Royal Ontario Museum

Play-Based Learning Space Project

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Judith Koke, MMSt., Lynn D. Dierking, Ph.D., Deborah Seigel, Ph.D., Marcel Robitaille, MMSt (2023)

Institute for Learning Innovation

Honour Indigenous Knowledge

Play-Based Learning

Foundational Principles

Effective Facilitation

Community Participation

Story Telling & Building

Royal Ontario Museum

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Introduction

The Royal Ontario Museum's (ROM) former *Discovery Gallery* is being reimagined to activate new and innovative approaches to family learning and for meaningful and memorable experiences in museums. A re-imagined play-based learning space (PBLS) will continue to offer hands-on, facilitated activities that provide accessible entry points into the museum's vast art, cultural and natural history collections, while incorporating innovative approaches and learning philosophies. This report is a review of existing and past ROM activities and programs, synthesized with new and relevant research in topic areas deemed important to consider in reimagining the space.

The report is organized into six sections, as well as a set of Appendices, that reflect the ROM's outline of deliverables:

Sections One through Three:

A summary and analysis of ROM's historic and existing hands-on, early childhood experiences in the Hands-On Biodiversity gallery, Schad Gallery, and the former Discovery Gallery, followed by a SWOT Analysis of the ROM's offerings in this area.

Sections Four through Six:

A review and synthesis of current research, practice examples and trends of play-based learning and other related topics in museums and the cultural sector. Foundational Principles emerged through this synthesis and many discussions with ROM staff. The principles were then reviewed by key informants representing a diversity of backgrounds, all leaders in fields relevant to this effort and selected collaboratively with ROM staff. These interviews were critical to the development of recognized and up-to-date theoretical and applied approaches to use in the creation of play-based learning experiences.

Appendices:

The report is followed by a set of three appendices: an annotated bibliography of effective practice research in play-based learning, family learning, effective facilitation, storytelling and story building, interdisciplinary approaches, and community participation (Appendix A), the consideration of these topics in the context of Indigenous Ways of Knowing, Being and Doing: An Indigenous Perspective (Appendix B) and a list of the Key Informants with brief descriptions of their expertise (Appendix C).

This work was completed over the months of April 2022 through January 2023 by the Institute for Learning Innovation team (Judith Koke, Lynn D. Dierking, Deborah Seigel, and Marcel Robitaille), in close collaboration with ROM staff. We would like to extend our appreciation to the many ROM staff and leadership for their generous contributions, support and counsel.

Note: For the purposes of this project, a family is two or more people in a multi-generational group with an ongoing relationship; they may be biologically related, but not necessarily. The general rule is if a group defines itself as family, it is one. During the observations and survey efforts, any intergenerational group consisting of at last one adult and one youth who appeared to be of elementary school age, or slightly younger , were considered family.

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Executive Summary of Recommendations:

1. Reimagine the Play-Based Learning Space (PBLS) as primarily serving families with children 3 to 8 years of age. Obviously, family groups with older and younger children will also visit, but this age span is the primary focus of the space.[1]

2. Focus on family groups, rather than on children alone, based on observations of visitors to ROM conducted through this effort, and research on museum learning that demonstrates the prevalence of the family as the learning unit visiting. ROM evaluation study findings also show that adults are equally likely to engage in most activities (other than those obviously aimed at preschool-aged children), unless they feel they are pre-empting a child from the activity.

3. Utilize the Five Foundational Principles to develop the physical, sociocultural and activity design of the space:
   a. Playful Learning for families
   b. Honouring Indigenous Ways of Knowing, Being and Doing
   c. Effective Facilitation
   d. Storytelling and Story Building
   e. Community Participation

4. Consider the Play-Based Learning Space (PBLS) as both a physical space and an approach. Reflect this decision in the budget as well. Rather than a huge upfront cost for the physical space, with little operational support, equalize the investment, creating less defined more flexible spaces that can support changing activities, as well as sufficient budget to update and maintain the area.

5. Invest in PBLS staff early on by providing the additional training and support they will require to adopt new approaches to facilitation, as well as create a committed budget line for ongoing professional development for current and new staff. Recognize that position descriptions and hiring criteria may also require revisions.

6. Extend the ROM's long-standing history of leadership in innovative space design for early childhood learning by supporting research activities to study play-based learning integrated with an explicit commitment to honour Indigenous Ways of Knowing, Being and Doing, that can inform the greater field of learning in and from museums and other cultural institutions.

7. Integrate community participation as essential to creating a welcoming space that honours multiple worldviews and cultures, as well as aligns significantly with the ROM's aim of becoming a focal point for communities in Toronto. Ensure that the work is embedded in the PBLS, but also woven into other spaces/activities throughout the ROM, ideally extending back to the communities themselves. Building such long-lasting relationships and activities likely will require a dedicated individual.

Photo: Martin Prescott

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[1] Since the space is focused on the 3-8 age group, it may not serve older elementary students as well as the previous space did. Consider working with the Learning Team to develop additional destinations for older students.

SECTION ONE:

Building on the Past; Shaping the Future

The Royal Ontario Museum (ROM) has a long leadership role in the development of hands-on discovery galleries in museums. From planning prior to its 1977 opening, to planning for the future gallery, the ROM has served children and families for over 50 years with spaces that support hands-on discovery-based learning with objects related to collections and exhibitions. This section of the report details the evolution of five iterations of ROM discovery spaces for families and children at the ROM between 1977 and 2021, distilling the most salient learnings from changing approaches and models, intended to inform the development and approach for future models.

This work was completed by careful review of ROM archival materials, as well as the review of mentions of the Discovery Galleries in both internal and external publications, as noted in the references section.

Interestingly, the 1970's were a time of rapid development of Discovery and Children's galleries with a science focus in North America, in Natural History museums (National Museum of Natural History, 1974; Field Museum, 1976; American Museum of Natural History, 1977), Children's museums (i.e., Please Touch Museum 1976) and Science museums (i.e., Franklin Institute, 1976, Boston Museum of Science, 1978). In Toronto, the Ontario Science Center opened in 1969, having been originally planned for Canada's Centennial in 1967. (Danilov, 1986). Utilizing this exploration and foundation of child focused museum work, the ROM created their first family space, committed to discovery-based learning with objects related to ROM collections.

ITERATION 1: ROM Discovery Room 1977-1981

This 1500 square foot space was modeled on a similar gallery at the Smithsonian Institution's National Museum of Natural History, which opened in 1974. The ROM's Discovery Room was originally planned to be restricted to children 6 and up and limited to twenty-five people for thirty-minute intervals; the small space was located on the lowest floor of the museum (Room 4, Lower Rotunda).

This activity room welcomed children and adults to engage with real artifacts from the teaching collection and modeled its activities on those at the Smithsonian Museum ("stumper" objects, discovery boxes, investigation stations) and, interestingly, a reference collection for the public to bring their 'discoveries" (insects, fossils, etc.) in for comparison, to identify them and learn more about their properties.

The development of a Discovery Room was strongly aligned with the museum's theme of "*Mankind Discovering,*" and received broad support. The goals of the space were to provide a welcoming space and learning experience for children and adults to enjoy together, to create an interest in museum work, and to encourage learners to use all their senses in the examination of objects. Text was presented in English, French and Braille.

Discovery Learning was defined at the time by Jerome Bruner , considered the father of this approach, in his 1966 book, *Towards a Theory of Instruction,* which proposed that the learner's' experiences should be heuristic (enabling a person to discover or learn something for themselves), rather than didactic, that is, educator directed. The goal was to encourage the learner (in his case the child) to learn how to learn. Bruner's philosophy of learning was to instill problem-solving and inquiry skills in children, along with a sense of agency, motivation, and confidence. Relevant to today's learning landscape, later is the observation that one of the most valuable tenets of discovery learning is that the 'absolute' nature of information and knowledge is not recognized as the learner is empowered to shape the outcomes of learning themselves. Also reinforced in these later observations was Bruner's original suggestion that a discovery does not have to be empirically new, just new to the learner. (Shulman and Keislar, 1966)

It is also important to note, that just as the theory of Discovery Learning was developing, so too were ideas about the concept of Experiential Learning. Rooted initially in Dewey's theories of the role of experience and doing in learning, and delineated in his book, *Experience and Education* (1938), it was further developed by David Kolb, considered the father of experiential learning (Kolb & Fry, 1975; Kolb, 1984). In Kolb's view, experiential learning has the following elements:

1   Reflection, critical analysis, and synthesis.

2   Opportunities for learners to take initiative, make decisions, and be accountable for the results of their explorations.

3   Opportunities for learners to engage intellectually, creatively, emotionally, socially, and/or physically.

4   A designed learning experience that includes the possibility to learn from natural consequences, mistakes, and successes.

Discovery Learning and Experiential Learning were prevailing ideas in the field of museum education when the first gallery was created and provided a critical foundation for that pioneering work. Although other theories are more prevalent today, they expand on concepts that Bruner, Dewey and Kolb did not consider at all (or if they did, not in detail) namely, the sociocultural and physical dimensions of learning. Essential ideas that are important takeaways from these early efforts are to create experiences which:

- *enable learners to discover or learn something for themselves,*

- *instill problem-solving and inquiry skills, along with a sense of agency, motivation, and confidence, which empower learners to shape the outcomes of their own learning,*

- *build in opportunities for learners to reflect, critically analyse and synthesize, and take*

initiative, make decisions, and be accountable for the results of their explorations,

- *include possibilities to learn from natural consequences, mistakes, and successes, and*
- *recognize that optimal learning results in designed learning experiences that engage learners intellectually, creatively, emotionally, socially, and physically.*

This early gallery, which offered experiences limited to thirty minutes, proved to be a significant success, by both visitors and early evaluations (Freeman, 1989). As a point of interest, several evaluation studies were completed on this space and reports published in 1979. Although a "Small Room" without artifacts was planned it was not constructed. As the museum was closed for significant construction and renovations between 1982 and 1983, a larger Discovery Gallery was planned in a new location.

Key learnings from Iteration #1:

- *Visitors deeply enjoyed and appreciated these kinds of spaces.*
- *30 minutes was not long enough – visitors needed at least 45 minutes. Thus, restrictions were changed to 20 visitors every 45 minutes.*
- *The discovery space has always been intrinsically, (if not explicitly) interdisciplinary – at last in its collections from across the museum and in the variety of experiences offered.*
- *The ROM discovery spaces have always been committed to paid and/or volunteer facilitators.*
- *The original space proved more successful with children than with adults, perhaps due to its very undirected nature.*
- *Visitors' favorite activities were the human skeleton, the microscope, and the discovery boxes.*
- *School groups were keen to use the space during field trips.*

ITERATION 2: Discovery Gallery 1983-1995 /Discovery Centre 1995-1999

With the construction of new gallery spaces in 1982-83, a new 2800 sq ft. Discovery Gallery opened on the lower level of the new terrace galleries, and hence became part of the main museum. The space was designed as a public gallery, and not an activity room, and contained many of the elements developed for the Discovery Room. However, based on the learning philosophies of Israeli American educator Muska Mosston, the learning experience became more content-based – a space of 'guided discovery' in which the instructor devised a series of questions that guided the learner to a single, predetermined goal. Hence, Bruner's focus on 'learning to learn,' was replaced by Mosston's 'understanding the subject matter" (Freeman, 1979).

The space was designed around four themes – the Arts of Man, Bones, Colour and Wood – themes which framed the activities at the workstations. All the previous two hundred (or so)

Discovery Boxes were available, with some added to align with temporary exhibitions. Some immersive spaces such as a forest and a discovery trail were added and expanded into the larger space. As with the first gallery, the space was designed for children aged 6 to 12 but was open to school field trips and teachers' guides were produced. The time limit was completely lifted. The gallery was designed to never be finished and to continue to change and be updated, which proved challenging given budgets and museum priorities. The space was large enough to host temporary exhibitions between 1992 and 1994 (i.e., A Woman's Story; the Haudenosaunee Confederacy; Day of the Dead). In 1994, some elements for preschoolers were added that focused on engaging the senses.

Despite the foundation of Mosston's more structured description of discovery learning, both the galleries manager and curator (Ruth Freeman) and an outside scholar (Barbara Soren), felt visitors rarely used the space as intended, and rather, were guided by their own interests and motivations (Soren, 1986:8 in Chalmers, 1988). In the early 1990's additional structured activities were added to the space, which were relatively text heavy and required visitors to follow prescribed steps. Later evaluation indicate that these more didactic activities were among the least used, indicating that visitors chose to use the space in a more exploratory manner. In fact, later changes in the gallery reverted to the looser discovery approach – with one or two questions guiding a visitor in investigation (Chalmers, 1988).

Key learnings from Iteration #2:

- *Visitors do not read detailed text outlining the steps of an activity unless they are unable to figure it out, at which point, they may seek "instructions or choose a new activity."*
- *Visitors prefer less rigid, more exploratory, and open-ended activities.*
- *Adults sometimes read to kids; they also sometimes allow or encourage children learning to read, to read material aloud; kids over 9 can read silently themselves.*
- *Although designed for children aged 6-12, the space is largely utilized by children aged 5-10-year-olds.*
- *Objects are taken at random and often not used as intended.*
- *Little children like trying costumes on.*
- *Adults appear to be as involved as kids.*

ITERATION 3: CIBC Discovery Centre 1999-2004

In 1999 the Discovery gallery was moved to a larger (6500 sq. ft.) and more prominent area on the second floor near the new Biodiversity Gallery (now the Hands-On Biodiversity Gallery), which opened in February of 1999. It was designed to be an environment, rather than a room, and had several themed and immersive areas (Franklin's World; Cosmos; From Field to Lab). In addition, it offered a dinosaur dig, a scientist's field camp and even live specimens of lizards, insects, and small mammals. Although

significantly larger and more prominent, the experience was strongly based on Discovery Learning goals, and was designed to strongly appeal to multiple senses.

In 2000, staff identified a series of issues. The space was hard to find and offered limited operating hours. Most problematic was the restriction on children under six, as families arrived with children of varying ages. In response, a planning group was convened to develop solutions and a revised proposal entitled "The New Discovery Centre at the Royal Ontario Museum: A Proposal." It appears this plan was never enacted as proposed. This proposal recommended adding the following opportunities to the existing Discovery Centre:

1   A preschool area for under six.
2   A programming space for storytelling and demonstrations.
3   A continuation of the temporary exhibition space.
4   A resource room with computers and books to support personalized learning.
5   An orientation/waiting room (for visitors to wait in until there was room for them to enter).

Key learnings from Iteration #3:

1   The time limit continued to be problematic.
2   The age restriction was also problematic and created a space in which facilitators felt their role was largely 'policing.'
3   Environments needed to be designed carefully as several young visitors were hurt in Franklin's World.

ITERATION 4: CIBC Discovery Room – 2004-2007

In 2004 the entire museum underwent significant construction and renovation that was named the "ROM Renaissance." During this time, the Discovery Centre was relocated to a temporary, much smaller location and renamed the CIBC Discovery Room. It was organized around five themes (Earth Sciences, Paleontology, Science Exploration, Communication and What We Were). As this was a temporary, make-do space during construction, it served only to offer the visitor a small discovery experience while the museum was open during the construction period.

