipates a continued partnership with Impact NW as an ongoing formative prototype partner.

During Play Labs Adventure Three, the project finally had a designated space in which to design the experience. The project team also built its capacity by gaining bilingual (Spanish and English) exhibit developers and evaluators. This allowed the team to engage more deeply with Spanish-speaking community partners and caregivers to receive feedback on caregiver interactions with their children as "observers," "helpers," and "co-players," and to develop bilingual copy and instructional materials for the exhibit experience. Through this experience, the team concluded that children lead their caregivers' learning experiences about children.

Reflection on Design Strategies Related to Conveying the Main Messages

This section identifies the influences of Play Labs' design strategies to convey the main messages in Adventures One, Two, and Three. The goal of the Play Labs Adventures was to help caregivers increase their awareness of and interest in the critical role of play to the development of their children. Given that OMSI is a museum that designs educational experiences for children and youth, their caregivers are a community we aim to support in building research-proven caregiver choices. However, caregivers often see themselves as the secondary audience in OMSI's early childhood spaces, instead of the primary learning audience or "co-player." During the Adventures we learned the educational value of designing experiences so caregivers see themselves as helpers and facilitators of their children's development.

Play Labs Adventure One Reflections

The Play Labs Adventure One experience relied heavily on labels to increase awareness and understanding of the critical role of play to the development of children. One of the goals for the experiences was for caregivers to become comfortable using science-based information to inform their parenting/caregiver choices. Caregivers were encouraged to read about research that proved how valuable play is to the development of their children's creative thinking. However, the Adventure One signs had too many layers of messages and did not indicate a clear take-away message for caregivers, so engagement between caregivers and their children was low. In fact, instead of designing an engaging opportunity for caregivers to put research into practice, caregivers read about play.

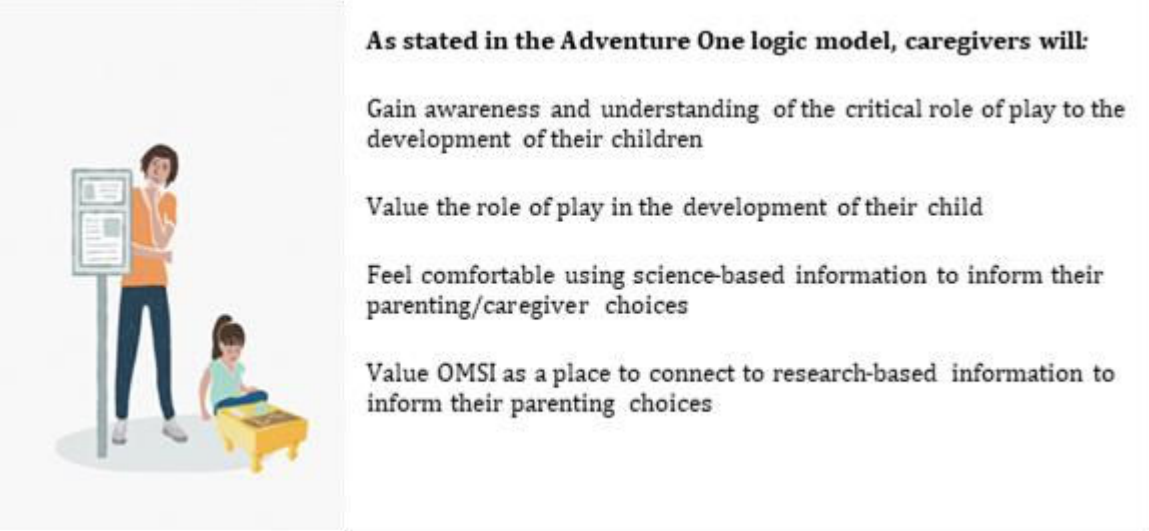


Figure 2. Representation of caregiver experience with main messages in Adventure One

Team-based inquiry findings

Through TBI, the project team learned that caregivers felt that the Bloops were beneficial for child development and that they allowed for uniqueness and individuality to play out among children. Caregivers expressed an interest in learning how to practice creativity at home. Although caregivers

described the creativity as art-based, rather than science-based, they were in fact interested in understanding the science behind creative play through an engaging experience. Based on this thinking, the team highlighted the creative process of science as part of the Bloopodome, casting young visitors as Bloopologists.

Evaluation results

Overall, caregivers reported their experience in the Bloopodome resulted in their children (not caregivers themselves) playing, building, and exploring. During their time in the Bloopodome children played with Bloops and caregivers engaged with the research station and talked to Bloopodome staff. Caregivers strongly reported that they valued OMSI's presentation of research on early childhood education. In addition, caregivers claimed that if they tried something that was learned in the Bloopodome it would be asking children questions, using stories, and exercising children's play with objects. The majority of survey respondents indicated they were members of OMSI, had visited Science Playground, were female, and White. See Appendix D for Play Labs Adventure One Findings.

Indeed, the data revealed the need to provide clear and relevant communication with target audiences to strengthen the learning experiences for caregivers. The evaluation resulted in recommendations to improve partnership communications, heighten adult learning experiences and clarify the desired outcomes for the adults. To help caregivers capture, communicate, and retain the big idea, the team considered strategies for parents to step into the role of child development facilitator, to do activities like a researcher.

Play Labs Adventure Two Reflections

Play Labs Adventure Two made an effort to incorporate opportunities for caregivers to play with behaviors that allowed them to see their children's play like a researcher. In this particular Adventure, caregivers were encouraged to play like a researcher and identify children's play behaviors as contributing to social development. With this goal in mind, the project team designed an experience for caregivers to make observations of their children's social play behaviors and participate in opportunities for dialogue (oral or written) related to the big idea. Although the intended outcome was for caregivers to verbally recognize a science lens as a resource for them, data shows that very few caregivers received this message through the experience. (See Appendix E)

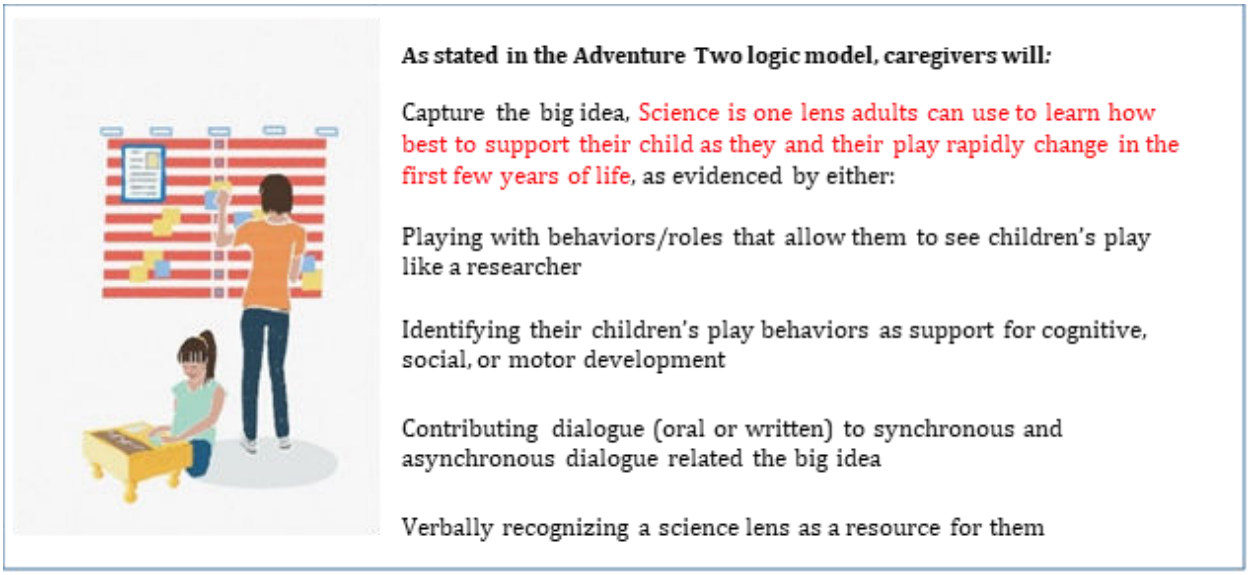


Figure 3. Representation of caregiver experience with main messages in Adventure Two.

Team-based inquiry findings

The project team found that 96% of adults identified young children as a learning audience in Play Labs. Yet only 46% of adults identified themselves as a learning audience in Play Labs. The project team recognized that they needed to continue thinking about how to prime adults for their own learning. The team also found that adults often did not read signage and that the project team must continue to find ways to orient people to signage immediately.

Evaluation results

Overall, the formative evaluation found that the caregivers would tell another adult that the possible benefits of visiting Play Labs is for children to exercise creativity, collaboration, and social skills. The majority of caregivers neither agreed nor disagreed that they learned something new about how children's play supports social development. The adults mostly reported that their experience in the Block-O-Sphere resulted in them and their children learning "a little." During their time in the Block-O-Sphere caregivers primarily looked at the Welcome Adults panel, explored Ball Wall Climbers, and engaged with the Center Research Station. In addition, caregivers predicted that if they were to try something with their children at home that was learned in the Block-O-Sphere, it would be building. The majority of caregivers were members of OMSI, had visited Science Playground, were female, and White. See Appendix E for Play Labs Adventure Two Findings.