ITERATION 5: CIBC Discovery Gallery – 2007 to 2021

In its most recent 14-year iteration from March 2007 to its closing in Spring 2021, the CIBC Discovery Gallery was located near the exit of the Bat Cave. Open to all, with children under 12 requiring adult supervision, it offered a specific area dedicated to children 5 and under that was very successful. This area was separated by a low wall, allowing visibility for parents. Time limits were removed entirely, the themes evolved to be more universal, and less grounded in specific collections: Earth Sciences; Palaeontology;

What is discovery; Costumes; Innovation and Invention; Communication; Art and symbolism; Trade and commerce. Later additional themes were added: Close to home; Daily life; People and their environment. Of note is the transition from collections-based themes to themes relevant to everyday life that connect ROM collections to visitors' personal experience. Discussions with staff with recent experience in this space identified few suggestions related to content or activities but many regarding the logistics of crowds, stroller parking, the need for windows, and improved budgets for upkeep and updating.

In 2013 a study was completed of the CIBC Discovery Gallery and Hands-On Biodiversity Gallery (ROM 2103). Findings indicated that visitors deeply appreciated the space, and were, in fact, hard pressed to offer suggestions for improvement. Fully 74% of visitors to the space arrived at the museum with the intention of using the space, and more than half came more than three times a year. The gallery served members and local audiences extremely well.

Key learnings from Iteration #5:

1   Consider practical elements such as strollers, bathroom, sunlight.
2   Any new space must be accompanied by an operating budget that supports staff, upkeep, and the gradual replacement/introduction of new elements.
3   Most visitors to the space are members and live locally.
4   The 5 and under area was strongly appreciated and heavily used.
5   Design spaces for school group and family learning use.
6   Continue the use of themes that connect with people's everyday lives

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SECTION TWO:

Observations of Current Gallery Activities and ROM Membership Survey Findings

This section provides an analysis of ROM's existing hands-on experiences in the Hands-On Biodiversity and Schad Galleries, with particular attention to family use, as well as a summary of the findings from an online questionnaire sent to ROM members in July of 2022.

Observations

The Hands-On Biodiversity and Schad galleries are located near the previous location of the CIBC Discovery Centre and provide a wide range of experiences from immersive (i.e., the Bat Cave) to computer interactives (i.e., Great Lakes Ecosystem). For the purposes of this project intergenerational group visitors were observed to explore the:

- Type of Interactive (immersive, touch screen, analogue, etc.)
- General level of use (attracting power) for family unit
- Use to completion (holding power)
- Ease of use (facilitation required for the youngest member to complete successfully)
- Stimulation of related discussion
- Presence of other perspectives: both cultural and interdisciplinary

The *Schad Gallery* Interactives are mainly interactive touchscreens that layer information about the ecosystem next to the collection display that illustrates each system. Of the ten available stations only two were turned on and available to visitors as the stations were turned off during the pandemic. The two stations that were operational were: The Great Lakes, very near the gallery's entrance, and Neotropical Forests, located midway.

Each station layers additional information about the ecosystem, the species that inhabit it and the environmental crisis that challenges each area. As most of the interactives were turned off, it is difficult to develop a deep understanding of how families use the systems, as most visitors quickly learned the stations were generally not operational. Children tended to try each station by tapping the touch screen. When the two stations that were operational sprang to life, children were largely fascinated by navigating through the screens, and read very little. Two additional interactives are offered in the area – a series of six drawers in the "Library of Biodiversity," that are currently inoperable, and a touch station at the Coral Reef that has been removed. From the two operational stations we can observe that the stations are didactic in nature and did not present multiple perspectives.

Conversely, the *Hands-On Biodiversity Gallery* was almost completely operational. Table 1 summarizes the results of the observations in this gallery.

Table 1.

Results of observations in the *Hands-On Biodiversity Gallery.*

Name	Type	Attract Power	Hold Power	Successful Use	Social Interaction	Comments & Observations
Ontario's Tall Grass Prairie Area	3 area flip up IDs 8 drawers of collections Didactic presentations	Medium	High	Child interest leads	High stimulations of related discussion and excitement of discovery	Area at the gallery entrance is significant less used than the area in the alcove. Adults become interested in opening drawers if they are ajar, or if children initiate.
Open Forest Diorama	Largely immersive – find the items listed	Very High	Very High	Approx. 50% of visitors use as intended	High – working together to problem solve	Most visitors use for photo op
Bat Cave	Fully immersive cave walk	Highest	Very High	Experientially high; learning uncertain	High shared excitement	Highlight of many museum trips
Wheel of Life	Roulette wheel spin chance made you human	High	Very High	If one group member uses all will do	Anticipation of assigned role is high	Works well to engage group – but little related discussion
Life Cycles	Align rotating cubes	Low	Very Low	Most use randomly	Almost none	Visitor uncertain of purpose/use
Biodiversity TV	English & French Video	Very Low	Very Low	No	None	Does not contribute to experience
Food Webs	Button Interactive to visualize 3 food webs	Low	Very Low	No – random button pushing	Medium among adults	One 'web' not working. Many children do not connect buttons to lights on web.
Drawing Table	Paper, crayons, small chairs, display board	High	Very High	Very High	Significant discussion & personal connections	Most visitors take drawing with them
Live Bee Hive	Live hive with tube to outdoors	High	High	Hive difficult to understand	Much discussion about 'queen'	Visitors engaged with bees coming and going outside
Track Touch	4 Brass tracks related to diorama above	Very Low	Very Low	Unknown	Unknown	Area often blocked by parents waiting for child in cave
Fox Den Cave	Crawling / experiential space for preschoolers	High	Very High	Child's interest leads	Between children inside den	Older children use diorama pop up
Track Rub/Identify	Brass Rubbing / identify local animals	Medium	High	Medium	Low	Less popular than tree rubbing
Bird Sounds	Correctly identify bird to sound	Low	Medium	Children listen not complete	Very Low	Success appears connected to adult interest. Hard to hear over ambient noise
Tree Shape Rub/identify	Brass rubbing/identify local trees	Medium	Very High	High	Medium – personal connections	

Name	Type	Attract Power	Hold Power	Successful Use	Social Interaction	Comments & Observations
Computer Station	Layered Information related to local area species	Very Low	Very Low	Very Low	Very Low	Area used as adult seating for children at other stations
Skeleton Touch Station & Drawers	Animal skulls, horns, antlers to touch and explore	Low	Medium	High, when used	Very little – usually used by individual away from group	Location does not support success
Dress Up Station	Preschool – dress up as bat, zebra, etc.	High	High	High	High – lots of sharing and photos	
Wingspan Wing Flap	Size of Wingspan and Wing Flap	Zero	Uncertain	Uncertain	Uncertain	Perhaps of photo of children completing activities in place of text?
Carolina Forest Area	Egg box, Microeye, Match skull to food, Fish Discovery Box, displays	Medium	High			Microeye highly popular with adults and children. Easy to use. Adults use Discovery Box (fish cards) more than children
Tropical Rainforest Area	Discovery Box – Products Discovery Box – identify Displays	Medium	Medium - High	High use of Microeye	Significant discussion when Discovery Box used	Adults walk in and look at displays – grazing behaviour. Adults interested in Products Discovery box. Many photos.
Great Marsh Area	Microeye, Discovery Box, Fish Puzzle	Medium	Medium	Moderate	High level of discussion	Again, Microeye highly popular. Stimulates large number of personal "fish stories"
Facilitated Touch Station	Volunteer facilitators with specimens (animal bones, fossils etc.)	Highest	Very High	Very High	Very High	Attracts children and adults equally

ROM Membership Survey Findings

An online questionnaire to gather input from ROM members was developed with ROM staff input and sent to members with family memberships on July 11, 2022. Open until July 26th, 146 people responded. Members were encouraged to respond even if their children had outgrown the area, based on their memories of previous experiences.

ROM members volunteered that they used the Discovery Gallery most frequently when their children were between 3 and 5 years old, followed by 6 to 8 years old. There was a significant drop-off once children reached 9 years of age, and before 2 years of age. Although families obviously arrive with children of various ages, the area best serves the 3 to 8 years and future spaces should likely focus on this age range.

When asked about the previous iterations of the Discovery Gallery participants offered that their favorite activity was the **Dino Dig**, followed by the **Costumes Station**, the **Batcave** and the "**Dinosaur Collection**," in decreasing order.

"That room where they could try on costumes and "dig" for bones."

"Dress up, teepee, microscope, the sand area where you pretend to uncover fossils"

"digging for dinosaur bones and the dress-up area "

When asked what supported families best in learning and exploring the area, members responded that Human Facilitation was the most important scaffolding mechanism, followed by activity advice or instructions, a guided tour of the space, an on-line trip planner and finally, parenting tips about the museum.

When asked how the space might become more enjoyable and useful to adults, members offered that they'd like more places to sit, more advanced information for adults, and joint activities that were aimed at adults and children working together.

The survey showed that parents offered conflicting input regarding the use of technology. We stated: "We've heard from some adults that technology is important in engaging their children. Other caregivers say they would prefer to have spaces without those things. How do you feel and why?" Interestingly, parents immediately assumed we were discussing 'screens' - perhaps because the technology currently offered by the ROM consists of touchscreen interactives. Although somewhat split in opinion, generally parents said they prefer this area be a space without screens.

When asked about the use of the QR codes offered at the museum, 40% of participants were not aware that QR codes were offered, suggesting that if the use of QR to layer information is continued, an education campaign about their presence and content in elevators and other public areas might be helpful. The small number of people who were aware of the QR codes, but chose not to use them, perhaps suggests as a few people said, that they prefer to stay off their phones, or that they are too busy with their children.

"I'm too busy chasing and guiding kids that I do not have time to take out my phone"

"I prefer to experience the museum vs. reading about it on my phone."

It is important to note that although QR codes may not work well for family groups, we cannot generalize to adult visitors.

The questionnaire then inquired about other destinations families enjoyed spending time together, and what it was that made the spaces fun. Families offered an unsurprising list of Toronto cultural destinations (Zoo, AGO, OSC), as well as outdoor destinations. Most importantly however, they defined the spaces they enjoyed as connecting to nature, interactive, educational, works for all group members and away from technology.

Photo: Alexander Schimmeck - Unsplash.com

Summary of Relevant Findings:

1. The Royal Ontario Museum is very successful at creating interactive spaces that work well for adults and children.

2. The most successful areas (in terms of social interaction and engagement) are the Bat Cave and the Touch Station facilitated by volunteers. The most museum-related discussions occur at the facilitated Touch Station.

3. The activities are designed with key messages and outcomes - and are not play-based. They are hands-on explorations of curated information.

4. These areas were developed prior to the ROM's commitment to interdisciplinarity and reconciliation. Hence, it is not surprising that these principles are not reflected in the material - which is entirely Western science-oriented.

5. The flow of visitors into these spaces from other galleries is steady; the two galleries feel like they belong to the rest of the museum and are not aimed at children, although they are highly popular with children.

6. Adults are equally likely to try most activities (other than those obviously aimed at preschool-aged children) unless they feel they are pre-empting a child from using the activity.

7. The presence of preschool areas does not appear to deter adult engagement in adjacent areas.

8. The key age the Discovery Gallery serves is 3 to 8 years of age, and the gallery should focus on serving families with children in this age group well.

9. Members have a slight preference for family spaces without screens. QR codes do not seem to work for this specific audience.

10. To make the space more supportive of adult interaction, adults requested more places to sit, more advanced information for adults, and joint activities that were aimed at adults and children working together.

11. Family groups find a destination 'fun' when it is interactive, works for all members of the group and is educational. There is also a strong interest in connections to nature.

Daniel MacDonald from Halifax, Canada - Royal Ontario Museum

This section reviews the ROM's existing and historic approach to family visitor engagement in galleries, based on the summarized reflections of observations (see Section Two), a review of supporting materials (see Section One) and interviews of twenty current and previous staff members whose positions brought them into contact with the space.

Strengths

As mentioned above in Section One, the Royal Ontario Museum (ROM) has long held a leadership role in the development of hands-on discovery galleries in museums. From planning prior to its 1977 opening, to planning the future gallery, the ROM has served children and families for over 50 years with spaces that support hands-on discovery-based learning with objects related to collections and exhibitions. This has resulted in an expert staff with deep familiarity with the creation and operation of these spaces, and an audience that has come to expect them as part of the ROM experience. Further, the ROM's commitment to supporting the discovery experience using staff and volunteer facilitators, expands the nature of experiences that can be offered. Currently, ROM statistics indicate that families are consistently 70% - 80% of the visitor mix and both in-house evaluation and the popularity of these spaces, demonstrate that visitors find them engaging. A ROM evaluation completed in 2013 indicates that most Discovery Center visitors visit at least three or more times per year, with half visiting at least once per month. The frequent repeat visitors to these galleries are largely members (ROM, 2013).

Despite this emphasis on family audiences, staff interviews have indicated that when the discovery gallery was open to adults only the activities were popular and deeply engaging. This supports that the current offerings offer meaningful exploration for adults and children. With the ROM's recent re-branding effort designed to engage adult visitors, this finding indicates that well-designed hands-on opportunities will support positive adult visits as well as family visits.

Opportunities

Building on these strengths, a number of opportunities arise. First, the ROM has the opportunity to build on the Discovery Center, and its work in the Hands-On Biodiversity Gallery, developing new approaches to engaging adults in hands-on discovery learning. While a family-friendly space is important to serve the solid family audience, it can be designed to be appealing to family *and* adult audiences, and individual activities can migrate into other gallery spaces. An example of this approach is the Denver Art Museum, which has located several hands-on studios (Storytelling Studio, Design Lab, to name a few) in areas adjacent to gallery spaces.

As in the past, the future Play-based Learning Space will likely be a slightly more relaxed space than other galleries, and thus has the potential to host community events and representatives more comfortably than more formal spaces. Creating some form of community element would also support stronger connections to 'place' (Discovery Gallery visitors are largely local), and integrate co-creation into gallery offerings. This connection to local place and community supports the building of personal connections for visitors and honours indigenous principles of connecting all learning to people's relationship with land and community.

Finally, the presence of facilitators in the space creates an opportunity to use the space to pilot concepts and test prototypes of exhibitions or gallery elements in development. A small investment in formative evaluation skills would yield significant benefit for the entire museum.

Weaknesses

The discussion of weakness was derived from discussions with ROM staff and changes in ROM policies, as visitors had little to say about deficiencies or improvement.

The key weakness of ROM practices identified by staff is the need for sufficient budget to support the ongoing operation of the PBLS once installed. Staff have much respect for the work of former planning teams, and appreciate the experiences offered. However, high level of traffic and intense use means the space needs on-going improvement and maintenance that budgets rarely support, or new additions or changes to the space. Any future PBLS should be supported with sufficient monies to support the upkeep of the space to ROM standards.

Staff also mentioned that elements arrive on the floor without prototyping, and that changes are often required, making demands on the already limited budget. As mentioned above in opportunities, investing in gallery staff who understand the principles and skills required to perform formative evaluation, would also allow prototype elements to be tested before final design and build.

Finally, the gallery embodies somewhat outdated approaches to museology, offering a single museum voice of expertise and authority. The ROM, already working with community involvement and co-creation, could incorporate those contemporary practices into this space, sharing authority with many different cultures and creating a lively, multi–voice and changing space.

Threats

Threats are few, outside of future pandemics and black swans. The opportunity for some

entity to enter the Toronto market with a children's museum is possible, which would compete for ROM families with very young children. Secondly, a further investment in interactive elements in the PBLS and throughout the museum, without sufficient budgetary support, could result in a "tired" space. Another threat is achieving a balance between message and offerings; in many ways the push for growing both family and adult spaces can sit in contradiction to each other, as family spaces are usually considered 'uncool' by young adults.

SWOT Analysis Summary

Strengths:	Opportunities:
• 50 years of experiences that build family visitor familiarity, participation, and demand. • Commitment to facilitation and human animation. • 50 years of experience designing meaningful hands-on learning opportunities.	• Develop field leadership in adult hands-on experiences and play-based learning spaces that integrates Indigenous world views. • Piloting for future exhibition or program elements • Engagement of community groups in family spaces for greater connection to place.
Weaknesses	**Threats**
• Ongoing maintenance and upkeep. • Formative testing of new elements. • All ideas generated from internal ROM perspectives – need for broader input.	• Opening of a Children's Museum in Toronto impacting family audience. • Over-committing to families at the expense of adult audiences. • Cost of doing this work well.

Photo: monkeybusinessimages

Photo: monkeybusinessimages

To better understand the most current thinking and research on concepts and theories that underpin play-based activity spaces for families, a literature review was conducted in the following domains:

- Play-Based Learning, including Family Learning
- Indigenous Ways of Knowing, Being and Doing, including Interdisciplinary Learning
- Effective Facilitation
- Storytelling/Story Building
- Community Participation

Extensive annotated bibliographies are compiled in Appendix A.

The literature review and bibliographies originally included two additional domains: Family Learning and Interdisciplinary Learning. Family Learning is now nested under Playful Learning and Interdisciplinary Learning under Indigenous Ways of Knowing, Being and Doing, to align bibliographies with Foundational Principles. This work then informed interviews with key informants, which added both detail and nuance to the discussions of the principles and practical considerations and examples of excellence. The list of Key Informants with a description of their areas of expertise can be found in Appendix C.

These domains were chosen with purpose and care, and the following considerations shaped our work:

- The ROM described their vision for the space as play-based, and this team agrees. In fact, findings from earlier iterations of the Discovery Gallery indicated that visitors chose to use the space in a relaxed and self-directed way, even when the museum worked to direct the process.
- The domain of Family Learning is highlighted because children are not here on their own, as in a childcare center, or kindergarten. Children arrive at the museum with an adult or adults, who are invested in their learning and enjoyment. Families are the very center of the learning of humans, and shape the learning and worldview of their children for years to come. Integrating the most recent research on how to support high-quality family learning supports the ROM in both the immediate and distant future.
- Our team designated storytelling as an important domain to explore as this is how concepts, ideas and values are shared in family units and how identity (individual, family and community) is shaped. Museums use exhibitions, programs, tours and staff to share carefully crafted stories. In particular, understanding cultural nuances in forms of storytelling is crucial for engaging diverse audiences. This discussion evolved to include discussions of cultural differences in the use and telling of stories, and how communities can build shared stories together, thus we added Story Building to this principle.

- The Royal Ontario Museum is committed to honouring Canadian Indigenous knowledge and world views in how it does its work, and the products of that work. First Nations' Philosophies are interdisciplinary and grounded in the land at their very foundation. Learning moves beyond the presence of multiple disciplines, and moves to an integration, or weaving together of concepts and practices from different disciplines into new concepts and skills. Finally, what does it mean to do this work in a manner that supports new relationships between Indigenous and settler cultures? How can the museum from its very center work to integrate western and indigenous worldviews in a manner that positions both ways of knowing as equal and useful, while still creating a narrative that is clear and accessible to audiences? Finally, other thoughtful individuals in free-choice learning environments have been thinking and doing this work — what can we learn from them?

- All staff interviews, archival materials, member input, the family learning research and evaluation studies of exhibitions and programs underscore the tremendous benefit of social interaction by individuals trained to facilitate family and play-based learning successfully. As the museum changes its approach to the museum experience, visitors need support and affirmation that their participation is what is expected and valued. Effective facilitators provide welcome, support, affirmation, and connections crucial to success, but, in turn, require intensive training and professional development.

- As museums strive to work 'with' their communities, rather than 'for' or "to" them, integrating community voices into decision-making, shared storytelling and experience creation becomes increasingly important. A societal shift in attitudes toward authority means that audiences continue to value expert opinions, but in new ways not always appreciating the single voice of museum authority. Audiences want to know if other experts have different opinions, and most importantly, want the museum to value their opinions. A shift to practice that encompasses multi-vocality, literally 'many voices,' suggests creating an area or tool in the new Play-based Learning Space that supports platforms for community voices and participation. While noting that a commitment to engaging communities in collaborative practice is labour intensive, it also builds important relationships with current and new audiences. This Principle also aligns with ROM's strategies to "Dramatically increase their relevance to the people of Toronto and Ontario, becoming more central to the life of the community," and to "Establish the ROM as the undisputed focal point for cultural and community engagement."

Current research and theoretical foundations of each of these domains is summarized under the appropriate Foundational Principle below. As well, an Indigenous Perspective in response to each area was developed by project intern Marcel Robitaille, which forms much of Honouring Indigenous Ways of Knowing, Being and Doing and is included in its entirety in Appendix **B**.

Honour Indigenous Knowledge

Effective Facilitation

Story Telling & Building

Community Participation

Play-Based Learning

Foundational Principles

Based on the literature review, Interim Report work, and discussions with ROM staff, a draft set of eight potential principles emerged that were discussed and vetted at length with the ROM team. The final set of five Foundational Principles emerged from that discussion and served to inform interviews with key informants who had specific expertise to contribute to their further development. (These interviews were conducted digitally and were recorded for future use by the ROM.) The Foundational Principles serve as an Intellectual Framework for the future development of the space, both in terms of physical design and activity development. Each Foundational Principle is supported by an annotated bibliography, a summary of recent literature and research, and by discussion with related experts. This methodology ensured that each principle is grounded in high-quality theory, while also integrating practical expertise and experience.

The Foundational Principles are:

Foundational Principle One: Promote Play-Based Learning. Although often self-directed by the family, playful learning (also referred to as guided play), has a structure and adults (family and staff facilitators) can play scaffolding roles. Playful learning[2] takes place in well-crafted learning environments that offer highly engaging interactive experiences for all ages, abilities, and interests of individual family members. Effective playful learning experiences support choice and experimentation on the part of the family members and allow spontaneity and open-ended activity that is focused on process and learning how to learn, rather than about acquiring content knowledge and skills.

Foundational Principle Two: Honour Indigenous Ways of Knowing, Being and Doing explicitly. Part of the work of reconciliation must move beyond acknowledgement of past injuries to include active consideration of multiple worldviews in all work. Indigenous worldviews are strongly land-based and interdisciplinary, emphasizing the connection between all things, as well as moving beyond intellectual outcomes to the spiritual, emotional, social and physical.

Foundational Principle Three: Support Effective Facilitation by well-prepared ROM staff and volunteers. All staff interviews, membership surveys, and family learning research and evaluation studies underscore the tremendous benefit of social interaction with individuals trained to facilitate play-based family learning successfully. The importance of recognizing and respecting the (possibly different) goals of the family is crucial and requires the support of well-prepared facilitators.

Foundational Principle Four: Utilize storytelling and story building in new ways. Storytelling is critical to how humans develop their identities (individual, family and community) and understanding of the world. Building shared stories with family groups, between visitors through time and platforms, and moving beyond the walls of the museum into, and back in, from the community to the institution, will serve to connect the museum to the city as residents connect to the museum and each other.

Foundational Principle Five: Value Community Participation. Creating platforms within the PBLS for historically underrepresented voices has the potential to connect the ROM's significant foundation of knowledge, to the wisdom, interests and funds of knowledge held by a variety of members in the greater community. Sharing authority with community groups of all kinds (cultural groups, age groups, interest groups), underscores the importance of diverse world views and builds connections across difference. While this work is highly labour-intensive, and requires the long-term commitment of the museum, the benefits are worth the effort. This principle also aligns strongly with the ROM's strategic plan.

Each Foundational Principle will be discussed in depth in the sections that follow.

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[2] Play-based and playful learning are used interchangeably and synonymously throughout this report.

Foundational Principle One:

Play-Based Learning

Child development professionals, psychologists, learning scientists and other childhood experts agree that play is an essential component of healthy childhood development. In particular, the vital importance of creative, imaginary play in children's cognitive, socio-emotional, and even moral and academic development, is well supported by decades of research. It is a natural tool for children to develop resiliency as they learn to cooperate, overcome challenges, and negotiate with others and ideally, it provides time for parents to fully engage with their children, to bond and see the world from the perspective of their child.

The literature draws a distinction between free, unstructured play and playful learning. Although often self-directed by the family (or designed in such a way that it feels like families are "in charge" of the experience), playful learning (also referred to as guided play), has a structure and adults (family and staff facilitators), often play scaffolding roles, including setting up the environment for children to learn, since research suggests that well-crafted learning environments foster playful learning, as does actively engaging with the child by asking questions and commenting on their activities. Playful learning has been found to be more effective in supporting children's learning, than their own unstructured, self-directed play or adult-led didactic (teacher-directed) *instruction*. However, mixing types of play can be effective.

Project Zero, a research group at Harvard University, investigates the ways in which children learn. The group is particularly interested in the role of play in learning and find it helpful to frame their thinking around a constellation of features as displayed in Figure 1 below:

CHOICE

Feels like... empowerment, autonomy, ownership, intrinsic motivation

Looks like...

making and changing rules

negotiating

setting goals, challenges, purpose

having and sharing ideas

being spontaneous

choosing how long to work/play

choosing collaborators and roles

moving around

WONDER

Feels like... curiosity, novelty, surprise, engagement, fascination, challenge

Looks like...

learning from mistakes

exploring

improving

imagining

creating

inventing

taking risks

pretending

trying

expressing excitement

...with materials, ideas, languages, processes, perspectives, music, names, symbols, words, stories, movements

Play-Based Learning

DELIGHT

Feels like... enjoyment, excitement, satisfaction, inspiration, pride, belonging

Looks like...

smiling/laughing

competing

joking, being silly

singing/humming

focusing attention

anticipating

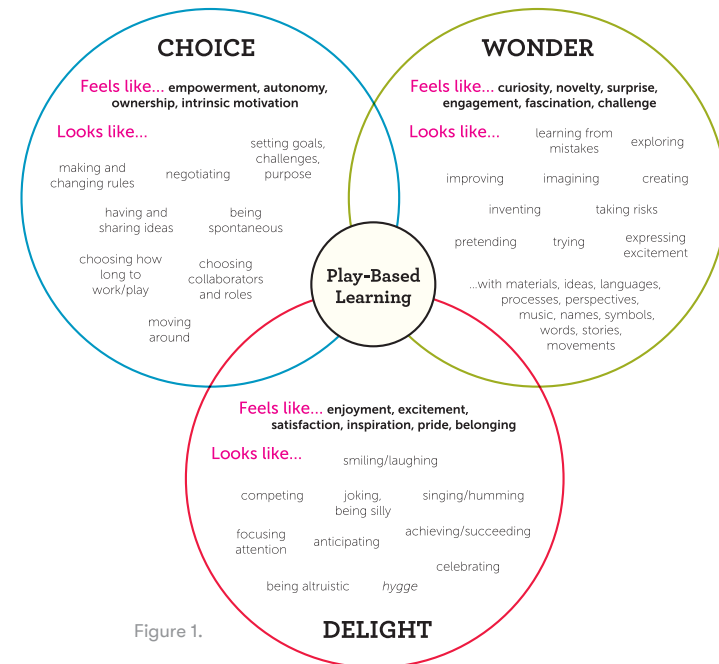achieving/succeeding

celebrating

being altruistic

hygge

Figure 1.

They write:

Foregrounding playful learning does not mean that all learning has to be playful, or that every moment of playfulness involves significant learning. What it does mean is that a close look at play and playfulness reveals numerous emotional, social and cognitive features that can powerfully abet learning in many, perhaps most, circumstances. Sometimes these features help to make learning feel playful; sometimes they simply help the learning to proceed in a more engaging and exploratory way. (Mardell, et al, 2016)

Design for playful learning offers highly engaging interactive experiences for all ages, abilities, and interests of individual family members. Effective playful learning experiences support active discovery and experimentation on the part of family members and allow spontaneity and open-ended activity that is focused more on process and learning how to learn, than acquiring content. There are different yet overlapping definitions of playful learning. Literature shows that playful learning generally includes some of the following characteristics:

- Play, like learning, is active, and to be effective, must be meaningful to the learner or learners.
- Involves social interaction and collaboration.
- Provides contexts for children to practice skills such as self-regulation, setting goals, sharing ideas, flexibility and compromise, problem solving, persistence, and perspective-taking.
- It empowers and intrinsically motivates children by giving them ownership and agency over their learning.
- It is a low stakes context in which children can feel comfortable taking risks, being curious, exploring new ideas and innovating, and making mistakes.
- It engages, is fun and exciting.
- It also helps build children's confidence and gives them a sense of pride and belonging.
- Children can pretend, imagine, and engage in role play.

Despite these well-justified arguments, children's creative play is increasingly endangered, particularly opportunities to engage in open-ended, self-directed play. An overemphasis on shallower and narrower learning in school and busy schedules outside school (after school programs, scouting, extracurricular activities, etc.) are major contributors. Some experts even argue that the "demise of play" represents a crisis in early childhood education (Olfman 2003). Although it is easy to point fingers at schools, there is evidence that many parents and caregivers are also complicit in this trend. In addition to overscheduling children, some adults regulate the type of play and environments in which their children engage. For example, research conducted in children's museums indicates that many adult visitors accompanying children are concerned if the children are "only playing" and quickly try to redirect their play to more goal-oriented galleries and exhibits.

At home, the toys and activities that parents buy for their children can often be highly structured and academically oriented. Although not the case for all home, leisure, or museum play experiences, many of the choices for play activity are highly designed, perhaps even over-designed. Even though designed play experiences may be "informal," they often require direction and/or facilitation by an adult.

A prerequisite for children's play is a place to play. In many communities, children's options for safe, accessible, stimulating, parent-approved play spaces have become more limited in recent years. Children who live in poverty often face socioeconomic obstacles that impede their rights to have playtime, thus affecting their healthy social-emotional development. For children in under-resourced communities to reach their highest potential, it is essential that parents, educators, and pediatricians recognize the importance of the lifelong benefits that children gain from play.

One response to the understanding of the role of play for advocates has been the growth of children's museums. Children's museums are 'the youngest and fastest growing segment of the museum field as a whole' (Association of Children's Museums [ACM], 2002, Section Success and Growth). In addition, the children's museum movement is becoming increasingly global' (Atkin, 2002b, p. 15). In terms of the mission/goals of children's museums, discussions about the underlying philosophies (e.g., Dewey, Montessori and Piaget) support the rationale of emphasizing hands-on learning, interaction with real materials and intergenerational participation in a community context.

In a content analysis of the stated missions/goals of more than two dozen children's museums, the following key words appeared most frequently in this order: (1) Learning (e.g. to enrich children's lives, broaden their cultural experience and provide them with a creative space in which to learn about the world [Canadian Children's Museum]),

(2) Interactive/hands-on (e.g. to teach children more about themselves and the world around them within an interactive learning environment [Manitoba Children's Museum]), (3) Fun/ enjoyment/joy (e.g. where fun meets learning [Minnesota Children's Museum]) and (4) Play (e.g. learning through play [and] a place for families to learn and play together [Santa Fe Children's Museum]).