The data indicated that the team should continue considering how to afford a more explicit caregiver role in the learning experience. The team continued to explore how caregivers interacted with the Play Labs labels and how to demonstrate more clearly that the learning experience was, in fact, for adults.

Play Labs Adventure Three Reflections

Play Labs Adventure Three sought to encourage caregivers to observe, help, and facilitate play, as well as co-play with their children, more explicitly. These roles were to allow them to observe children's play as skill-building. Two focus groups were facilitated with Impact NW in both Spanish and English, where evaluators learned that a balance between new and old types of play encouraged familiarity for caregivers that increased their confidence to help and facilitate play with their children. Ultimately, in the Adventure Three experience, caregivers did help and facilitate play, as well as co-play with their children. We learned that most times, caregivers follow their children's lead in order to identify how to best support their children's cognitive development. Often, caregivers' goal was to help, facilitate, and play until their children chose to play independently. However, a challenge we found again was encouraging caregivers to see themselves as "learners" of their own children's development during the experience. Most often, caregivers viewed the experience as for their children, not for themselves and not for both of them. Nonetheless, the Adventure Three experience was successful as a design where caregivers and children played together, while adults supported children to use their design-thinking skills.

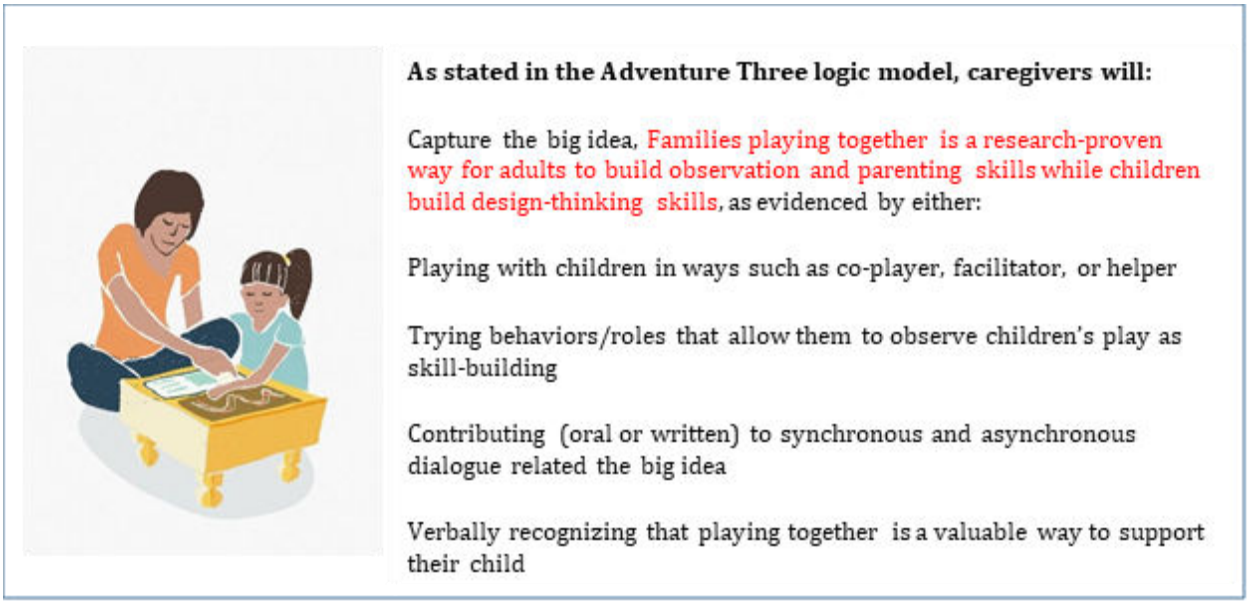


Figure 4. Representation of caregiver experience with main messages in Adventure Three

Team-based inquiry findings

Once the BeeBot experience was designed, the project team participated in TBI by conducting observations and interviews. The team found that caregivers and children alike found the BeeBots fun and engaging. However, they were often met with challenges understanding or using the instructions to help them get started comfortably. Caregivers most often saw themselves as observers, facilitators, helpers, and/or guides to support their children playing with the BeeBots. When caregivers were asked if they learned anything from playing with the BeeBots, they expressed that they did not see themselves as the primary educational audience. However, they still stated that they observed their children learning and saw the value in their play. Caregivers often described playing with the BeeBots as learning how to code or program the BeeBot in order to achieve the path the children and caregiver planned. Caregivers would support their children by counting and pressing buttons together to avoid the instinct

to “push” or “drive” the BeeBot. Most groups helped each other create designs, until the children could create designs independently. Similar results were found when the summative evaluation of Play Labs Three was conducted.

Evaluation results

Hands-on, interactive experiences with an intuitive component, like the BeeBots, allowed for children to test and iterate, while their caregiver learned alongside them. Some children would jump into the experience without reading the instructions and learned through trial-and-error, while others read the instructions. This simple observation by caregivers allowed them to learn. When adults identified that their children required more support to create an intentional path for the BeeBot to reach, the adults would read or explain the instructions, help children press buttons, and count. The BeeBots allowed caregivers to teach their children how to play through design-thinking, counting, creating paths for the BeeBots, and celebrating successful programming. Indeed, the BeeBots afford intuitive play and complex play that utilized math, testing and iteration, and an introduction to coding/programming. Ultimately, the level of difficulty was co-designed by the caregiver and their children. The estimated number of children and caregivers who visited BeeBots during the first five months is 129,596.

Ultimately, the project team learned that caregivers learn about supporting the development of their child through co-playing, facilitating and observing them play. Caregivers often learn about their children’s development through their child first, then from supporters like peers and researchers. For OMSI staff, Play Labs Adventure Three generated lessons learned related to the BeeBots, design-thinking, caregiver involvement, and the role of copy on a screen, table, and wall. Effective instructional materials played a significant role to ensure that caregivers and children not only learned how to use the BeeBots, but in their understanding that they were participating in design-thinking. Indeed, the project team observed that playing together is a valuable way for caregivers to support children’s development in STEAM learning. For a detailed evaluation of caregiver learning outcomes in Play Labs Adventure Three, see the following section.

Evaluation of Caregiver Learning Outcomes in Play Labs Adventure Three

The Play Labs Adventure Three experience included the BeeBots, robots designed specifically for young children ages 4-8 to learn sequencing, estimation, problem-solving and design-thinking while playing. The Adventure Three experience also included a table with projected instructions and flowers which respond when the BeeBot has been programmed to successfully reach the flowers. The experience is designed for caregivers and their children to place the BeeBots on the table and begin to sequence and advance them through a projected field of flowers. In addition to the BeeBots, Adventure Three included the Buzz Wall, where groups were encouraged to share how they use technology at home. The Play Labs Adventure Three experience was the first and only Adventure to include bilingual (English & Spanish) copy and instructional materials.

Evaluators collected data on caregiver involvement with their children and the BeeBots; the target audience was caregivers. The purpose of this evaluation was to determine the ways and extent to which Adventure Three elicited the following caregiver impacts:

1. Caregiver engagement with the exhibit experience;

2. Caregiver understanding of the critical role of play in design-thinking; and

3. Caregiver interest in value of play in design-thinking.

Methods

The OMSI Research and Evaluation team addressed evaluation objectives using a mixed-methods approach including unobtrusive observations, group interviews, and individual self-report questionnaires. All three methods were conducted during a three-week period and took place around the Adventure Three exhibition area, which included the BeeBots and the Buzz Wall, where adults could provide insight on how they use technology at home with their children.

Observations

Fifty-nine observations were conducted of visitor groups with at least one child between the ages of 0 and 8. The target audience is adult caregivers for this exhibit. Within the 59 groups, 7.5% of the people were 1 to 3 years old, 30% were 4 to 8, 14% were 9 to 10, 3.5% were 11 to 17, and 45% were 18 or older. The observations focused on physical and verbal interactions within the participant groups.

Instrument: Evaluators created an observation sheet to document actions taken by caregivers — behaviors such as reading and explaining the instructional copy and screen to their children, observing their children play, creating designs together and separately, participating in play with their children, scaffolding, story telling, creating new designs, talking to each other, and writing on the Buzz Wall. See Appendix F.

Interviews

Interviews were conducted with 20 adult caregivers from the observed groups immediately after their experience. Of the interviewed adults, 7% had children between the ages of 0 and 1, 18% were 1 to 3, 57% were 4 to 8, and 14% were 9 to 10. Sixty percent of adults who participated in the interview identified as female and 40% identified as male. Forty percent of adults identified as White, 10% identified as Multiracial, 5% identified as Black or African American, 5% identified as Filipino, 5% identified as Latina/o, 5% identified as Middle Eastern, and 5% preferred not to answer. Fifteen percent of adults identified as Latino/Hispanic and 85% identified as non-Latino/Hispanic.

Instrument: The interview included questions about caregivers' experience in Adventure Three, how

they supported their children's play with the BeeBots, their observations of play and design-thinking, insights into their children's learning process, whether they captured the big idea, and whether they talked to another adult or wrote on the Buzz Wall. See Appendix G.