In two studies, Providence Children's Museum investigated caregivers' observations and perceptions of their children's play and learning at the museum. In the first, caregivers (N=40) were interviewed about what they observed children doing, what they believed children were thinking about, and their own thoughts and actions while watching children play. In the second, caregivers (N=22) described what they valued about their museum visits, and what types of learning might occur through play in general and at the museum. Responses showed that most caregivers reflected on their children's play and articulated a variety of benefits of museum visits for their children. Nevertheless, some found it challenging to articulate how children learned by playing at the museum, even when they believed that children learned through play in general. The findings informed the development of exhibit materials that aimed to make learning through play more visible within the museum.

A study at a grocery store exhibition at the Austin Children's Museum found there was less mutually engaging, responsive role play at the children's museum, than at home. The difficulty was while children engaged in role play, parents tended to remain outside the play frame in a directing or prompting role. Parents reported that they were reluctant to role play and thought they had a duty to teach in a museum setting. Researchers concluded that the process of play and the parent-child interactions observed, seemed too structured, too didactic (teacher/school-like), or too brief to engender the benefits of engaged social pretend play, in part because of the role parents thought they should assume.

More recently, there has been an increased use of playful approaches to teaching and learning in higher education. Proponents argue that creating 'safe' playful spaces supports learning from failure, management of risk-taking, creativity and innovation, as well as increasing the enjoyment of learning for many adults. However, the emergent field of playful learning in adulthood is under-explored, and there is a lack of appreciation of the nuanced and exclusive nature of adult play. The author (Whitton, 2018) presents a table of learning tools, techniques and tactics; see here in Table 2, and discussed in detail in the annotated bibliography.

Table 1. Playful learning tools, techniques, and tactics.		
Playful learning...	**Description**	**Examples**
Tools	Objects, artefacts and technologies that signify a playful environment.	Games Toys Simulations Puzzles Virtual environments
Techniques	Pedagogies and learning approaches that facilitate play.	Role play Making Performance Problems Quests
Tactics	Mechanics and attributes that engender playfulness.	Surprise Humour Chance Competition Storytelling Mystery Badges
Citation: Research in Learning Technology 2018, **26**: 2035 - http://dx.doi.org/10.25304/rlt.v26.2035		

Again, although much of the scholarship on playful learning has focused on young children, it also is seen as effective in engaging older children and adults. The focus of the ROM's Playful Learning Space will be family groups - adults who arrive with children, aged 3 to 8 - with a desire to engage in hands-on, participatory and fun experiences that will naturally support important learning. As the focus of the gallery is to support intergenerational, family learning a review of the principles and research of family learning follows.

Family Learning

The very first learning group a person belongs to is her family, a unique learning group of mixed ages and backgrounds bound together by a complex set of shared experience, beliefs, and values. Anthropologists, sociologists, and social psychologists consider families to be educational institutions, not unlike museums but without the brick and mortar. Knowing this, it is surprising that even though families have long constituted the highest proportion of visitors to museums, historically, little research focused on the "what, how, and why" of family learning in these settings. More recently, however, (from the late 80s) research in museums and other free-choice learning settings, such as nature centers, zoos and aquariums, and botanical gardens, as well as studies in the home, has focused on family learning.

Critical though, before summarizing this research is to define family. For the purposes of this project, a family is two or more people in a multi-generational group with an ongoing relationship; they may be biologically related, but not necessarily. The general rule is if a group defines itself as family, it is one. This broad definition of family is essential as the Royal Ontario Museum seeks to honour Indigenous worldviews. As Marcel Robitaille notes in his summary below, "Family can represent kinships, they can represent people sharing the same household, they could be distant cousins. Family does not always mean a shared ancestor – family is a mindset of shared familial support." In the still too-few studies of family learning among non-white families in free-choice settings, the importance of allowing families to self-define is critical.

Appreciating the pressing need to diversify families in the research to include varied cultural and economic backgrounds, family learning research in free-choice learning settings has contributed to the recognition of the family as the first and foremost learning institution people are a part of, and family learning is a significant form of lifelong learning. Family learning is critical to shaping children and adults' joy for learning, as well as their desire to continue to learn. Supporting the value of family learning, research shows that visiting museums as a child with one's family correlates more highly with adult use of museums than visiting these institutions with a school group, evidenced by a study of African American leisure pursuits which showed the impact of historical exclusion, as well as studies of children's perceptions of museum experiences, preferring

visits with family and friends, which allowed them to look at more things of interest to them personally, and to talk about what they were doing and seeing. Educational research also demonstrates that what happens in the home and community is as critical to a person's success as schooling, if not more so, thus suggesting that museums have an opportunity to play an important role in supporting lifelong learning in their communities.

The literature in the annotated bibliography offers insights into four aspects of family learning that can be roughly described as: (1) How families engage in learning while in these settings, with a general focus on the time they spend and what they do; the specific types of interactions observed among adults and children engaging with objects, videos and different types of activities in the setting; (2) What goals, agendas, socio-cultural resources, identities and motivations families *bring* to these settings and the importance of focusing on the family agenda rather than the agenda of the institution; (3) How to design and facilitate experiences in support of family learning, both in the setting, but prior to it and after; and, (4) Discussions of the role that macro-level sociocultural factors, such as a person's cultural background and how society positions them, as well as societal structures, social class, religion, gender, ethnicity, ability, customs, etc., play, shaping, and sometimes delimiting families' opportunities to engage in free-choice learning.

Research has demonstrated the varied agendas that families bring to these settings which often include an interest in the topic area, something of quality to do together on a weekend, a place to take a visiting relative, and a good thing to do on a rainy day. Observations and interviews also show that families use these settings and activities to shape/enact *their* family identity, as well as importantly, bring their own goals, socio-cultural resources, and motivations with them to the experience. Prior knowledge, both of topics in the museum, but also familiarity with the setting, is critical to families accomplishing their goals. Evidence suggests that if the institution does not recognize the assets families bring, they will ignore the agenda of the museum and do their own thing anyway.

Research also has begun to address the influence of macro-level sociocultural factors, such as a person's cultural background, societal structures, social class, gender, ethnicity, ability, customs, etc. This work is critically important because it offers insights into why families, particularly culturally diverse or low-income families, do not regularly use museums for free-choice learning. Results suggest numerous reasons, many of which are not about the cost of attendance (although some of these studies were conducted in museums in the U.S. with high ticket prices). They include not wanting to look "dumb" in front of 'my' children, difficulties with transportation since "I do not have a car" or "it takes a train and two busses to get there" and the hours institutions are open. Interestingly too, many of these families are busy, working several jobs just to meet the family's basic needs and feel good that "the schools take them" to the museum. Given that the correlation of adults using museums was higher for family visits, this is an important issue to better understand. Efforts to effectively engage families who have historically not visited, have often been programs that connect with community-based organizations that have long-term, trusted relationships with the families.

Playful, Family Learning in Practice

One debate within the playful learning field relates to whether there is a role for technology as a tool for learning, "playful" or not. The goal of one program described below was to bridge the digital divide (giving children without access to technology opportunities to learn CAD and practical skills) as well as storytelling. Carol Tang, Director of the Children's Creativity Museum in San Francisco explained:

> The clay animation studio has been our classic with generations of parents coming back who play videos, from when they were kids; we have grandparents who tell us that they still have the CDs with their kids' animations on them. As we think about the next generation, we're reflecting on using technology to support young children's storytelling and identity. Our museum uses technology, which is perhaps different from most other children's museums. For example, if you're four years old, you don't really know how to read or write; your eye to hand coordination and ability to hold a crayon can be frustrating, if you're trying to tell these great stories in your mind or talk about a dream, you can't really do it well with traditional tools. By providing technology, we're allowing children to tell their stories or find their voices. So, we've always believed in technology as a tool that supports young children's storytelling and identity-shaping and voices, and as an equity issue as well. Instead of being a passive consumer, if a kid who has not had access to tech is making a video, they know the power of storytelling.

She also discussed their changing understanding of play. "We've been struggling with play for a while because we weren't traditional. How can we say we're doing play when we don't have free play. On Saturday, I'm giving a talk at the California Department of Education STEAM Conference, which is called Bridging the Play Gap. There is much evidence of the importance of play and yet low-income kids have the least access to green space or open play; their schools don't have recess, or if they do, they often take it away - they use it as punishment, you know, everything about it is exacerbating this issue because, as a society, we don't respect play." Tang further explained that the museum has "really changed our approach now that we understand and [dove] into the play literature. They are members of Lego's playful learning network, so have participated in significant professional development on the elements and importance of play. She added,"For us the big breakthrough was the idea that ...Free Play is not the end all and be all - it's not the *only* kind of play. Research has shown... it's effective for many things, but that ...guided play...does some things that free play does not do."

Family learning in these settings equals social interaction. Families talk, collaborate, and make meaning together (although some families do separate, and then come back together to share what they have done, and even have been observed taking other family members back to an area or activity that they enjoyed). Conversation and video-analysis reveals the importance of questions, the influence on talk of the types of experiences in which families engage (i.e., hands-on activities compared to computer or virtual reality

experiences), and the concrete ways in which they interact with objects, even when the object is a representation, such as a map or globe. Other important social interactions are nonverbal. Family members watch one another, as well as other visitors and staff to figure out how to "do" the museum. Through conversation and observations of one another, knowledge and understanding are constructed by the family and incorporated into a family narrative, a set of shared meanings among and between family members. This interaction, collaboration and sharing can be direct (a family participating together in an activity or experience) or indirect (a family discussing or doing something together after an experience a child or adult has had elsewhere). Some families take time to talk and explore a topic during their time, while others wait until the ride home or two weeks later to discuss something they did over dinner.

Previous work at the USS Constitution Museum developed indicators of what high quality family engagement in museums looks like. To assess a new activity or element, educators and evaluators can look to see if:

- » All ages are actively participating in the experience.
- » Everyone feels there is something for him or her.
- » Intergenerational conversations are taking place.
- » Adults and children are learning together.
- » It is an enjoyable, collaborative, social experience.

Image provided by the Royal Ontario Museum
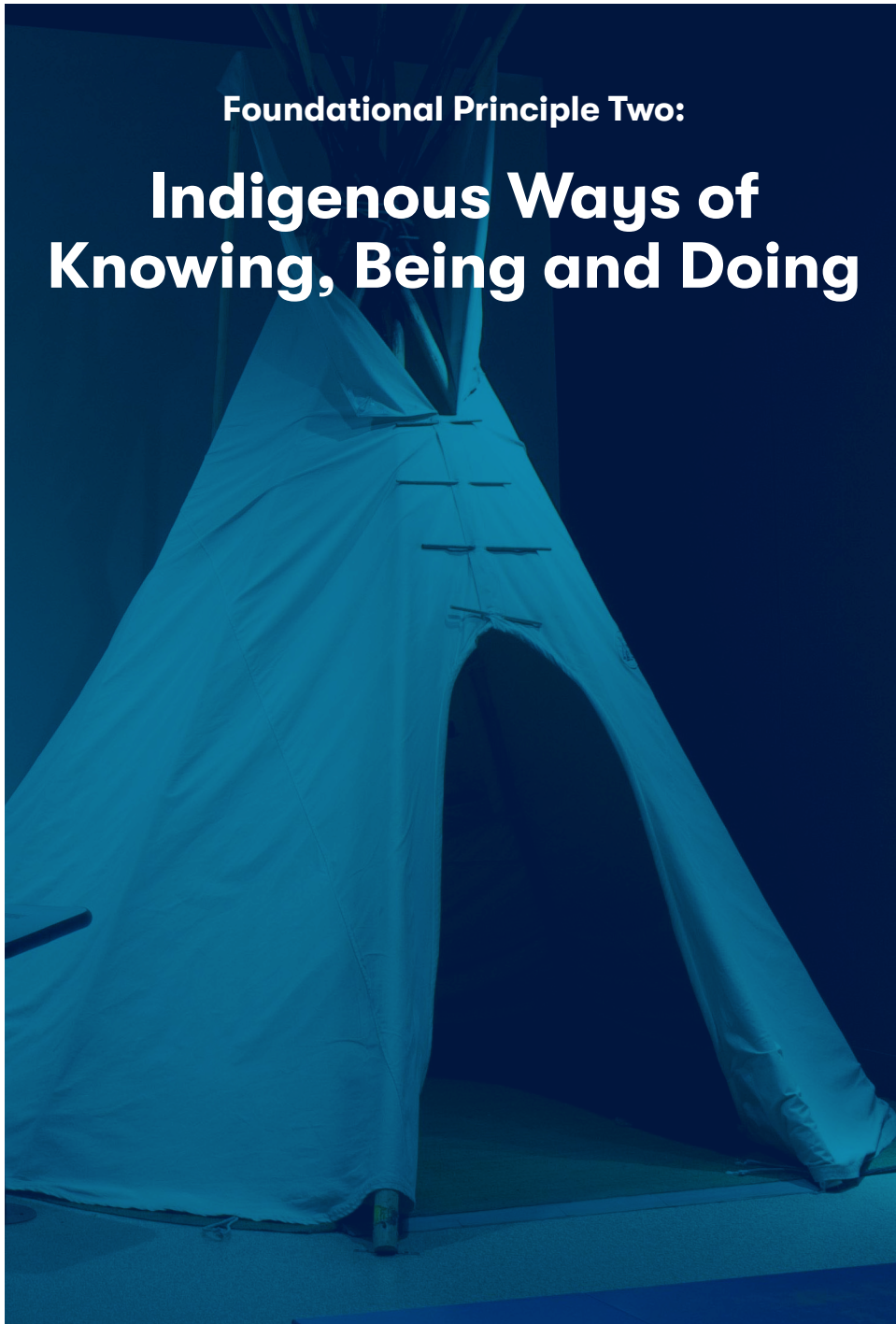
Foundational Principle Two:

Indigenous Ways of Knowing, Being and Doing

NOTE: Important contributions to this section were authored by an Institute for Learning Innovation 2022 intern, Marcel Robitaille, a proud member of the Caldwell nation and, at the time, a University of Toronto Museum Studies Graduate Student. His written contribution to this report (beyond his work on the ROM's Discovery gallery history, visitor observations and the membership on-line input) can be found in its entirety in Appendix B. Much of this section references that writing.

In its effort to transform lives by helping people understand the past, make sense of the present, and come together to shape a shared future in which people flourish, in concert with the natural world, the Royal Ontario Museum acknowledges that: In these times of extraordinary change, a global movement is underway to dismantle systemic, institutionalized racism. In order to serve our communities, to transform lives, and to help people navigate their world, we must recognize our own position in it and **commit to our own transformation** (emphasis theirs) through anti-racist work including institutional self-reflection, inclusive practice, the dismantling of racism, and the pursuit of reconciliation. Thus, the museum is working to honour reconciliation in its practice, and, explicitly in exhibitions, programs and experiences. To that end, the Play-based Learning Space (PBLS) must be an extension of that work, offered in a family friendly manner, which supports a deeper understanding of First Nation's ways of knowing, being and doing. Indigenous worldviews are strongly land-based and interdisciplinary, emphasizing the connection between all things, as well as moving beyond intellectual outcomes to the spiritual, emotional, social, and physical.