Surveys

Twenty-eight surveys were collected from individuals who experienced the BeeBots, but did not participate in the observations or interviews. Seventy-nine percent of participants identified as female and 11% identified as male. Thirty-nine percent of participants identified as White, 32% identified as Asian, 14% identified as Hispanic/Latino, 7% identified as multiracial, 4% identified as Middle-Eastern, 4% did not provide a racial/ethnic identity.

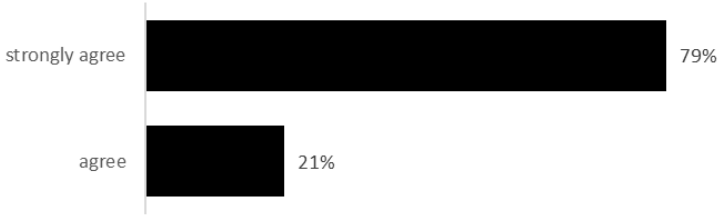
Nine percent of participants had children present between the ages of 0 and 11 months, 21% between the ages of 1 and 3, 63% were between the ages of 4 and 8, 2% between the ages of 9 and 10, and 3% were 11 and older.

Instrument: The survey questionnaire included closed-ended questions, similar to the interview, about participants' experience in Adventure Three. See Appendix H.

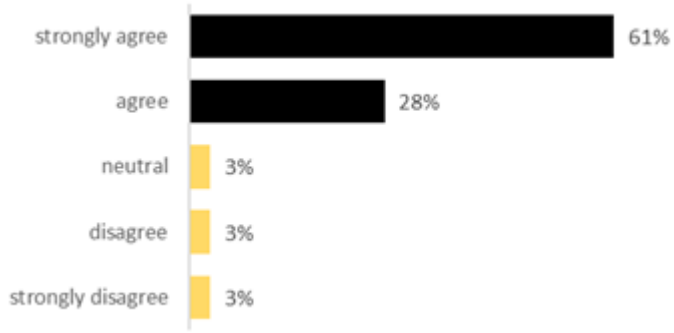
Engagement with Adventure Three Experience as Observer, Helper, Co-Player

The Adventure Three experience was designed for caregivers to engage with children as observers, helpers and/or co-players in their experience with the BeeBots. According to survey respondents, **37%** of caregivers had played with the BeeBots before. The data below are related to how the caregivers defined their engagement with their children and the Beebots.

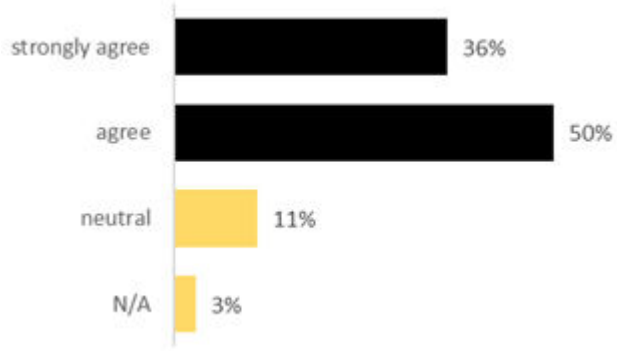
According to survey responses, 100% of caregivers strongly agree or agree that they **observed** their children playing with the BeeBots.



According to survey responses, 89% of caregivers strongly agree or agree that they **helped** their children play with the BeeBots.



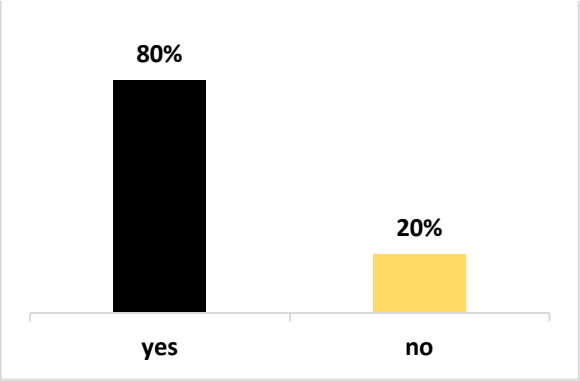
According to survey responses, **86%** of caregivers strongly agree or agree that they **played** with their children and the BeeBots.



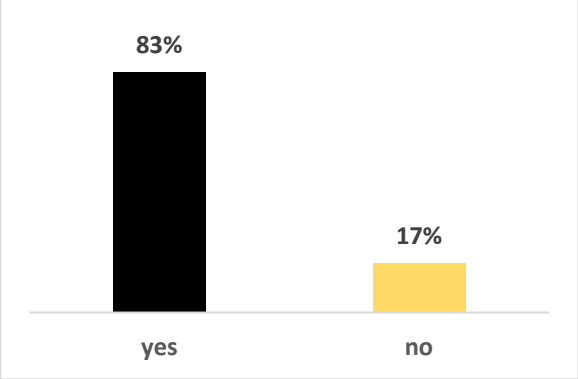
Engagement with Adventure Three Experience as Observer, Helper, Co-Player

The data below are related to how caregivers were observed engaging and supporting their children within the BeeBot experience. Caregivers often engaged with the experiences by explaining instructions so children could co-design the BeeBots' path to the "flowers." Caregivers often encouraged children to continue designing by asking questions to continue iterating, counting to support with sequencing, or celebrating their accomplishments with physical gestures.

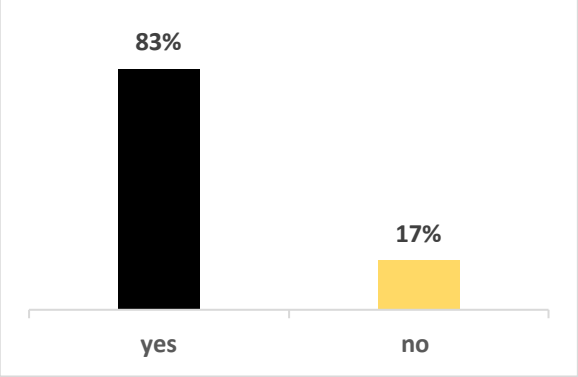
According to observations, **80%** of adults explained instructions to their child



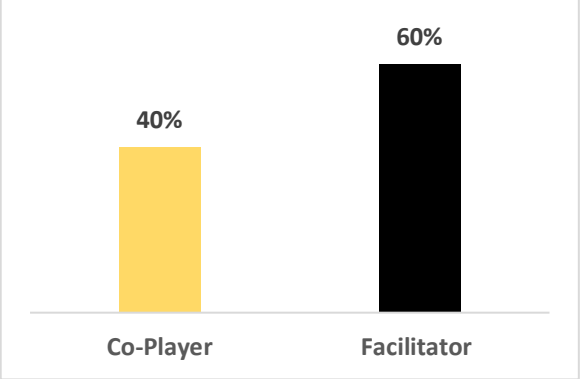
According to observations, **83%** of adults helped their child with the design process



According to observations, **83%** of adults encouraged their children through verbal cues and/or gestures of excitement (i.e. raising arms with cheer)



60% of adults were observed taking on a facilitator role with their children, while **40%** were observed more as co-players



Identifying caregiver roles

According to interview responses, designing together was often a part of the instructional process. According to observations, caretaker and child would often design a pathway together a few times before splitting off into individual exploration. **Eighty-five percent** of observed children created designs alone, **71%** created a design together, and **51%** of observed adults created a design on their own. Evaluators noted that **97%** of caretakers intently observed their child playing with the BeeBots and followed their lead to inform their facilitation or play style.

Identifying caregiver support

Additionally, **63%** of observed adults were seen providing scaffolding during play by asking challenge questions and counting aloud with children. **Twenty-four percent** of adults used personification and story-like language to encourage play (i.e. the bee is lost – let's send it home, or make sure we get enough pollen for the bee to take to the hive).

Engagement with Adventure Three as Observer

Survey respondents were asked, "*What did you see from your experience with the BeeBots today*?" Interview respondents were asked, "*Can you tell me about your experience playing with the BeeBots*?" Survey and interview participants shared what they *observed* from their experiences with the BeeBots. Caregivers observed the BeeBot experience to support the development of their children's math, coding and programming, goal setting, and iteration skills.

Math skills

- "Good tool for children to learn **order of operations.**" - Interview 1
- "I like that it's **experiential**. It takes a while to figure out. It helps as an intro to **computer programming** and **math skills** by keeping score in head."- Interview 15
- "Great, it was entertaining. Lots of **thinking and counting.**" - Interview 59

Coding & programming

- "It teaches kids about **coding** and **pattern recognition**. I see no instructions other than what the controls are, which allows for free play. Lots of kids are figuring out how to play and engaging without knowing that it's teaching them something." - Survey 25
- **"Programming** ideas. Kids enjoyed **programming** their BeeBots and seeing the results." - Survey 23
- "That **programming** is easily included [and] can be **taught through play.**" - Survey 24
- Beginning understanding of **code** problem solving." - Survey 15

Iteration

- "Some **trial and error.**" - Interview 41
- "Last time we only **played manually**, this time **we used the buttons.**" - Interview 46
- "[It was] **frustrating** at first, but **fun.**" - Interview 47
- "Fun, **tricky** at first, but then **we got it.**" - Interview 57
- "My children's interest in the play increased with their function to use it!" - Survey 18

Goal oriented

- "Good for kids. [Helps] **create goals.**" - Interview 32

Engagement with Adventure Three Experience as Helper

The data below are related to caregivers' roles and actions as they help their children play with the BeeBots. Interview participants were asked, "*In what ways were you supporting your child in exploring the BeeBots?"* Caregivers most often defined their engagement with the experience as teaching, guiding, and explaining, often with the ultimate goal being that their children would eventually be able to press buttons, set a goal, and design independently. In order to support their children, they would remind them of similar types of play their children participate in at home or by asking questions to encourage iteration.

Teaching, guiding, and explaining includes caregivers explaining instructions, choosing a flower and creating a path and a step-by-step plan, pressing buttons together, and troubleshooting. Ultimately, caregivers often stated that they provided "instructions from a distance" until the children could play "independently."

- "**Teaching** instructions" (Interview 30, Children, 0-1, 1-3, 4-8)
- "Helped show her how to do it until she could do it **independently** " (Interview 40, Child, 4-8)
- "**Guiding** in using buttons " (Interview 46, Child 1-3)
- "Helping to **explain instructions**, she would **choose flower** and help **plan path**" (Interview 49, Child, 9-10)
- "Older [child] **distant instructions** [and] younger [child] helped **step by step**." (Interview 4, Children, 4-8)
- "Did **buttons together** [and] worked up to doing it **alone**." (Interview 16, Children, 4-8)
- "Helping figure out **goals**, troubleshooting" (Interview 50. Children, 9-10 and 11-17)
- "Pushing buttons, helping them choose flower" (Interview 57, Child, 4-8)
- "Helping them understand **memory component**. [I] liked that the bees support **growth mindset** - making mistakes is a good thing" (Interview 32, Child, 4-8)

At home play was mentioned twice by interview participants in order to remind their children that they have played similar games at home.

- "Trying to **remind** her of her toys that are similar [and] **redirect her focus**." (Interview 12, children, 4-8)
- "Telling them it's similar to a **computer game** they do" (Interview 14, Children, 4-8)

Inquiry was used by parents to learn how to play with the BeeBots together and to encourage their children to practice troubleshooting.

- "Ask what to do, share what they know. Kind of tired so **figured out together**. One child wanted to do it **alone**, other wanted **help**" (Interview 15, Children, 4-8)
- "**Teaching, asking** how to get to destination, [and] **showing** how to turn." (Interview 6, children, 1-3 and 4-8)

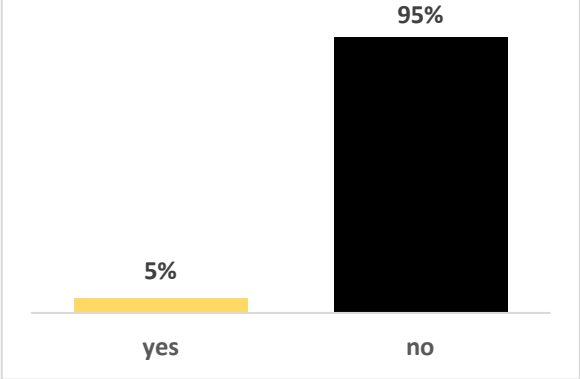
Iteration was observed by a caregiver

- "[I] didn't feel helpful because [my] daughter understood it through **trial/error**" (Interview 17, child, 4-8)

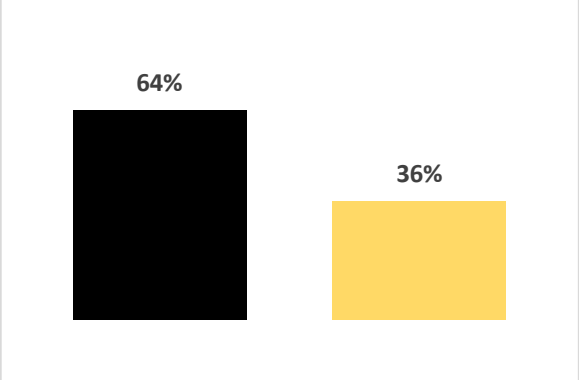
Engagement and Experience with Adventure Three Through Dialogue and Writing

The data below are related to caregivers' dialogue with other adults and writing on the Buzz Wall related to the value of play. Although only 5% of observed caretakers wrote on the Buzz Wall, 36% of survey respondents reported that they wrote on the Buzz Wall. Meanwhile, 50% of survey respondents reported that they talked to other adults about how play is a valuable part of supporting their children.

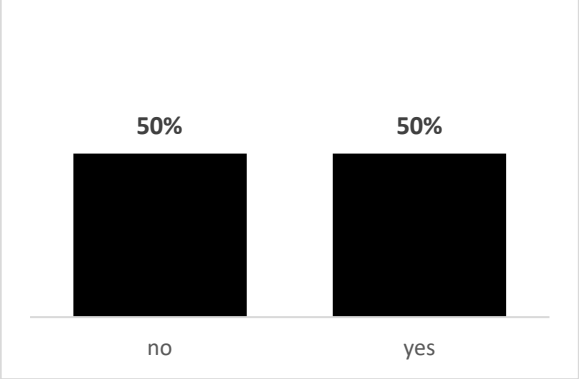
According to observations, **5%** of individuals wrote on the Buzz Wall.



36% of survey participants reported that they wrote a comment on the Buzz Wall about how play is a valuable way to support their children.



50% of survey participants reported that they talked to other adults about how play is a valuable part in supporting their children.



Engagement and Experience with Adventure Three Through the Buzz Wall

The following section describes caregivers' engagement with the Buzz Wall. Responses to the Buzz Wall question, "*How does your family use technology at home?*" represented non-users of technology, passive users of technology that watch TV, and active-users of technology that participate in the design of homes.

The following are examples of anonymous group responses to the Buzz Wall prompt "How does your family use technology at home?"

"They use it by finding or looking up things."

"We watch movies & shows (about 30-40 min); We read books online, too sometimes."

"We use remotes to turn on/off or to choose channels."

"We use technology for Alexa."

"We use it por (for) Netflix. Si si (Yes yes)."

"Video games!"

"Wi-Fi, phone, google."

"We like to use scratch to build websites or stockbots to make stop motion animation films. We also use YouTube to learn and enjoy a math game website called Dream box."

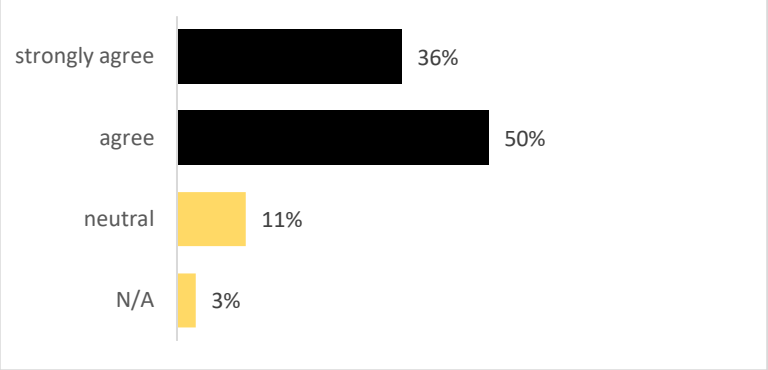
"Our family uses technology at home by turning on the lights."

"We barely use it but my dad uses it for building houses and my mom uses it to take pictures. Xrays of people's mouths."

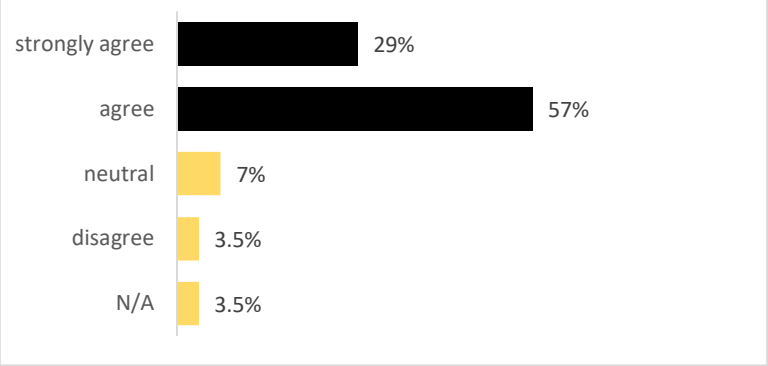
Understanding of Play's Role in Adventure Three - Design Thinking

The data below are related to survey respondents' understanding of play as a critical part of design-thinking, as well as the influence of the content and instructional materials on survey respondents' understanding.

86% of survey participants strongly agree or agree that the instructional materials supported them in helping their children understand how to play with the BeeBots.