To date, much of the effort in this area in Canadian Museums has focused on collections and improving relationships with Indigenous peoples. Crucial and foundational, this work is also largely invisible to the public, but must also be an act of community, of support and uplifting from all peoples across Canada. It is a commitment to acknowledging the truths of a people, as well as a commitment to repairing a bridge of friendship that has been systematically neglected. Between 2008 and 2015, the Truth and Reconciliation Commission (TRC) created a series of calls to action for government agencies, institutions, and communities to follow, in order to begin the healing process. That commission developed 94 separate calls to action. Many cultural institutions, like museums, are considering these calls and what they mean for museum work over the coming years. Together, as Indigenous and non-Indigenous individuals, we are charged to ensure that the voices of the past and of generations yet to be born are heard, acknowledged and that they influence our stories and practices. As Robitaille explains:

A fundamental aspect of the Two Row Wampum Covenant-Chain is that Indigenous and non-Indigenous people operate as equals, fording the river of the human experience on separate vessels. Each perspective is valued, those operating the vessels on either side of the river are able to offer a distinct worldview – neither are assimilated into the other. These two vessels are separate, never veering into the other lane. However, there is a tradition that's arisen within recent years that honours reconciliation within research and cultural institutions. Etuaptmumk – a Mi'kmaw word for two-eyed seeing. It is, as Mi'kmaw Elder Albert Marshall says, "learning

to see from one eye with the best in the Indigenous ways of knowing and from the other eye with the best in the mainstream ways of knowing, and most importantly, learning to see with both eyes closed". It is within the Western disciplinary framework that all things are knowable, especially when it comes to science and nature. Further, by understanding the blank slates of human knowledge can we learn to understand ourselves and the world around us? In contrast, Indigenous knowledge is positional – knowledge and the natural world are tied to place, the body and spirit. Knowledge and learning become one and the same, knowledge is relational to place and people, knowledge is moral and ethical, knowledge is ways of knowing passed from one generation to the next as a distinct equity. Two eyed seeing on the other hand, creates structures in which western knowledge can create the infrastructure through which Indigenous knowledge can interact with the community. This allows institutions to create research and education roles for Indigenous peoples in line with the mandates proposed by the TRC. Two eyed seeing becomes an interdisciplinary action that creates collaboration between different viewpoints, rather than operating as a separate entity for separate goals. Further, it creates space for Elders and communities within the institution – allowing them a key role within the ceremony of research, conversation, and connection.

A process for working collaboratively with First Peoples was first formally acknowledged through *Turning the Page: Forging New Partnerships Between Museums and First Peoples,* a 1994 report of a national task force comprising twenty-five individuals from the Aboriginal and museum communities. Jointly organized by the Assembly of First Nations (AFN) and the Canadian Museum Association (CMA) the task force was jointly led by Mr. Tom Hill of the Woodland Cultural Center, and Dr. Trudy Nicks of the Royal Ontario Museum. The ROM has continued its early leadership in this area and continues to hold an ambitious plan to expand this collaborative work in the future.

Mr. Robitaille underscores the importance for institutions to create educational spaces for honouring Indigenous ways of knowing, being and doing within the public sphere. Education must represent Indigenous historical and contemporary contributions to Canada – whether it is through science, culture, technology, medicine, or other avenues. It must be approached on a par with western knowledge; one is not more important or relevant than the other. Indigenous learning is holistic, interconnected and always connected to the land. This approach aligns well with the ROM's collections and commitment to working in a more interdisciplinary manner.

Interdisciplinary exploration promotes the development of knowledge, insights, problem solving skills, self-confidence, self-efficacy, and a passion for learning – all key and common goals of most museums. Different from Multidisciplinary Learning (which contrasts disciplinary perspectives in an additive manner), Interdisciplinarity combines two or more disciplines to a new level of integration suggesting component boundaries break down. Interdisciplinarity is no longer a simple addition of parts but the recognition that each discipline can affect the research output of the other (Caldwell, 2015). Interdisciplinarity means teaching across disciplines, generally by using a common

theme, topic, or issue. A single disciplinary approach has limitations, particularly as it is concerned with the norms of one particular discipline, ignoring other disciplines' contributions to the issue or potential solutions. Through interdisciplinarity, people can look at the same theme, issue, or topic from the perspectives of different, individual disciplines. Many of today's global problems are just too complex to be solved by one specialized discipline. (Smothers 2020).

Research demonstrates important benefits to a true interdisciplinary approach. Research studies show that students of interdisciplinary techniques have higher test scores in both core knowledge and critical thinking problems, and become independent, confident individuals who learn how to learn' and develop lifelong learning skills. Students who are taught with an interdisciplinary manner master higher order thinking skills (Jones, 2009). This approach strongly supports the development of twenty-first century skills, thus strongly aligning the process with contemporary formal education goals and outcomes. Evidence indicates that the integration of the humanities and arts with STEM are associated with increased critical thinking abilities, higher-order thinking and deeper learning, content mastery, problem solving, teamwork and communication skills, improved visuospatial reasoning, and an increased level of engagement and enjoyment of learning (National Academy, 2018). Compared to traditional approaches, an interdisciplinary approach expands *what* people learn by allowing them to tackle problems that do not fit neatly into one subject. It also changes *how* people learn by asking them to synthesize multiple perspectives, instead of taking what they re told by an expert at face value (Suddreth, 2022).

The Assembly of First Nations (AFN) also underscore that First Nations Peoples have a profound and spiritual connection to the land, and all living things, which is based on reverence, humility and reciprocity, an approach in direct contrast to colonialist extraction philosophies. Thus, to honour Indigenous Ways of Knowing, Being and Doing, the renewed PBLS must underscore this approach. As Mr. Robitaille explains:

> *Belonging to the land, the community and family needs to be an integral part of any institution's commitment to understanding and supporting Indigenous pedagogies of play. Likewise, the TRC mandates that resource allocation should be given to provide for opportunities in which Indigenous knowledge can be showcased. Honouring reconciliation is understanding how to best provide a platform in which Indigenous Knowledge can be disseminated – recognizing a large portion of Indigenous knowledge and early play is situated within nature. Whereas Western Knowledge often limits time spent in nature, nature itself is an educator - the birds, trees, wind and mud are as much of an educator as anyone else. Humans are not distinct from nature; we create a symbiotic relationship with it – not in discord with it. There is an emphasis that early play must be based within this truth – an understanding and respect of the environment should encompass early learnings. Creating land-based experiences and opportunities are an important facet of Indigenous knowledge and pedagogies. Play within nature is important to Indigenous knowing.*

The concept of family, likewise, is not entirely the same as western notions. Family can represent kinships; they can represent people sharing the same household; they could be distant cousins. Organizations must collaborate closely with parents, Elders and communities to provide an educational model that is culturally safe and equitable. Cree scholar and educator, Michael Hart, states that "it can be said that Indigenous knowledge is holistic, personal, social and highly dependent upon the local ecosystem." He further adds: "it is also generational, incorporates the spiritual and physical, and heavily reliant on Elders to guide its development and transmission."

To support Indigenous ways of knowing, being and doing in play-based learning, the experiences offered must connect to history, land, language, and ancestral knowledge. Play is impacted by intergenerational trauma and socio-economic status. Within some Indigenous families, many of whom due to Canadian generational policies, are at-risk, low socio-economic households— play is often focused on supporting survival skills, rather than leisure (this is the case for many low-income families as pointed out in the previous playful learning section). As discussed above, in many cases, meaningful play opportunities are lacking. Institutions need to offer opportunities for families of all backgrounds and incomes to play together. Further, such family play needs to be supported and training provided to parents and extended kin, about the important role of play in learning, not just content, but how to interact with their children in ways that build their creativity, resourcefulness and agency.

In Indigenous Culture stories are an essential part in facilitating play through "silence, storytelling and teasing". Regardless of background, children are able to recognize the lessons and morals shared within stories. There is an inclusivity in story work that expands beyond the confines of culture — even then, Indigenous story work provides children of non-Indigenous background an insight into Indigenous education methods. Honouring reconciliation within the institution is allowing elders and educators to provide access to good story work. Through story work, and art, children are able to access their own creativity. This becomes a means to understanding the self, an important aspect of Indigenous holism. In Indigenous traditions, stories are built on seven fundamentals, respect, responsibility, reciprocity, reverence, holism, interrelatedness and synergy. That said, holistic understandings of storytelling strengthen our ability to emphasize with others, builds on our understanding of who we individually and promotes a connection to our wider family, community and society.

Storytelling can be an act of resistance against colonialism. There are important stories passed down by people who had the courage to remember them, to teach them and facilitate their dissemination. Learning not only explores our identity but it is a sacred act given with permission, honouring our ancestors, land and ways of knowing. In many cases this learning involves generational roles.

Honouring Indigenous Ways of Knowing, Being and Doing must be a collaborative process, one that involves direct action with Elders, communities, Indigenous peoples and allies. It is not a river traveled alone, is not about overtaking the other or veering into another's lane. It is not performed because you expect a return, reward or even recognition. Murray Sinclair, the chair of the Truth and Reconciliation Commission of Canada and Indigenous Senator (2016-2021), stated that "reconciliation will be about ensuring that everything we do today is aimed at that high standard of restoring that balance to that relationship (between Indigenous and non-Indigenous)".

Honour Indigenous Ways of Knowing, Being and Doing in Practice

Within Mr. Robitaille's reflection on research and lived experience in An Indigenous Perspective (Appendix B), he outlines many approaches and practices that support playful, family learning among Indigenous nations, captured here.

- Many Indigenous cultures observe childhood learning and support it through non-verbal learning styles rather than directly intervening – children are free to explore their environment as they wish. Family learning encompasses all aspects of family within the Indigenous context; it must incorporate the family structure and allow caregivers to participate. One such mandate by the TRC is to provide parents the full opportunity to be part of their child's education.

- Although providing opportunities for all should be important, special attention should be given to Indigenous women in educational opportunities within the space – they are traditionally the caregivers and educators of the people. The Indian Act, residential schools and colonial policies were direct malicious attempts to subvert family structure, stripping rights away from women and their roles within the family. However, although women play an important role within families, the mother's partner and community has a direct role to play as well.

- When approaching family learning within the museum, serious focus should be given to the role that the mother plays within the hierarchy of the family structure. Traditionally, western society has subverted the power that women held within matriarchal societies of Indigenous nations – placing women in the bottom of the social power structure, rather than in their traditional space as the heads of families. This subversion of family roles hastened assimilation policies of Europeans – women were traditionally seen as the caregivers of both children and family. Parenting is a shared act between both parents, the community, Elders and kinships.

Ange Loft discussed that Western stories tend to have a defined journey and tie together at the end. In contrast, Indigenous stories have branches, and uncertainty with questions left unanswered. Among Indigenous communities there is a comfort with uncertainty and not knowing why something happened in a story. "Sometimes there's part of the stories that are just magic. Sometimes there's part of the story that just happened and you just need to take it at face value." She discusses this here:

I think that's one of the most challenging things for...history institutions to have to deal with is the fact that oral narratives and indigenous oral narratives are in flux and continue to be in flux. And they will always be, and they have always been...Because it's never the story. There are always 10,000 other versions, and there are always 10,000 other openings and ways to get in and morals and kind of like things to pull out.

In addition, Western stories tend to have one single voice whereas within Indigenous stories there are many versions and interpretations. It is important to not just have single voice even from the "chosen" community as "our" or "the" storyteller. Non-indigenous academics and content specialists can work together with Indigenous communities and tell multiple stories. However, the academics and content specialists must see themselves as support staff around Indigenous mythology.

A conversation with Dr. Jill Carter underscored the very fine, razor-like edge between invisibility and hyper visibility. She described how Indigenous peoples are often invisible, or presented as historic, until, suddenly – museums create spaces in which they become hyper visible and on display as exotic or separate. Museums' lack of knowledge and experience in doing this work only underscores the importance of doing it collaboratively with elders and community involvement.

Foundational Principle Three:

Effective Facilitation

Image provided by the Royal Ontario Museum

All staff interviews, archival materials, member input, the family learning research and evaluation studies of exhibitions and programs underscore the tremendous benefit of social interaction with individuals trained to facilitate family learning successfully. As the museum changes its approach to the museum experience, visitors need support and affirmation that their participation is what is expected and valued. Effective facilitators provide welcome, support, affirmation, and connection; positive partnerships between parents (and other adults) and facilitators, are characterised by mutual respect, common goals and recognition from each party of the role, skills and challenges of the other (Tett and MacLeod 2020).

Research also shows that not all facilitation is successful. Even if well meaning, facilitation by staff can interfere with the natural interactions of the family. Neglecting to acknowledge the role of the *family facilitator* (whether an adult or child in the group) or trying to impose the goals of the institution to "teach" content or process ideas if that is not the goal of a family, can negatively influence the entire experience. Families may have predetermined roles and ways of interacting that may or may not support the intended learning goals of the informal space. (Simmons et al. 2022) The importance of recognizing and respecting the (possibly different) goals of the family is crucial and requires the support of well-prepared facilitators (Pattison and Dierking, 2016).

As stated, the core of effective facilitation is the perception of the adult or parent by the museum facilitator. Research demonstrates that when the facilitator begins from a deficit model (the parent/adult needs my help to get this right) there is a negative effect on the family's engagement (Tett & MacLeod, 2020). Research underscores that adult participation is supported by the acknowledgment of the adults' knowledge and participation as crucial supports in their children's learning (ibid). If the facilitator communicates that the different knowledge that the adult brings is valued, the power relationships at play are mitigated, and the parent relaxes into a facilitator role.

Adults and children bring different motivations to the experience. Family learning strategies are often designed for children as the main or sole audience, with the accompanying adults perceived largely as companions. Yet research indicates that there are *two* target audiences: both parents and children bring their own set of motivations to participate (Schulter et al, 2022; Simmons et al. 2022). Elementary school–aged children had a high motivation to spend time with their parents (social enjoyment) and to learn together with their parents (social learning). The parents or adults in the learning group wanted to support their children's learning. They enjoyed joint activities that were difficult for one person to do on their own and enjoyed being "needed" as a learning partner. In fact, in this study parents expressed a strong motivation to research and experiment themselves (Schulter et al, 2022).

Family interactions are powerful influences on the identity development of children, not only academic development, but also their moral, ethical, and social development. The research performed by Simmons et al (2022) identified that parents structure learning experiences to support their family and cultural values, passing down values from generation to generation, influenced by the culture, religion, ethical, moral, and social values held by the adult. The study went on to demonstrate that through asking a few

intentional questions, informal science educators can better understand the perspectives and objectives of families and align them with program goals (ibid). Reflecting on the fact that family learning takes place against a backdrop of family and cultural values and understanding that each family brings their own unique assets to any learning opportunity will support facilitators in transforming informal learning spaces into what Tzou et al. call sites of possibility and equity (2019).

Harris & Winterbottom (2018) studied the impact of facilitation during a series of activities in a natural history museum in England. Families visiting the museum were invited to take part in activities designed to spark scientific talk between family members and encourage an inquiry-based approach to gallery exploration. This work demonstrated that family learning could be supported in informal learning contexts through strategies that promote increased family dialogue and co-investigatory behaviours about museum objects and exhibits. In a play-base learning space the facilitator's role must include encouraging dialogue and co-investigatory behaviours, while also framing or affirming the learning explicitly – naming it and holding it up for families to see as an important shared accomplishment.

This work requires significant skill and understanding of family and play-based learning. The shift away from knowledge and skill acquisition as the primary learning goal to that of learning how to learn – as families and individuals – demands an investment in the professional development of facilitators, and, possibly, a shift in the hiring of staff and recruitment of volunteers.