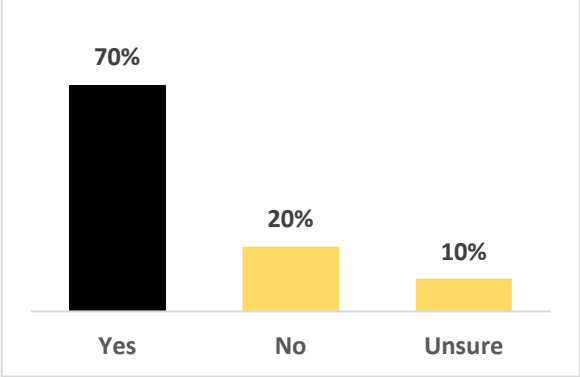
86% of survey participants strongly agree or agree that they increased their understanding of play as a part of design thinking.



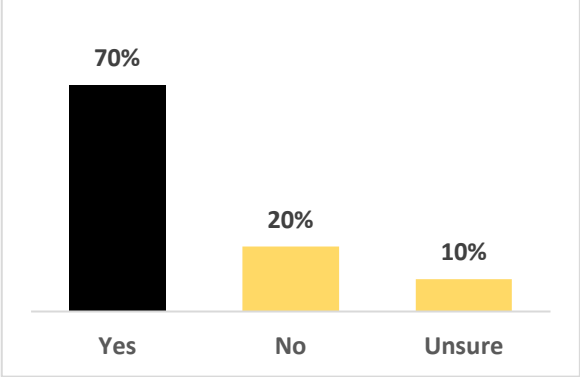
Eighty-six percent of survey participants strongly agree or agree that the instructional materials were useful. Similarly, eighty-six percent of survey participants strongly agree or agree that they increased their understanding of play as a part of design thinking. The instructional materials were created to help caregivers support their children to design a path for their BeeBots. Although instructional materials are not the sole reason for capturing play as a part of design thinking, they do provide guidance around how to engage in play and design thinking. When trial and error is insufficient to understand how to play with the BeeBots, the instructional materials provide additional support to children and, in particular, caregivers.

The following section describes the influence of the content and instructional materials on interview respondents, as well as their understanding of play as a critical part of design-thinking.

70% of interview participants reported that the instructional materials supported them in helping their children understand how to play with the BeeBots.



70% of interview participants reported that they observed their children participating in design thinking.



Interview participants who reported that the instructional materials supported them in helping their children to play with the BeeBots were the same interview participants who reported that they observed their children participate in design thinking. However, those who reported that the instructional materials were not supportive, stated that they figured out how to use the BeeBots based on trial and error and/or another child explained it to them. Another interview participant stated that their child could not read yet, so the child asked for help instead. Notably, **interview participants who stated the instructional materials were not helpful, stated that they did not see or read them**. Eight of the 14 interview participants who said the instructions were useful found the cards to be most helpful. One of 14 said the **cards and screen were helpful, but they struggled to toggle between the screen and card**. Instructional materials provide support around understanding how play and design thinking work together to reach the BeeBots programmed destination.

Interest in Play's Role in Adventure Three – Design Thinking

Interview and survey respondents were asked, *"If at all, how did the BeeBots provide insight into your child's learning?"* Caregivers most often mentioned that free-play creates opportunities to observe how their children "learn," "imagine," and "build meaning together." Caregivers observed whether their children jumped into play with the BeeBots or read the instructions first. Caregivers expressed support for iteration and trial and error learning. Caregivers observed whether their children preferred to learn independently. Ultimately, caregivers revealed that they followed their children's lead and adapted their support to their children's process and learning style. Lastly, 75% of survey respondents strongly agree or agree that they increased their interest in play as a part of design thinking.

Free Play

- "There wasn't enough conversation to know. **Build meaning together**, dad needs to let them be **free** and **get imaginative**. Success through struggle" — Interview 15
- "Learned that child is **intuitively learning** through play and that child just goes." — Interview 16
- "**Physicality** is his primary mode of learning - the exhibit lacks the narrative that he usually likes." Interview 32
- "Something different, watching them in **different environments.**" — Interview 38

Instructional

- "[I] watched them **learn the instructions**." — Interview 30
- "Some went **straight to instructions** or some try **without instructions**" — Interview 59

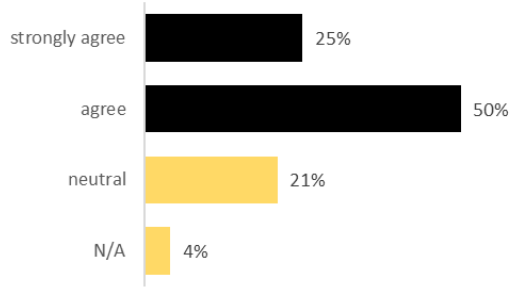
Iteration

- "She needs to do it on her own, **individual learning**, **trial and error**" — Interview 12
- "Son **tries something** else if he doesn't get it. Daughter keeps **working on same one**." — Interview 14

Independent Learning

- "Yes- she wanted to do it by herself" — Interview 41
- "She likes to do things **on her own**, but he needs help" — Interview 48

According to survey responses, **75%** of caregivers strongly agree or agree that they increased their interest in play as a part of design thinking



Interview and survey respondents were asked, "*What would you share with your family or friends about playing with your children and the BeeBots?"* Caregivers most often expressed that coding and programming was a prominent and valuable part of the BeeBot experience. One caregiver explicitly stated that coding was taught *through* play. Iteration was also described as a valuable way of interacting with other children. Observation was described as a tool to learn how to play with the BeeBots. Last, but not least, caregivers described the experience as a fun and interactive way to learn how to code. Many adults expressed that they valued the design-thinking processes within the Adventure Three experience.

Coding & Programming

- "I have told them it is a great basic starter to **programming** and seeing a practical use and a game too. I have been very impressed at the ease to use it and that my 6 year old understands. It has her asking questions about why it works with just buttons and has started our **conversation** on **robots, programs**, and the **morals** and ethics of it. I think it is also a great way to **get parents involved with playing** with their kids and increase their understanding"— Survey 14
- "That ***programming is easily included*** [and] can be ***taught through play***" — Survey 24
- "That this is a very engaging, interactive learning tool to teach kids ages 4-10 the **basics of coding.** That this is a really fun, new exhibit they should check out. I would suggest parents let their kids figure out how it works and don't direct their play" — Survey 25
- "Lovely [way] to expose to **programming** and sequences; order - helps them with puzzles/analytical thinking" — Interview 14

Iteration

- "I enjoyed my children interacting in a **trouble shooting** way with other children" — Survey 18

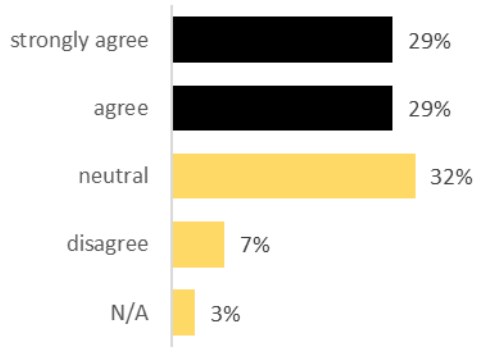
Playful observation

- "We figured out how to **play by observing others**" — Survey 23

Fun

- "Fun, entertaining coding game" — Interview 57
- "Fun, but for older kids" — Interview 43

58% of survey respondents reported that they learned something about play and design thinking that they can try at home.



Caregivers' Recommendations for Improvement of Adventure Three

Interview and survey participants provided recommendations to improve the BeeBot experience for their children. Recommendations included making environmental changes that allow their children to decrease distraction and remain focused on the BeeBot experience, instructional changes that promote ease of play and design thinking, and technological changes that ensure the buttons are working properly.

Environmental

Caregivers expressed that providing prominent paths for the BeeBots to travel would discourage children from pressing buttons without intention. Also, providing pencils and writing pads would encourage children to draw or write a plan before programming the BeeBot.

- "Tempting to touch or push, buttons more prominent/ option to have different routes lit up" — Interview respondent 46
- "Maybe writing pad and pencils for kids to write down directions to use on the BeeBots" — Survey respondent 20
- "Benches or stools for smaller children to sit on. If it messed up in the middle or stopped he couldn't reach it" — Survey Respondent 16
- "Add more imaginative play tools, more ways to get out high energy nearby so they can focus on bees and not back area" — Interview respondent 43
- "No distractions behind them ." — Interview respondent 47

Instructions

Caregivers expressed that more flashcards and audio instructions would decrease wait time and allow for more children to participant simultaneously.

- "Screen and each one was numbered so they could see, like a scoreboard" — Interview respondent 17
- "More flashcards, kids are waiting for them" — Interview respondent 59
- "To have audio directions for independent children who cannot read yet" — Survey respondent 10

Technology

Caregivers expressed that the BeeBots' movement should reflect the buttons pressed.

- "I felt the button is not working very well. When I press the button, sometimes it doesn't move" — Survey respondent 1
- "Better game instructions, less buttons on bots, more correlation to bot movement, and sounds and colors" — Survey respondent 18

Summary of Adventure Three

Evaluators gathered information on caregiver engagement, understanding of the critical role of play in design thinking, and interest in play's role in design thinking. Caregivers also provided feedback on environmental, technological, and instructional factors within the experience.

Caregiver engagement

According to survey responses, 100% of caregivers observed their children play, 89% helped their children play, and 86% co-played with their children. According to observations, caretakers and children would design a pathway together a few times before splitting off into individual exploration. Eighty-five percent of observed children created designs alone and 71% created a design with their caregiver. Eighty-three percent of adults encouraged their children through verbal cues and/or gestures of excitement. Ultimately, we learned that caregivers often observe and follow their children's lead to identify their child's needs. Caregiver observations and interactive play lead them to decide whether to engage as a co-player, facilitator, or an observer of their child's development and play.

The Buzz Wall prompted many groups to engage in answering the question, "*How does your family use technology at home?*", and while not many adults engaged in conversation with other adults, the language they used was often centered around exhibit-prompted topics (technology, coding, other STEAM opportunities in the area etc.).

Understanding play's role in design thinking

Eighty-six percent of survey respondents and 70% of interview respondents reported they increased their understanding of play as a part of design thinking. The usage and readability of instructional material may have influenced caregivers' awareness of play as a contributor to design thinking. Nonetheless, the majority of participants reported an understanding of their children's play as a part of design thinking.

Interest in play's role in design thinking

The majority of interview and survey respondents described their children participating in math skills, coding or programming, and iteration. Overall, caregivers expressed an interest in participating in an experience that encouraged coding, programming, iteration, and math skills for young children. Many adults expressed that they valued the design thinking processes within the Adventure Three experience and would encourage their friends and family to participate as well.

Environmental, technological, and instructional factors

Feedback from participants suggests that some environmental factors could engage their children more intently. For example, including prominent paths for the BeeBots to travel would discourage children from pressing buttons without intention. Also, providing pencils and writing pads was suggested for children to draw or write a plan before programming the BeeBot. Some participants also recommended having more physical instructions available to decrease wait time.

The Implications for OMSI ECE Initiatives

Play Labs was an early step in OMSI's overarching strategic initiative to invest in Early Childhood Education (ECE) to increase OMSI's value for families and promote inclusion of underserved audiences. Play Labs findings are available to inform planning for place-making and property development included in the organization's 20-year vision. Findings will be utilized to inform future work on the Curium space, un-facilitated exhibits, ECE professional development, design of tangible technology, and technological best practices at OMSI.

Curium Space

During Play Labs the project team launched the Curium space for 4- to 8-year-olds and their families within the Center for Innovation. The Play Labs Adventures were successful in building a suite of rotating experiences that informed other ECE exhibits and programming. In addition, Play Labs has benefitted from upcycling exhibit components from other ECE exhibits. In November 2019, the Play Labs Adventure Four will be installed in the Curium. Exhibit components include a Kinect dance floor, which is a prototype from OMSI's Interactive Family Learning exhibit on early brain development. The experience will also explore playing with color.

Unfacilitated Exhibits

Play Lab Adventures' iterative process informed the development of Interactive Family Learning, another ECE exhibit that seeks to encourage caregivers to be the primary audience and learners within the exhibit. The project also informed upgrades to the Science Playground for 0- to 6-year-olds and their families. Unfacilitated exhibits remain challenging, yet imperative to the success of STEAM museums. Play Labs Adventure Three was particularly successful in demonstrating an interactive, hands-on experience without the support of museum educators. Instead, caregivers served as the primary facilitators of learning and play.

Early Childhood Professional Development on Accessibility

Input gathered from Impact NW related to accessibility and inclusion within museums and in particular, for caregivers of children between the ages of 0 and 6 has informed OMSI's professional development on ECE. Impact NW partners and caregivers were excited to have OMSI providing professional development in their space and created a more accessible and comfortable atmosphere. Providing professional development in communities is instrumental to increasing accessibility and inclusion, building stronger partnerships, and disseminating knowledge.

Tangible Technology at OMSI

After Play Labs Adventure Three, the project team suggested designing OMSI's own tangible technology in order to have more control over the instructional messaging within tangible technology. Two members of the project team, Thomas Hudson and Dave Laubenthal, presented about the BeeBots and tangible technology at the 2019 Association of Science Technology Centers (ASTC) conference.

Technological Best Practices

OMSI's ECE initiatives will benefit from conducting research on best practices for using technology with caregivers and children. Although the screen and kiosk combination is used in the Science Playground, OMSI will benefit from exploring other technological advancements and options for caregivers and their children to learn and play.

Future Research Questions for OMSI ECE

Museum professionals continue to grapple with the notion that adults often do not see themselves as the primary learners in early childhood museum spaces. It is possible that adults with children see themselves as caregivers first and learners second in order to prioritize their children's learning, development, and play. The following research questions can serve as starting points for studying the relationship between caregiver learning about child development and related museum activities.

- How can OMSI design for intergenerational learning that focuses on developing skills to support caregivers and children between the ages of 0-8?
- What are design strategies that encourage caregivers to view themselves as the primary learners in ECE experiences?
- What role does tangible technology play in building caregiver/parenting skills?
- How can OMSI most effectively use instructional technology for the benefit of children ages 0-8 and their caregivers?

Appendix A: Logic Model for Play Labs Adventure 1

SOCIETAL NEED	PLAYLABS AUDIENCE	DELIVERABLES	STRATEGIES	OUTCOMES/IMPACTS
Caregivers equipped to serve as their child's first teacher **Accessible evidence-based resources that demonstrate the developmental role of play to caregivers** **Supports for young and/or underserved families** **Opportunities for children to learn through physical movement** **Safe, outdoor play areas for children**	**Target Audience:** ● Parents and caregivers ● Underserved families **General audience:** ● Science Playground visitors (young families, children 0-6) **Professionals** ● OMSI Staff ● Local ECE community & researchers	**Interpretive Materials for Caregivers** **Play Lab** A series of four temporary (six month) experiences, or "adventures," that facilitate various types of play	Develop temporary "pop up" experiences that demonstrate various developmentally appropriate types of play Provide opportunities for caregivers to converse with early child researchers and knowledgeable OMSI staff within play spaces Foster opportunities for caregivers to access research-based parenting resources and research Provide children access to engaging, fun, active play experiences **Characteristics of experiences include:** ● Temporary "pop up" experiences ● Safe and comfortable covered spaces ● Utilize novel materials to elicit play ● Emphasize authenticity ● OMSI staff/researcher facilitated interpretive materials ● Written and graphic interpretive materials ● Indoor and outdoor ● Opportunities to "go tall" **Leverage existing, local parenting groups**	1. **OUTCOMES MEASURED BY THE SUMMATIVE EVALUATION** ***CAREGIVERS WILL:*** **Gain awareness and understanding of the critical role of play to the development of their child(ren)** **Value the role of play in the development of their child** **Feel comfortable using science-based information to inform their parenting/caregiver choices** **Value OMSI as a place to connect to research-based information to inform their parenting choices** 2. ADDITIONAL INTENDED OUTCOMES *CHILDREN WILL:* Be happier and healthier Be more prepared to achieve academic and social success *OMSI STAFF WILL:* Increase engagement of underserved families with young children Identify effective play experiences and interpretive materials best suited for integration into existing museum spaces Learn how to effectively facilitate conversations and create interpretive materials for caregivers about research-based child development and learning Strengthen partnerships with local institutions that research and support early childhood development and learning *LOCAL ECE COMMUNITY & RESEARCHERS WILL:* Gain new mechanisms to support the families they serve Gain new mechanisms to share research with the public Gain authentic professional training opportunities for research students

Appendix B: Logic Model for Play Labs Adventure 2

SOCIETAL NEED	DEFINED PORTION OF SOCIETIAL NEED ADDRESSED BY PLAYLABS	PLAYLABS AUDIENCE	DELIVERABLES	STRATEGIES	OUTCOMES/IMPACTS
Caregivers equipped to serve as their child's first teacher Supports for young and/or underserved families Accessible evidence-based resources that demonstrate the developmental role of play to caregivers Opportunities for children to learn through physical movement Safe, outdoor play areas for children	OMSI will contribute to this societal need by helping equip caregivers as their child's first teacher by promoting: Science is one lens adults can use to learn how best to support their child as they and their play rapidly change in the first few years of life	**Primary learners:** ● Parents and caregivers, particularly from underserved populations **Secondary learners:** ● OMSI staff ● Children 0-6	A series of three temporary (six month) experiences, or "adventures," where parents learn that Science is one lens adults can use to learn how best to support their child as they and their play rapidly change in the first few years of life.	Partner with parent-serving organizations and researchers to co-develop Play Labs Study and apply design principles for adult free-choice learning in museums or similar environments Provide opportunities for parents to experience the big idea through: ● Play with children – serve and return ● Observation ● Experimentation process (e.g. test an idea, feedback, reflect, iterate) ● Synchronous and asynchronous dialogue related to the big idea with other adults ● Reading Develop temporary "pop up" experiences that afford developmentally appropriate play for 0 – 6 year olds and their caregivers Foster opportunities for caregivers to access research-based parenting experiences and resources Characteristics of experiences include: ● Afford multi-model, experiential caregiver learning ● A "voice" that resonates with parents of diverse backgrounds ● Spotlights on strands of development for children 0 – 6yo that visibly change through early, middle, and late stages of very young childhood ● Temporary "pop up" experiences ● Safe and comfortable covered spaces ● Utilize novel materials to elicit desired behaviors ● Emphasize authenticity ● Interpretation of experiences ● Opportunities to "go tall"	**OUTCOME MEASURED BY THE SUMMATIVE EVALUATION** ***CAREGIVERS WILL GAIN AWARENESS and UNDERSTANDING:*** Caregivers will capture the big idea, Science is one lens adults can use to learn how best to support their child as they and their play rapidly change in the first few years of life, as evidenced by either: 1. Playing with behaviors/roles that allow them to see children's play like a researcher 2. Identifying their children's play behaviors as support for cognitive, social, or motor development (in each respective adventure) 3. Contributing dialogue (oral or written) to synchronous and asynchronous dialogue related the big idea Verbally recognizing a science lens as a resource for them ADDITIONAL INTENDED OUTCOMES *OMSI STAFF WILL:* Learn how to effectively facilitate caregiver learning through doing, conversations, reading, framing intentions, and multi-model message redundancies Learn experience design principles for providing effective play experiences and interpretation in existing museum spaces Strengthen partnerships with local institutions that research and support early childhood development and learning *CHILDREN WILL:* Engage in creative play, constructive play, and physical play that supports their development