Effective Facilitation in Practice

Key Informants offered several practical suggestions to improve facilitation in the space:

- When facilitating, do not have a long introduction before moving onto the interactive part.
- Adults want to feel knowledgeable in front of their children. How can you provide content/processes for them to use when needed?
- It is important to give adults permission to not know, to play, to use their imagination, and even not engage at times.
- Focus on the emotion you want to invoke in the space over content/process.
- Understand that families will incorporate this space into their visit differently, so they will have different motivations and needs. Some might go there first, others might see it as the last place to go, and others might only go to this space.
- Design spaces for collaboration within and between families. This would include arranging seating so family members can sit together and having exhibit components and multiple heights.
- Consider how adults might engage. For example, including adult-size costumes for pretend play invites adults to play with their children and allows for a different

type of interaction. Similarly, climbing structures or tunnels can be designed to allow room for adults to enter.

- Provide opportunities for both parallel play and collaboration, as well as space for adults to pull back and allow kids to independently explore.

Laura Huerta Mingus spoke at length about how activities can be designed to build and strengthen family relationships:

- » Did they learn something together? Did they learn something about themselves and each other"
- » Support families in thinking about "what if" and different perspectives.
- » Support imagination; emphasize process over product.
- » Use connections to a kitchen table to support bringing complex conversations into, and then out of the museum, so families continue to engage.
- » Create the desired culture of the space by modeling.
- » Volunteer families can act as facilitators, modeling a culture of community space and representing the diversity of the Toronto area.
- » Consider the aesthetics of the large space and do not rely on stereotypical kid design like primary colors and cartoons.

Marissa Largo offered that it would be important for the ROM to have facilitators from Indigenous communities to show that it is a living culture and to exemplify Indigenous approaches:

> *I think that's why it's super important to have animators from indigenous nations, hired to activate the space, because it really reinforces that idea that, yeah, this is a living, breathing people and culture, it's still here, it's not in the ethnographic past."*

Kelly McKinley reinforced that children should be seen as competent learners, capable of engaging in conversations about difficult topics. It is important to engage people in difficult conversations from an early age. This also means providing multiple access points and levels of complexity to accommodate different ages.

Foundational Principle Four:

Storytelling & Building

Image provided by the Royal Ontario Museum

The active process of meaning-making is viewed as essential to learning. This process involves contextualizing information and experiences, making them culturally and personally relevant by connecting them to prior experiences and knowledge. Storytelling is a way to support personal meaning-making by highlighting relevance to people's lives, discussed in Rounds (2002) and Siegel & Cid (2018).

Humans are storytellers. Starting from an early age, human identities are shaped by the narratives created, either "alone" or collaboratively, notably with family. Young children play an active role in contributing to the creation and re-creation of these stories. The stories created can be about many identities, including an individual's, the identity of the family, or cultural heritage. Storytelling is at the core of culture, how histories are passed down, customs shared and traditions become endemic to a group.

Storytelling has been used to support learning in a variety of subject domains and types of institutions including history museums, natural history museums, art museums, and science centers. This approach has been used with preschool through late elementary school-aged youth and their families. The ways that stories have been used include the museum telling a story either through an exhibit or with a docent, as well as children and their families actively participating in storytelling (Fivush, 2008).

Structuring exhibit content as a story, has been found to be engaging in general, and particularly engaging for young children, supporting families in making connections to themselves, and in some cases, supporting conversations about scientific practices. Presenting stories also has been found to help youth make connections between exhibits. There are a number of examples in which stories are used to convey science content and practices. Storytelling has been viewed as a way to support non-experts in science learning since, in contrast to the typical logical approach used in scientific thinking and the decontextualized information transfer model of learning, stories are contextualized and tend to relate more to non-expert audiences. In turn, they may increase understanding and engagement. These ideas are illustrated in Callanan et al. (2012); Dahlstrom (2014); and Evans et al., (2016).

Inviting families to actively create their own stories is especially effective in helping children situate themselves in the content/processes; with family scaffolding further connections can be made to one's own family, cultural histories, values, and experiences. It invites families to engage together, supports connections to content/ processes at a "cognitive level," but more importantly it helps connect visitors to the material emotionally. This is illustrated in some papers Aerila et al. (2016); Carter (2018); and Fisher & Sastre (2008).

As storytelling is the core of creating culture, culture influences how stories are told and valued. One's cultural background shapes how the receiver reacts to a story, both the content and style of the story. If a shared culture is rooted in a shared tradition of communicating, then stories communicate much more than the plot of what a particular culture values. In Indigenous cultures storytellers are revered as historians and knowledge keepers; in western Africa cultures honour storytellers as griots -

individuals that are also considered counselors to rulers and the group's genealogists. In the Jewish faith, the shared telling of the Passover story is a ritual.

As a city of remarkable diversity, the ROM has an opportunity to use storytelling as a shared community building effort. It can move beyond storytelling to story building – weaving different cultural stories together. Story weaving is the practice of weaving disparate stories together into a cohesive whole, and among Canadian Indigenous people refers to a very specific practice that weaves individuals into the story, and vice versa, through a practice of story embodiment. The practice of building shared stories brings different perspectives, histories and values together to shared understandings and possibly a shared future.

Storytelling and Story Building in Practice

Humans are storytellers from an early age. Stories support individuals, including families, in the active process of meaning-making, which is viewed as essential to learning. This process involves contextualizing information and experiences, making them culturally and personally relevant by connecting them to prior experiences and knowledge. This is discussed in Rounds (2002) and Siegel & Cid (2018). Stories also provide context and an underlying purpose to visitor experiences. Jennifer Robinson points out that the underlying purpose is what can spark engagement and curiosity:

> ...like you go into the typical Children's Museum, and you've got ... the ball machine that's sucking up different pillars of balls. And it's just process play, right? It's like cause and effect, and it doesn't have a wraparound or storyline. Taking that same interactive, you can use it, so the visitor is trying to solve a problem ... like you're trying to get water out of the levee in New Orleans, because it's flooded. You know what I mean? You could use that same mechanism. But the storyline, the balls are blue now, or gray or whatever the color of the water is. But there's a bigger storyline behind that interactive, that provides and enhances motivation to want to take part of it"

Structuring exhibit content in a storyline format and presenting stories is an effective approach to engage museum visitors because beyond using the content to connect to the "cognitive level", more importantly it helps connect visitors to the material *emotionally*. Engaging peoples' emotions is important because emotions strongly connect to memory. A common theme across the expert interviews was that to access visitors' emotions (which many saw as one of the priorities of exhibit design), support making personal connection and seeing relevance, it is essential to move away from generic stories or transmission of information and focus instead on specific stories of individuals.
 For example, Robert Kiihne mentioned:

> For us, you know, there are lots of emotional stories. We've found that it's better for

us to tell emotional stories about individuals rather than talking about the technical nature of a ship. So, for our technical nature of say, a battle, rather than saying this ship went there, and this ship was there, and then the ship shot cannons...and trying to make that dramatic, which is a very standard technique *the field talks about*, [We identify this person *by having them as a* first-person interpreter, of this is what it was like for me to be aboard the Constitution in this battle. And then, conversely, for the British soldier, and sailors to be talking about what it was like from their perspective."

Similarly, Jennifer Robinson shared her museum's approach: *"instead of just saying...a lot of astronauts once were fighter pilots, we say this is a fighter pilot, and her name is ... She's a real person."*

Stories also humanize experiences and content and provide entry points for individuals, including children, to make personal connections and insert themselves into the story. Jennifer Robinson said, "So you're not talking at, it's how can they find themselves there". She also discussed the Anne Frank exhibition at the Indianapolis Children's Museum to illustrate how to engage visitors in an historical story, with the primary goal of fostering empathy:

> ...how do you get someone to invest in a historical story? ...we have an exhibit about Anne Frank. The goal wasn't just to tell... the war started in this year and then Anne Frank was this age in this year, and then this happened. And then the Western Front... The goal was to help you have empathy for what Anne went through, and to make sure nobody else has to go through that. But also, if somebody's having a hard time, on a different level, that you can be a nicer person. And we wrote it down... we talked a lot about walking in her shoes...what was that like? And...this immersive exhibit; we've got these cobblestone steps, because when I was in Amsterdam, I was walking up to the house, and I [thought] Oh, this is not a regular sidewalk...just by walking on what you're walking on, I'm somewhere else...I'm in a different time period, I'm in a different country. But then little things like we could have just a timeline and labels like the first thing that happened was her sister received a public notice, but we ended up putting in like a real mailbag out. And you lift up the mailbag, and you pull out Margot's public notice. Okay, so the point is you're collecting parts of the storyline. Before you even get up. You know, there's another vignette where it's a basket of sewing equipment, sewing materials, with the Star of David hanging out. We could have just mounted a yellow star David and said, they had to put this on their clothes. But it's more, you would just one day come home from school and your mom is sewing yellow stars onto your clothes. So that's another little vignette where there's another provocation before you get into the sound and light show, which actually looks like the secret annex. We've used the blueprints, tons of things to uncover and read when you're in the secret annex, pulled together by the sound and light show that ends in this quote from those about how Anne said, "I hope my story is not forgotten"...there's a call to action coming out of that, "I don't want this story to be forgotten. I'm gonna go out and do something."

Across different cultures, stories can have many purposes. They can convey knowledge, share morals, and be a creation of our identities including our own individual identity, the identity of our family, or cultural heritage. One example of a study that discusses this is Fivush (2008). Stories also play a role in shaping our identities. Even from an early age we engage in such stories, creating them "alone" or collaboratively with others, notably our families. Young children even play an active role in contributing to the creation and re-creation of these stories.

Marissa Largo discussed the power and significance of storytelling in different cultural communities:

> ...storytelling is a mode of knowledge production. And if we look at Indigenous communities, and many racialized and diasporic communities, like my own the Filipino community, storytelling is a key source of knowledge transmission. So, in my culture, there's something called Quinto Han in which you pass on values and knowledge through the act of storytelling. And so, it could be folkloric, or it could be familial. It could be about kinship, but the idea is that through the story, you pass on key teachings, key values to the next generation. And so, it can take on the form of oral tradition, which is aligned with indigenous communities. Or it can be a visual form of storytelling. But yeah, storytelling, for sure, if it's recognized as a form of knowledge production, and also knowledge transmission, that would be a great way of acknowledging that, that that storytelling is, is a valid form of, of archive, living archive.

Stories can humanize science and scientists. There are a number of examples in which stories are used to convey science content and practices. In contrast to the typical logical approach used with scientific thinking and the decontextualized information-transfer model of learning, stories are contextualized and tend to be more relatable to non-expert audiences, and, in turn, may increase understanding and engagement. These ideas are illustrated in Callanan et al. (2012); Dahlstrom (2014); and Evans et al., (2016). Providing accounts of individual scientists and their process including mistakes can engage visitors.

An exhibition can combine multiple types of storytelling including those created by the museum as well as those created by families. An example of how different types of stories were interwoven into an exhibition was the Mammoth Discoveries at the Children's Discovery Museum in San Jose. The exhibition included a story of an authentic scientific discovery of fossilized mammoth bones, which happened locally, and the process of doing science as a story. Families engaged with an animated story timeline of an individual mammoth using a spin browser. They moved along from when the mammoth was on earth, to when it died, to when it turned into bones, and later when the fossilized bones were discovered. One exhibit involved story cards which were just illustrations and allowed families who speak many different languages, to create their own stories.

Further, by providing opportunities for families to create stories, it allows space for families to bring their whole selves, make connection to their own family and cultural histories, values, and experiences, contributing their own culturally relevant content and meaning, and with that make the museum experience their own and invites families to engage together. This is illustrated in some of the papers in the reference list including in Aerila et al. (2016); Carter (2018); and Fisher & Sastre (2008). Such opportunities also provide spaces to hear multiple voices and learn about the diversity of experiences.

Jenni Martin from the Children's Discovery Museum in San Jose, CA discussed an example of an interactive exhibit that invited diverse cultural and intergenerational storytelling as well as conversations between families from different cultural communities. An exhibit emerged from an event that engaged immigrant families in exploring connections between food and cultural identity (https://www.cdm.org/event/a-seat-at-the-table/):

> As part of this Seat at the Table exhibit... we then created an interactive experience out in the community where people were. We had playdough of different colors and different scents. And then we had cooking items and utensils from the five different immigrant cultural groups that we were working with, in this project, and so families could come in and use the playdough. And molded into different, you know, mooncake mold or a tortilla press or... And, again, just lots of different things that they were using, along with the dough. And parents would end up telling children's stories about when they used that when they were a child, that kind of thing.

Another example was illustrated by one of Marissa Largo's projects, in which she invited people to tell the story of "how they came to be on this land".

> There's a project that I've done called Mulata stories where... I engage audiences in the act of telling their story as to how they came to be on this land. And the way that I phrase that question, it's very particular to the fact that some folks are indigenous to this land. So how did you come to be on this land? And it's a participatory art installation, where people write their stories on luggage tags, and they're hung onto this web that demonstrates an interconnection of, you know, this idea of this global family that, you know, folks come from different parts of the world, but we all meet on Turtle Island.

Jennifer Robinson shared an example from the Long Island Children's Museum in which visiting families were invited to contribute their ideas and stories. She suggested that the collectively produced artifact can be memorialized and shared with the public:

> Long Island Children's Museum may have the most beautiful implementation of it, where they have an actual sculptural tree. It's a wish tree, a heart, a Wishing Tree. And they have had different prompts for families to do with paper and other materials that they might ask them to, you know, around a holiday with what are your favorite foods or in times of crisis, they've had people share wishes for these families, and they become very, you can tie yours up onto the tree, but you also see all of the other contributions and they become this communal art piece.

To incorporate Indigenous voices and practices, it is essential to understand the role and practice of storytelling within Indigenous communities. There are often layers to

Indigenous stores, underlying symbolism, and opportunities to peel back those layers and further break down iconography. Ange Loft provided an example of this process:

> …the breakdown of iconography inside stories is interesting to me. I feel like you can tell a story that's like five minutes long, get a lot of information in there still, and then spend some time breaking down some of the iconography. One story that she tells that's about a chipmunk, getting nuts and it's the funniest story but then she starts to break down, what the iconography of the chipmunk is what the significance of the certain types of trees is, what would happen if this and she ends up like what would happen if the squirrel had never been able to learn from another squirrel how to get nuts. What would happen if this or this chipmunk had like she breaks down like the word… then she ends up …you realize the whole thing's actually a boat, like missing and murdered indigenous women.

Whether designing exhibits that are structured in a story format or inviting active storytelling it is important to be inclusive in the practices of storytelling including who and how people are represented in the stories and broaden our definition of what we mean by stories to include written and oral storytelling.

In addition, Western stories tend to have one single voice whereas within Indigenous stories there are multiple interpretations. It is important to not just have a single voice even from the "chosen" community as "our" or "the" storyteller. These multiple voices and perspectives lead to an Indigenous practice called Story Weaving that Dr. Jill Carter describes as weaving together thread of voices and perspectives that create a rich and complex narrative. Encouraging participants to contribute and receive, to see individual threads and the completed fabric. She explains:

> Story weaving is about people weaving their stories together. Finding the threads that tie them together. So, you tell a story and I tell a story – someone else tells a story – and a facilitator helps us to find a through line to tie these stories together. This is the way Spider Woman works, encouraging us to make something new. A lot of traditional storytelling, as I understand it, the idea is that we are to place our selves in the story – the story is not fictive or finished. In the Western tradition the story is complete, finished. In our stories are being told the storyteller is weaving the present into the story – "Always and forever" is important to us, the listeners are invited to embody the story. What that does is to let the story live, over time, and helps you to understand on an organic level that we are forever and ever enacting or living the story. Also, our stories are strongly connected to the land – the land holds the stories.