Appendix C: Logic Model for Play Labs Adventure 3

SOCIETAL NEED	DEFINED PORTION OF SOCIETIAL NEED ADDRESSED BY PLAYLABS	PLAYLABS AUDIENCE	DELIVERABLES	STRATEGIES	OUTCOMES/IMPACTS
Caregivers equipped to serve as their child's first teacher Supports for young and/or underserved families Accessible evidence-based resources that demonstrate the developmental role of play to caregivers Opportunities for children to learn through physical movement Safe, outdoor play areas for children	OMSI will contribute to this societal need by helping equip caregivers as their child's first teacher by promoting: Families playing together is a research-proven way for adults to build observation and parenting skills while children build [*design-thinking*] skills	**Primary learners:** ● Parents and caregivers, particularly from underserved populations **Secondary learners:** ● OMSI staff ● Children 0-8	A series of three temporary (six month) experiences, or "adventures," where parents learn that Families playing together is a research-proven way for adults to build observation and parenting skills while children build [*design-thinking*] skills	Partner with parent-serving organizations and researchers to co-develop Play Labs Study and apply design principles for adult free-choice learning in museums or similar environments Provide opportunities for parents to experience the big idea through: ● Play with children – serve and return ● Observation ● Experimentation process (e.g. test an idea, feedback, reflect, iterate) ● Synchronous and asynchronous dialogue related to the big idea with other adults ● Reading Develop temporary "pop up" experiences that afford developmentally appropriate play for 0 – 8 year olds and their caregivers Foster opportunities for caregivers to access research-based parenting experiences and resources Characteristics of experiences include: ● Afford multi-model, experiential caregiver learning ● A "voice" that resonates with parents of diverse backgrounds ● Spotlights on strands of development for children 0 – 8yo that visibly change through early, middle, and late stages of very young childhood ● Temporary "pop up" experiences ● Safe and comfortable covered spaces ● Utilize novel materials to elicit desired behaviors ● Emphasize authenticity ● Interpretation of experiences ● Opportunities to "go tall"	**OUTCOME MEASURED BY THE SUMMATIVE EVALUATION** ***CAREGIVERS WILL GAIN AWARENESS and UNDERSTANDING:*** Caregivers will capture the big idea, Families playing together is a research-proven way for adults to build observation and parenting skills while children build [*design-thinking*] skills, as evidenced by either: 1. **Playing with** children in ways such as co-player, facilitator, or helper 2. **Trying behaviors**/roles that allow them to observe children's play as skill-building 3. **Contributing (oral or written)** to synchronous and asynchronous dialogue related the big idea 4. **Verbally recognizing** that playing together is a valuable way to support their child ADDITIONAL INTENDED OUTCOMES *OMSI STAFF WILL:* Learn how to effectively facilitate caregiver learning through doing, conversations, reading, framing intentions, and multi-model message redundancies Learn experience design principles for providing effective play experiences and interpretation in existing museum spaces Strengthen partnerships with local institutions that research and support early childhood development and learning *CHILDREN WILL:* Engage in creative play, constructive play, and physical play that supports their development

Appendix D: Play Labs Adventure One Findings

Play Labs Adventure One Report

Background on Adventure One: The Bloopodome

OMSI's first Play Lab Adventure showcased how play builds a range of creative practices (e.g. asking questions or telling stories) through interactions with a one-of-a-kind art installation called The Bloopodome. The Bloopodome was created in collaboration with Dr. Erik Nilsen (Lewis & Clark College) whose research on creativity in young children informed the experience; and by artist Mike Yager, who concepted and built the installation.

Figure 1. *Staff and parent facilitate a young child's exploration of the Bloop activities.*

Bloopodome Summative Evaluation Methods

The logic model guided the summative evaluation (Appendix A). Development of the data collection instruments and protocols was a collaborative effort, led by the evaluation team. Summative data collection methods included caregiver observations and surveys. These activities took place during the final two months of Play Labs Adventure One, after the TBI studies concluded and any resulting changes or improvements had been made.

During Play Labs Adventure One, the observation and survey data were collected across weekdays and weekends. A random sampling strategy was used to recruit research participants at the beginning of their visit to the *Bloopodome*. This was done through two methods: 1) caregivers were approached upon entry into the Play Lab and asked for verbal consent to be observed during their visit to the *Bloopodome* with their child(ren) and 2) caregivers were asked to take an exit survey at the end of their visit. Furthermore, caregivers were informed prior to being given an exit survey that if they implemented an activity they saw, learned, or experienced during their visit to the *Bloopodome* at home to text a photo and/or video to Marcie Benne, Play Labs Evaluator.

In addition, the evaluation team collected data from Play Lab caregivers at events for OMSI members and Impact NW parents, as well as during normal museum operating hours. All event attendees were asked to take a survey at the end of their visit.

Bloopodome recruitment and informed consent.

All data gathered complied with the Informed Consent policies and practices set forth by OMSI's Human Research Protection Procedures (HRPP). Data were collected predominately though surveys. HRPP practices for verbal consent or implied consent were followed for anonymous data or data involving minimal risk.

Bloopodome analysis.

During Play Lab Adventure One, data entry and analysis began immediately after the completion of data collection activities. An evaluation briefing, which included interesting trends, preliminary findings and recommendations, were shared with and presented to the project team and advisors one week after the conclusion of Play Lab Adventure One to ensure the project team's access and timely use of evaluation feedback.

Bloopodome Findings

For Adventure One, the data gathered through team-based inquiry, summative evaluation, staff observations and staff reflections suggest that the project team has included some characteristics in their process and experience that allow OMSI to help parents support their young children's learning.

- Participants reported engaging with elements of the experiences.
- The majority of respondents affirmed the experience influenced the intended outcomes.

The same data indicate some areas to strengthen the characteristics of OMSI's approach.

- Promoting clear and relevant communication with target audiences to develop, engage with, and evaluation the caregivers' learning experiences.
- Heightening engagement with the experiences
- Clarifying the desired outcomes and strengthening the results

Some ideas for the team to consider moving forward include:

- Build meaningful relationships with parents and partners; consider adopting some principles related to culturally-responsive practices.
- Help parents capture, communicate, and retain the big idea; consider articulating some strategies for framing context so parents can step into the role of child development facilitator, even as a participatory facilitator.
- Increase the likelihood of parents engaging with the educational environment and activities; consider articulating and adopting some principles related to activity and spatial design.

Relevant Evaluation Findings

Team-based inquiry findings

1. Facilitated experiences led to more engagement and positive outcomes than unfacilitated experiences.
2. Two different narratives (e.g. the Play Lab big idea and the dramatic play storyline around the Bloops) compete with each other, making it difficult for parents to "read" the environment.
3. The most direct signs were the most effective signs (e.g. here's what's happening when your child does "this.").

Summative bloopodome findings

Across two invitational events and four data collection sessions with the general public, 34 groups were approached about their experiences with the *Bloopodome*. Most of the children in the groups were 1 – 6 years old (84%), most were members, and most had been to Science Playground.

1. The percentage of groups that *reported** engaging with the different types of activities in the *Bloopodome* were:
    - 91% played with Bloops
    - 50% played at the research station
    - 35% played at the music or dress-up station

- 41% read question signs
- 29% read instruction signs
- 15% read brochures or left comments

**observations were lower for each category*

2. The percentage of groups that agreed with the outcome statements were:
   - 97% agreed I value OMSI's presentation of research on early childhood education (Attitude-#4)
   - 66% agreed I learned something about play and creativity that I can try at home with my child (Knowledge-#5)
   - 62% agreed I increased my interest in play as part of child development (Interest-#5)
   - 60% agreed I increased my understanding of play as part of child development (Knowledge-#1)

3. When asked what they got out of their experience in the *Bloopodome*, responses most often reflected these themes: engaging in play, building, and exploring.