Dr. Carter goes on to discuss the work of Dr. Lee Maracle, who underscored the responsibility of the listener to respond – to offer an exchange. There is overlap between the museum and the theater, in that, traditionally, the audience is the audience and the group on the stage offer a story. Both museums and the theater are working to find ways of collaboration and exchange. As Dr. Carter describes:

Sometimes it is in the development of the piece – it becomes a co-creation of a work. We have, for a long time, held, talk backs where the audience respond after a piece. And then I think about Bertolt Brecht and his Lehrstucke – radical theater that invites amateur to actively participate in a production and explores the possibilities of learning through acting, playing roles, adopting postures and attitudes etc. and no longer divide between actors and audience. And then the audience becomes the jury and discusses what if it was another way.

Foundational Principle Five:

Community Participation

Current museology practice has focused on moving from creating experiences 'for' audiences to creating them 'with' audiences. A deepened understanding of their colonial roots, combined with the acknowledgment of interdisciplinary and different cultural forms of expertise, museum experiences are moving away from the anonymous museum voice of expertise to presenting multiple voices and perspectives. To do this effectively, (particularly given the lack of diversity among the staff of museums) they are incorporating new practices of engaging with communities to bring new voices into the museum. Community participation has been deeply considered at the ROM and is codified in two of the strategies of their Strategic Plan: (1) to "Dramatically increase their relevance to the people of Toronto and Ontario, becoming more central to the life of the community," and (2) to "Establish the ROM as the undisputed focal point for cultural and community engagement." As the Play-based Learning Space (PBLS) plans to strongly support local and repeat visitation, it provides an opportunity to invite participation of diverse cultural (heritage, social, interest and more) groups, and in so doing connect visitors to new groups and ideas.

Understanding the cultural dimensions of the museum experience and why some people use museums regularly as rich community resources to fulfill their personal and family learning needs, while others do not, is an issue of great importance, one that has long been a major goal of the field and many institutions. A key approach has been for institutions to build a variety of community participation efforts into in reach and outreach programming, such as family nights, special exhibitions that might appeal to different groups, festivals and more. More recently this has expanded to integrating community voices in audio tours or community labels in exhibitions and co-creating programs and other experiences with community groups.

Early in this conversation of engaging communities, discussions about learning ecosystems and public value arose. In 1993, educational evaluators Mark St. John and Deborah Perry proposed that learning in a community be re-conceptualized, suggesting that schools and universities and the free-choice learning sector (that includes museums and other cultural institutions) be considered components of a single, larger educational infrastructure in a community. They used the term *infrastructure* to describe the system of supports, conditions, and capacities that permit the smooth functioning of daily life; the educational *infrastructure* in a community supports and facilitates learning in schools and universities, but also in in the broader community and at home. This infrastructure is highly interconnected and interdependent. More recently, the notion of a network of connected (ideally) learning resources in a community, is referred to as an ecosystem, with efforts to conceptualize and use the approaches of ecologists to study, monitor and improve the entire learning system.

As with the idea of ecosystems, the discussion of community participation has also been reframed in the last few decades in terms of providing public value, the idea that the potential of institutions like museums is to make a positive difference in the quality of people's lives, as well as in the communities in which they reside. In the museum field there also are on-going discussions about how to effectively integrate community voices into exhibition development and other aspects of museum operations, reinforcing

the earlier discussion that groups of people who have historically not visited or used museums, are unlikely to change their behaviour in significant numbers, if the collections and temporary exhibitions are presented in ways that do not connect to ideas and issues important to them. Audiences are the experts in their own interests, preferences, and values.

It also is important that discussions of public value recognize possible broader outcomes beyond learning and education. Scholars, particularly in the UK and Australia, point out that in addition to lifelong learning goals, museums' potential value include enhancing social cohesion, health and well-being, citizenship/democracy, cultural identity, national heritage outcomes, and in some communities, financial outcomes. One example of meeting learning *and* social cohesion goals by partnering with the artistic resources of the cultural sector, in this case musicians and community symphonies, is the growth of El Sistema in Venezuela and Scotland. El Sistema is a voluntary music education program, originally called Social Action for Music, but now in English the "National Network of Youth and Children's Orchestras of Venezuela." El Sistema in Venezuela oversees youth orchestras and music schools for children throughout the country, 90 percent of whom are from poor socio-economic backgrounds. Later, the El Sistema model was adapted to one of Scotland's most economically challenged areas. Evaluation findings show that in terms of family life, there are improved relationships at home, wider social networks and more shared activities between parents and children. Parents and other significant adults can envisage a more positive, aspirational future for their children and the approach has engendered a sense of pride among the community.

There is also a rich resource of literature discussing "community participation" (CP) outside the field of museums. Generally, it refers to the equitable sharing of the work and benefits of any project. Others view it as a tool to enhance the efficiency and effectiveness of efforts. It also is used to describe the co-production of services (in the field of museums, this is often referred to as co-creation). And finally for some groups, community participation means community members have significant control over decisions made by the institution/organization with whom they are partnering. These diverse perspectives reflect differences in the objectives for which participation might be advocated by different groups. For the purposes of this summary, we propose defining community participation as an active process by which the ROM engages community groups in influencing the direction and implementation of a project, to create a product for the larger audience that builds awareness and an exchange of knowledge, understandings and the lived experiences of the diverse communities that call Toronto and Ontario home. The intended outcome of the effort is internal learning and, hopefully, a contribution to the groups' well-being, as well as the community-level goals discussed earlier (social cohesion, health and well-being, citizenship/democracy, cultural identity, etc.). For a detailed discussion of CP as a process that serves one or more broad objectives, see Kafuko's 1987 *Community participation in development projects: The World Bank experience* in the Annotated Bibliography for this section.

One avenue proposed by museum leaders for conceptualizing such community partnerships is to think about how museums are arrayed along a continuum of shared authority, discussed previously as the level of intensity the institution/organization chooses

to undertake in a CP effort. On one end are institutions, or staff members, who hold on to traditional approaches in which they are certain of what visitors' needs are (or should be). At the other end of the continuum is the position in which the institution gives up its role (or shares it) as they frame experience and provide a platform for the community to speak. Most museums are working to find the most appropriate and comfortable location for their institutions and the new audiences they wish to serve, understanding that to be relevant means there will need to be some degree of authority sharing.

Community Participation (CP) in Practice.

Writing on CP both within and outside the museum field, stresses the importance of clearly discussing and collaboratively defining at the outset of any effort, the level of community participation and authority sharing to be undertaken, or participants (including the museum) may be disappointed. Research on CP outside the museum field also discusses that successful community participation efforts require capacity building and training for the effort. For example, in the case of public health initiatives, capacity building and support/training are important for both health administrators and workers and community members.

Factors that facilitate successful community participation on public health initiatives included community-level trust, strong existing external linkages between and among the community and health entity, the intrinsic motivation of individuals involved, and supportive institutional processes that were flexible and responsive to community. Factors that challenged successful community participation included lack of training and/or interest in the goal, along with weak financial sustainability for ALL partners and the community engagement effort itself. Whatever degree of community participation is chosen, the need for long-term commitment, understanding, competencies and resources is invaluable. Ultimately, the most important element in doing this work is a true desire and respect for community wisdom.

Also critical to the success of any CP effort is the recognition of the importance of the local sociocultural context. Given the focus and foundational principle of Honouring Indigenous Ways of Knowing, Being and Doing, engaging First Nations in the creation of the PBLS is critical. The Lubicon Lake First Nation's boycott of the Glenbow Museum's exhibition "One Spirit Sings" in 1988 was the impetus for bringing First Nations and museums together in a series of national discussions that resulted in the creation of a Task Force and 1994 report, *Turning the page: Forging new partnerships between museums and First Peoples*, led by the Assembly of First Nations and the Canadian Museums Association. This report describes the process and outcomes that emerged from consultations and deliberations between First Peoples and Museums, including the resulting recommendations for an ongoing working partnership.

In addition to Honouring Indigenous Ways of Knowing, Being and Doing, the ROM must understand other sociocultural dimensions of greater Toronto. *The Three Cities Within Toronto: Income Polarization among Toronto's Neighbourhoods, 1970 — 2000*, is a 2007 report describing a study of neighbourhood change over a 35-year period. Later updated

in 2010, the study found that Toronto's neighbourhoods fell into three well-defined groups:

- What the report termed City #1, is a predominantly high-income area of the city in which neighbourhood incomes have risen considerably since 1970, relative to the Toronto Census Metropolitan Area (CMA) average; these neighbourhoods are generally located in the center of the city, close to the city's subway lines.

- By contrast, City #3 is a primarily low-income part of northeastern and northwestern Toronto, in which neighbourhood incomes have fallen substantially compared to the CMA average over the past few decades; these neighbourhoods do not have easy access to transportation.

- In between these two is City #2, a primarily middle-income area, in which neighbourhood incomes have remained relatively close to the CMA average since 1970.

While all cities can be divided into various groupings, the important finding in this research is the consistent trend over time: the three groups of neighbourhoods are changing at different rates and moving further apart economically. The polarization of the city into wealthy neighbourhoods and greater numbers of low-income, under-resourced areas continues while middle-income neighbourhoods are disappearing.

> *To sincerely welcome different communities into their spaces, museums may need to reassess and even change what are considered standard museum practices. For example, at the OMCA (Oakland Museum of California), Ms. McKinley explained a Black community member brought an object to the museum, a type of wreath, to include in the Panther Party exhibition. She (the community member) felt it was very appropriate for the space. Although collections practice would ordinarily require an accessioning process that can in some cases be lengthy, prior to putting an object on display, to show trust and honour the relationship and the object, the team dropped that practice in this situation. Finally, museums cannot assume if and how different community groups would like to be involved. Many collaborations require years of relationship building to develop connection and trust, prior to being able to collaborate on a shared product.*

To build long-term, sustained relationships that can lead to co-creation, we recommend that a portion of the reimagined Play-Based Learning Space resources (space, budget and staff) be dedicated to a public platform that will respectfully bring community voices into the museum, demonstrating that those voices hold value that the museum acknowledges, and chooses to showcase. Again, communities define themselves; the museum may choose to focus on heritage groups or cultural groups such as the LGBTQ2 + community, foster families, or 'off the grid' communities. An excellent resource for these efforts would be Dr. Imara Ajani Rolston, University of Toronto. This relationship-based work can result in temporary exhibitions, video presentations, and/or public programs and, as stated earlier, will likely require a dedicated staff member to develop, nurture and maintain relationships.

SECTION SIX:
Additional Design Considerations and Technology

In addressing how to design for family learning, research has primarily focussed on exhibitions (for example, Minda Borun's work at the Franklin Institute). Exhibit characteristics that supported active family learning included physical dimensions such as being multi-sided allowing families to cluster together and accessible so that children and adults could comfortably use them. Other characteristics provided the opportunity for use by several sets of hands (or bodies), were open-ended and multi-outcome fostering group discussion and were multi-modal with formats that appealed to different learning styles and levels of knowledge.

Research also shows how critically important effective staff facilitation is to family learning. Perhaps expected, given the social nature of family learning, science center staff efforts to "coach" families to engage in inquiry in two different ways, showed that the most successful approach was a collaborative game, rather than a more individualized one since it required all family members to participate and work together. Less studied are the myriad unstructured interactions that occur between museum staff and family groups. A study at another science center showed the critical role adult family members played as gatekeepers to deeper staff engagement, reinforcing that many families arrive with their own goals for the visit and when the goals of the institution do not align with family goals the interaction often stopped or was less successful.

One of the items that conversations often circled back to, by ROM staff and members, as well as the Key Informants, was the use of technology. Rather than beginning with what technology has the capability to do, it is important to first define the intended visitor outcome to guide the creation of aligned learning opportunities. Those opportunities can then be designed to engage in authentic practices that use appropriate tools.

The opportunity to experience authentic objects, stories, and activities is one of the primary reasons that people visit museums. By offering a range of the tools that museum professionals use in their practice, visitors come to understand, participate and make human connections to the institution. The key to choosing an appropriate tool is to consider what might help visitors better notice, understand, become curious about the object, story or activity. Currently, the tendency is to first think about using digital technology, however research suggests that many parents/caregivers are concerned about the overuse of digital technology, and even visitors themselves (including youth) see museums as escape from the digital and virtual. Using technology, and simpler hands-on tools, to connect, share or see things in new ways is preferable to just another touch screen interactive. Technology is but one of many tools to support family learning.

As mentioned above, interviews with Key Informants returned to the topic of technology frequently. Informants observed that technology-based experiences should be unique from visitors' typical experiences, that is, rather than using it as a means for conveying information, explore innovative ways that it can be a tool that supports interaction and play.

Including technology in experiences as a tool, also is an equity issue since many low-income children do not have access to innovative technology-based experiences at home or in school. They also observed that technology offers unique opportunities such as "Technology like VR and augmented reality can provide connections to land and place in the area" as well as "technology can offer a powerful platform for children's voices."

Finally, we reiterate that within the Play-based learning field a debate exists as to whether there is a role for technology as a tool for learning, "playful" or not. As discussed above, one goal of the Children's Creativity Museum was to bridge the digital divide, giving kids who didn't have access to technology opportunities to learn CAD and practical skills, as well as storytelling. As they consider the next generation, they are reflecting on using technology to support young children's storytelling and identity. Technology can offer a four-year-old a platform to share a story or a dream, when they are not yet able to write. By providing technology, children can tell their stories or find their voices.

Appendix A:
Annotated Bibliographies

Principle 1: Play-Based Learning /Family Learning

Alfieri, L., Brooks, P. J., Aldrich, N. J., & Tenenbaum, H. R. (2010). Does discovery-based instruction enhance learning? *Journal of Educational Psychology*, 103, 1–18.

- This paper reviewed a sample of 164 studies comparing the impacts of discovery learning versus explicit instruction. Two types of discovery learning approaches they examined including enhanced/assisted discovery (scaffolding) and unassisted discovery.
- Studies included children, adolescents, and adults and included learning in a variety of content areas.
- Overall, explicit teaching was more effective for learning than unassisted discovery. Enhanced/unassisted discovery methods were found to be more effective than both direct teaching and unassisted discovery.

Bachman, J. & Dierking, L.D. (2011). Co-creating Playful Environments That Support Children's Science and Mathematics Learning as Cultural Activity: Insights from Home-Educating Families. *Children, Youth and Environments*, 21(2): 294-311.

- This paper describes an ethnographic study of the Science, Technology, Engineering, and Mathematics (STEM) learning practices of home-educating families, documenting the importance of negotiated, co-created, playful learning opportunities that authors argue emerge from the inherent flexibility within homeschool family systems, and because facilitators and learners have strong emotional ties to one another and value play in learning.
- Three specific situations highlight flexible and co-creative playful STEM learning activity: (1) An adult and child play and learn together through an intentionally designed "play-lesson"; (2) play emerges from an intentionally designed academic lesson; and (3) a lesson emerges during play. Photos depict each of the situations.
- Although the context is home-education, the examples offer insights into how to support the culturally relevant and natural tendencies of children to engage in play-based STEM learning and how to design or co-create science and mathematics play-learning environments.