4. When asked for an example of something they learned at the *Bloopodome* that they might try at home, responses most often reflected these themes: asking questions, using stories, and playing with objects. (Knowledge-#5)

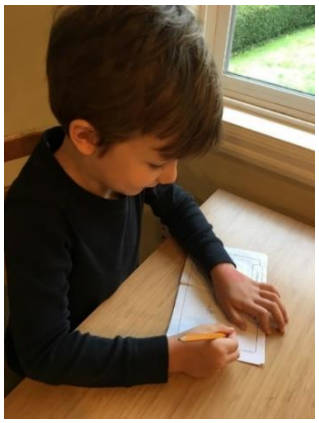


Figure 2. "*This is Vincent [at home]. He built a book and he is working on a journal listing the discoveries he made about the Bloops." ~Mom, Jessica*

Ideas to consider moving forward.

1. To build meaningful relationships with parents and partners, consider adopting some principles related to culturally-responsive practices. For instance, the *REVEAL* and *Head Start on Engineering* projects have articulated guiding assumptions like these which might resonate with Play Labs:
    - Our work is founded in relationships (HSE Collaboration Framework, 2016)
    - Our interpretations and understandings of the world are influenced by our own assumptions, perspectives, and cultural background (Kirkhart & Hopson, 2010).
    - An understanding of particular cultural norms and values requires first-hand knowledge and experience with that culture (Gonzalez et al., 2005)
    - Power dynamics associated with research and education should be acknowledged and leveraged with empathy and compassion.

2. To help parents capture, communicate, and retain the big idea, consider reviewing recent findings from OMSI studies such as *Designing Our World*, *REVEAL*, and *Design Zone* related to "frames" (e.g. identity-frames, facilitator challenges, exhibit challenges). These findings, and those they are based upon, can help articulate some strategies for framing context so parents can step into the role of child development facilitator, even as a participatory facilitator. The team could experiment with these strategies.

3. To increase the likelihood of parents engaging with the educational environment and activities, consider articulating and adopting some principles related to spatial and activity design. For example, can the team articulate some design ideas about:
    - The relationship between the physical layout and the conceptual layout: How are we aligning them to support the type of orienting and sense of coherence you want to evoke?
    - How the text is situated within 3-D space so that people encounter and see it when they need it in the space: As above, how are we aligning the physical and conceptual layout of text to support orienting and sense of coherence?
    - How parents are learning by doing; not just reading or observing: How are we embedding active non-text learning within parent participation?
    - What design characteristics are more likely to elicit social play?

Appendix E: Play Labs Adventure Two Findings

Play Lab Adventure Two: Synopsis of Summative Findings

v.1.29.18, Marcie Benne

For Adventure Two, data gathered through summative evaluation activities suggest that the experience includes some characteristics that allow caregivers to capture the Play Lab big idea,

Science is one lens adults can use to learn how to best support their child as they and their play rapidly change in the first few years of life, as evidenced by either:

1. **Playing with behaviors/roles that allow them to see children's play like a researcher**
   - If adults were observed playing like a researcher when they tried one of the prompts on the panels or used words like "try," "experiment," or "let's see what happens."

2. **Identifying their children's play behaviors as support for social development**
   - If adults reported the experience was about sharing, collaboration, or social skills.

3. **Contributing (oral or written) to synchronous and asynchronous dialogue related the big idea**
   - If adults reported talking or writing about how science can help us learn about children's play.

4. **Verbally recognizing a science lens as a resource for them**
   - If adults reported learning something new about using science to understand children's play.

Evidence that some caregivers captured the big idea

- 36% (20) of 55 caregivers were observed demonstrating at least one of these indicators.
- 52% (22) of 42 survey respondents reported at least one of these indicators.
- When asked, *What would you tell another adult are possible benefits of visiting Play Lab?*
  - 21% (9) of survey respondents reported something related to collaboration
  - 19% (8) of survey respondents reported something related to social skills

Areas that the experience can be strengthened

I observed my child's play by trying some of the research suggestions.	Strongly Agree 5% (2)	Agree 40% (17)	Neither agree nor disagree 29% (12)	Disagree 10% (4)	Strongly Disagree 5% (2)
I learned something new about how children's play supports social development.	Strongly Agree 7% (3)	Agree 36% (15)	Neither agree nor disagree 45% (19)	Disagree 10% (4)	Strongly Disagree 2% (1)

I learned something new about using science for understanding children's play.	Strongly Agree 5% (2)	Agree 29% (12)	Neither agree nor disagree 36% (15)	Disagree 24% (10)	Strongly Disagree 2% (1)
While I was here, I talked with someone or wrote a comment about how science can help us understand children's play.	Strongly Agree 2% (1)	Agree 40% (17)	Neither agree nor disagree 12% (5)	Disagree 31% (13)	Strongly Disagree 2% (1)

When asked, *If you think you might try something you learned from Play Lab at home, please share an example,*

- 45% (19) No response
- 21% (9) Building

Appendix F: Play Labs Three Observation Tool

Play Labs Adventure Three Observation Tool

Group #___ Date _____ Staff _____

# of Ages 0-11: __# of Ages1-3: ___# of Ages 4-8: ___# of Ages 9-10:__# of Ages 11-17: ___# of 18+

Describe the role the adult plays in the experience:

Describe how adults encourage play:

Describe how adults interact with each other:

Any interface difficulties? Describe.

Activity	Y/N	How many times?/Explain
Adult explains directions	Y/N	
Child explains directions	Y/N	
Adult observes play	Y/N	
Adult helps child create design	Y/N	
Child helps adult create design	Y/N	
Child creates design alone	Y/N	
Adult creates design alone	Y/N	
Create design together	Y/N	
Adult encourages creation of new designs	Y/N	
Adult supports with scaffolding	Y/N	
Adult acts as story-teller	Y/N	
Adults talk to each other	Y/N	
Adult writes on the Buzz Wall	Y/N	

Notes:

Appendix G: Play Labs Three Interview

The BeeBots Interview

Group #_____ Date _____ Staff _____

Hi there, we are part of OMSI's exhibit development team and we would like to hear about your experience with the BeeBots so we can improve the experience for all visitors. Would you like to participate in a 5-10 minute interview?

1. Did the instructional materials [menu, cards, and screen] support you in helping your child understand how to play with the BeeBots? Yes no unsure
    a. Yes- How so?

    b. No- How so?

2. Can you tell me about your experience playing with the BeeBots?

    a. In what ways were you supporting your child explore the BeeBots?

3. Design thinking is an iterative process, did you observe your children trying and re-trying different ways of playing with the BeeBots? Yes no not sure
    a. Yes- In what ways did you see your child trying and re-trying ideas with the Bee Bots?

4. If at all, how did the BeeBots provide insight into your child(ren)'s learning?

5. What might you share with your family or friends about playing with your children and the BeeBots?

6. Did you talk to another adult about play or write about play? Yes [write] [talk] no
    a. Yes- What did you talk or write about?

    b. No- What would have encouraged you to speak to another adult about play or write about play?

7. Is there anything that could be changed to improve your experience with the BeeBots?

8. What are the ages of the children with you?

Ages	Number of children in group
0-11 months old	
1-3 years old	
4-8 years old	
9-10 years old	
11+	

9. How do you describe your gender?_____
10. Are you of Hispanic, Latino, or Spanish origin? □ Yes □ No □ I don't know

8. How would you describe yourself? *(Please select all that apply.)*

□	American Indian or Alaska Native	□	Asian	□	White
□	Black or African American	□	Middle Eastern	□	Multiracial
□	Native Hawaiian or Other Pacific Islander	□	Prefer not to answer	□	Other:_____

Appendix H: Play Labs Three Survey

The BeeBots Survey

Hi there, OMSI is surveying caregivers to learn more about the value of the BeeBot experience. This is an opportunity to honestly tell us how you might or might not benefit from this experience.

1. Had you played with the BeeBots before today? Yes no not sure

2. What did you see from your experience with the BeeBots today?

3. Please rate your level of agreement with the following statements:

I observed my child(ren) playing with the BeeBots	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	N/A
I helped my child(ren) play with the BeeBots	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	N/A
I played with my child(ren) and the BeeBots	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	N/A
OMSI's instructional materials were useful in supporting our play	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	N/A

As a result of our visit to the BeeBots today. . .

4. What might you with your family or friends about playing with your children and the BeeBots?

5. Please rate your level of agreement with the following statements:

As a result of our visit to the BeeBots today. . .

I increased my understanding of play as a part of design thinking	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	N/A
I increased my interest in play as a part of design thinking	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	N/A
I learned something about play and design thinking that I can try at home with my child	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	N/A

6. I **talked** with someone about how play is a valuable way to support children. □ Yes □ No

7. I **wrote** a comment about how play is a valuable way to support children. □ Yes □ No

8. Is there anything that would improve your experience with the BeeBots?

9. What are the ages of the children with you?

Ages	Number of children in group
0-11 months old	
1-3 years old	
4-8 years old	
9-10 years old	
11+	

10. How do you describe your gender?_____
11. Are you of Hispanic, Latino, or Spanish origin? □ Yes □ No □ I don't know

10. How would you describe yourself? *(Please select all that apply.)*

□	American Indian or Alaska Native	□	Asian	□	White
□	Black or African American	□	Middle Eastern	□	Multiracial
□	Native Hawaiian or Other Pacific Islander	□	Prefer not to answer	□	Other:_____