Bonawitz, E., Shafto, P., Gweon, H., Goodman, N. D., Spelke, E., & Schulz, L. (2011). The double-edged sword of pedagogy: Instruction limits spontaneous exploration and discovery. *Cognition, 120*(3), 322–330. https://doi.org/10.1016/j.cognition.2010.10.001

- The study explored the impact of adult instruction of preschool age children's exploration of objects.
- The assumption is that children are aware of when an adult is trying to "teach" them something and will treat the interaction differently.
- There were two studies discussed.
- In the first they examined whether children would spend more time exploring a toy and explore it in more unique ways if an adult demonstrated how it works (pedagogical condition) as compared to if the adult they didn't.
- Children in the "pedagogical condition" spent less time exploring and performed few actions on the toy.
- In the second study, the focus was on how children might explore a toy after (1) being taught how to use it like in study 1, (2) watching as another child was taught how to use it, or (3) watching as an adult is taught how to use it.
- Children who were either taught how to use it or watched another child being taught how to use it performed fewer actions on the toy than those who watched an adult being taught how to use it. The children saw the context with their other children and treated it as if they themselves were being taught.
- They argue that teaching can constrain children's exploration and discovery.

Dooley, C. M., & Welch, M. M. (2014). Nature of interactions among young children and adult caregivers in a children's museum. *Early Childhood Education Journal, 42*(2), 125–132. https://doi.org/10.1007/s10643-013-0601-x

- This naturalistic, qualitative study examines the nature of child- and adult-led interactions in a children's museum, examining how children and adults engage in interactions while learning at a museum.
- Findings suggest that children and adults are almost equally likely to lead interactions, however, most child-led interactions are qualitatively different from adult-led interactions.
- Children are more likely to show-and-tell about their experiences and learn by asking questions and commenting about their play.
- Adults are more likely to teach by telling, prompting, and reporting a child's activities. Children and adults also equally engage in pretend play during their interactions.
- Leveraging these findings, recommendations are made for museum exhibit space design.

Ginsburg K.R. (2007). American Academy of Pediatrics Committee on Communications; American Academy of Pediatrics Committee on Psychosocial Aspects of Child and Family Health. The importance of play in promoting healthy child development and maintaining strong parent-child bonds. *Pediatrics.* **119(1): 182-91. doi: 10.1542/peds.2006-2697. PMID: 17200287.**

- Play is essential to development because it contributes to the cognitive, physical, social, and emotional well-being of children and youth. Play also offers an ideal opportunity for parents to engage fully with their children.

- Despite the benefits derived from play for both children and parents, time for free play has been markedly reduced for some children. This report addresses a variety of factors that have reduced play, including a hurried lifestyle, changes in family structure, and increased attention to academics and enrichment activities at the expense of recess or free child-centered play.

- This report offers guidelines on how pediatricians can advocate for children by helping families, school systems, and communities consider how best to ensure that play is protected as they seek the balance in children's lives to create the optimal developmental milieu.

Henderson, T.Z. & Atencio, D.J. (2007). Integration of play, learning, and experience: What museums afford young visitors. *Early Childhood Education Journal.* **35: 245-251. 0.1007/s10643-007-0208-1.**

- This paper examines important factors to maximize children's experiential learning in the context of inquiry-based children's museums; learning is understood as situated in physical, social, and interactive contexts in which children have opportunities to engage in play-based inquiry.

- Recommendations for maximizing children's learning in museums, supporting children's interactions with peers and adults, and offering affordances for children's play are discussed.

Hirsh-Pasek, K., Golinkoff, R. M., Berk, L., & Singer, D. G. (2009). Mandate for Playful Learning in Preschool: Presenting the Evidence. Oxford University Press. https://oxford.universitypressscholarship.com/view/10.1093/acprof:oso/9780195382716.001.0001/acprof-9780195382716

- This book takes on the false dichotomy of play and learning that impacts formal education and families' beliefs about how to prepare their children to succeed academically, placing pressure on parents/caregivers to "educate" their children.

- Due to this false dichotomy and the focus on testing in higher grades, play has been discouraged at the preschool level and evidence-based pedagogy has been ignored in favor of a didactic approach to teaching.

- The book presents evidence supporting the value of play and how it supports academic, social, and emotional outcomes by addressing the whole child. It also presents implications for practice and policy.

- Scientific evidence supports: (1) children need unstructured free play and adult guided play to prepare them for school, (2) it is essential to understand the interconnection between academic and social development, and (3) play supports learning in part because it supports children's engagement and motivation.

- This false dichotomy has its roots in opposing views of children's learning and development. On one hand is the empty vessel concept in which children are ready to receive knowledge with a focus on cognitive thinking. On the other hand, is the whole active child concept which views children as learning by actively exploring and discovering with the support of adults. The whole active child assumption views learning as not separated into domains; cognitive and social-emotional are intertwined. When children are playing, they are using and developing both cognitive and social-emotional skills, which together prepare them for school.

- Children benefit from BOTH direct instruction and play-based learning.

- Effective teaching by adults (e.g., teachers, parents/caregivers) can include direct instruction, but it also must include embedding learning in social, engaging, and meaningful activities).

- The National Association for the Education of Young Children (NAEYC) "Play provides a context for children to practice newly acquired skills and also to function on the edge of their developing capacities, to take on new social roles, attempt novel or challenging tasks, and solve complex problems that they would not (or could not) otherwise do.

- Play is a vague concept, but the authors list eight features of play (in another paper by the same authors, they specify that these are characteristics of "free play" rather than "playful learning"): (1) it is pleasurable and enjoyable, (2) has no extrinsic goals (3) is spontaneous, (4) involves active engagement, (5) is generally all-engrossing, (6) often has a private reality, (7) is nonliteral, and (8) can contain a certain element of make-believe.

- Three types of play include (1) object play- exploring and manipulating objects, (2) pretend play – make-believe, fantasy, symbolic, sociodramatic, dramatic play; (3) physical or rough-and-tumble play

- "Playful learning" is play that supports academic learning. Teachers can embed learning goals in children's play. Play-based learning can be guided learning.

- The authors list seven evidence-based principles of how young children learn that provide support for the importance of playful learning.

  1. Policies, programs, and products should be informed by child development research. And development should be viewed as a process or pattern rather than as distinct events that happen at particular ages.

  2. Children are active, not passive learners.

  3. Humans are inherently social beings. Children's learning is best supported by social interaction.

4. It is essential to provide opportunities for children to develop social and emotional skills. Some skills include self-regulation, flexibility and compromise, and perspective-taking.

5. We learn best when information is embedded in meaningful contexts and activities rather than in isolated and artificial contexts. This also relates to the importance of connecting learning to children's own lives, their prior experience, and knowledge.

6. The process of learning is as important as the outcome. Similar to #4, it is essential to provide opportunities for skill development for children to succeed academically. Such skills include language, directing attention, problem solving, flexible thinking, and self-regulation. (Many of these are also called 21st-century or soft skills).

7. It is essential to recognize and respect variability in skills and needs in order to support individual differences.

Ilgaz, H., Hassinger-Das, B., Hirsh-Pasek, K., & Golinkoff, R. M. (2018). Making the case for playful learning. In M. Fleer & B. van Oers (Eds.), *International Handbook of Early Childhood Education* (pp. 1245–1263). Springer Netherlands. https://doi.org/10.1007/978-94-024-0927-7_64

- They review the research on "guided play, "which is between "adult-directed didactic instruction and child-directed free play."
- Unlike free play which is generally devoid of adult-imposed rules or constraints (Pellegrini, 2009) playful learning targets specific learning objectives (Ilgaz et al., 2018).
- Guided play is developmentally appropriate scaffolded instruction while also enjoyable.
- Child-led so they lead the play and their own learning and discovery, but with adult guidance. Adult guidance can include setting up the learning environment, commenting on the child's activity, asking questions, etc.
- Adults take the role of coach rather than teacher or bystander.
- In play-based learning, children have ownership of their play which means the context is meaningful and interesting.
- They provide a review of research that suggests that a guided learning approach supports learning in the following areas: language and literacy, math, science, and socio-emotional development.

Kangas, M. 2010. Creative and playful learning: Learning through game co-creation and games in a playful learning environment. *Thinking Skills and Creativity,* 5(1): 1-15.

- This paper reports on a pilot study in which children aged 7–12 (N = 68) had an opportunity to study in a novel formal and informal learning setting. The learning activities were extended from the classroom to a play-based learning environment

(PLE), an innovative playground enriched by technological tools.

- Curriculum-based learning was intertwined with game co-creation, play, and computer games in the PLE.
- The results indicate that the children considered learning in groups, through co-creation and turning fact into fiction, to be a rewarding way to learn, practice group work and use their imagination for a common goal.
- The focus of this study was the use of this technology to extend school learning goals and teachers felt their role was important but challenging, especially in terms of the amount of tutoring and lesson planning.
- The study shows that one way to foster activity, creativity, imagination, and group work skills, is to integrate fact and fiction and a playful learning environment in teaching and learning.
- Perhaps these findings might have applications for family learning in museums, or as a way to enhance and reinforce the museum experience back at home.

Krakowski, P. (2012). Museum Superheroes: The Role of Play in Young Children's Lives. *Journal of Museum Education*, 37(1), 49–58.

- This study looked at a kindergarten field trip to the Warhol Museum to analyze how playing takes an important role.
- The study was developed in collaboration with the teachers and museum educators.
- They used superheroes as the theme.
- The children were then asked a year later to recall their trip to the museum and the activities that took place.
- The study showed that the children had a high recollection of the events.
- There are several key points brought up from the study, which include: active engagement, intrinsic motivation and flow, identity and role-play, symbolic thought and imagination and memory-in-action.

Letourneau, S.M., Meisner, R., Neuwirth, J.L., and Sobel, D.M. (2017). What do caregivers notice and value about how children learn through play in a children's museum?, *Journal of Museum Education*, 42 (1): 87-98. 10.1080/10598650.2016.1260436.

- In two studies, Providence Children's Museum investigated caregivers' observations and perceptions of their children's play and learning at the museum. In the first, caregivers (*N*=40) were interviewed about what they observed children doing, what they believed children were thinking about, and their own thoughts and actions while watching children play.
- In the second, caregivers (*N*=22) described what they valued about their museum visits, and what types of learning might occur through play in general and at the museum.

- Responses showed that most caregivers reflected on their children's play and articulated a variety of benefits of museum visits for their children. Nevertheless, some found it challenging to articulate how children learned by playing at the museum, even when they believed that children learned through play in general.
- The findings informed the development of exhibit materials that aimed to make learning through play more visible within the museum.

Mardell, B., Wilson, D., Ryan, J., Ertel, K., Krechevsky, M., & Baker, M. (2016). Towards a pedagogy of play. *Harvard Graduate School of Education (Project Zero Working Paper).* **https://pz.harvard.edu/sites/default/files/Towards%20a%20Pedagogy%20of%20Play.pdf**

http://www.pz.harvard.edu/projects/pedagogy-of-play

- They discuss the difficulty of implementing play in schools. For those who support it, they find that there is a lack of resources to do it. Others see play as running counter to school learning.
- They present a research initiative called the "pedagogy of play" as an approach to combining play-based learning and teaching in schools.
- Core tenets of play include taking risks, making mistakes, exploring new ideas, and experiencing joy.
- Across different conceptions of play, they talk about some components including that it is "pleasurable, spontaneous, non-goal directed activity that can include anticipation, flow and surprise".
- They make a distinction between play and playful.
- Playful learning supports intellectual, social, emotional, and physical development.
- They created a tool that assesses different Indicators of Playful Learning. This is based on a model of play-based learning that includes three overlapping categories: delight, wonder, and choice. The figure shows these categories and the relevant observable behaviors.
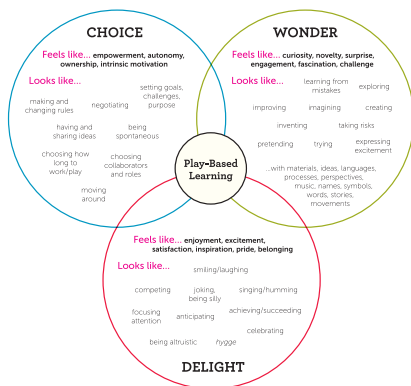
Mayfield, M.I. 2005. Children's museums: Purposes, practices and play? *Early Child Development and Care,* **175(2): 179–192.**

- This article briefly discusses the history and development of children's museums, their definitions, missions/goals and models, based on observations of 30 children's museums in Europe, North America, South America and the Middle East.
- The author argues that one of the prerequisites for children's play is a place that is safe, accessible, stimulating, and caretaker approved, thus children's museums fill a critical need.
- In terms of the mission/goals of children's museums, she discusses that the underlying philosophies (she mentions Dewey, Montessori and Piaget) support the rationale of emphasizing hands-on learning, interaction with real materials and intergenerational participation in a community context.
- In a content analysis of the stated missions/goals of more than two dozen children's museums, the following key words appeared most frequently in this order: (1) Learning (e.g. to enrich children's lives, broaden their cultural experience and provide them with a creative space in which to learn about the world [Canadian Children's Museum]), (2) Interactive/hands-on (e.g. to teach children more about themselves and the world around them within an interactive learning environment [Manitoba Children's Museum]), (3) Fun/ enjoyment/joy (e.g. where fun meets learning [Minnesota Children's Museum]) and (4) Play (e.g. learning through play [and] a place for families to learn and play together [Santa Fe Children's Museum]).
- One challenge the author identified is the lack of research on children and family play in children's museums. She discusses a study at a grocery store exhibition at the Austin Children's Museum in which they found there was less mutually engaging, responsive role play at the children's museum, than at home. The difficulty was that children engaged in role play, but parents tended to remain outside the play frame in a directing or prompting role. Parents reported that they were reluctant to role play in a museum and thought they had a duty to teach in a museum setting. Researchers concluded that the process of play at the museum suggests that the parent-child play interactions observed may have been too structured, too didactic (teacher/school-like), or too brief to engender the benefits of engaged social pretend play, in part because of the role parents thought they *should* play.

Milteer R.M. and Ginsburg K.R. (2012). The importance of play in promoting healthy child development and maintaining strong parent-child bond: Focus on children in poverty. Council on Communications and Media; Committee on Psychosocial Aspects of Child And Family Health. *Pediatrics.* **129(1):204-13. doi: 10.1542/ peds.2011-2953.**

- Play is essential to the social, emotional, cognitive, and physical well-being of children beginning in early childhood.
- It is a natural tool for children to develop resiliency as they learn to cooperate, overcome challenges, and negotiate with others.

- Play also allows children to be creative and use their imaginations. It provides time for parents to be fully engaged with their children, to bond with their children, and to see the world from the perspective of their child.

- However, children who live in poverty often face socioeconomic obstacles that impede their rights to have playtime, thus affecting their healthy social-emotional development.

- For children who are under-resourced to reach their highest potential, it is essential that parents, educators, and pediatricians recognize the importance of lifelong benefits that children gain from play.

Playful Learning Landscapes Action Network. (n.d.). Playful Learning Landscapes Action Network. Retrieved May 19, 2022, from https://playfullearninglandscapes. com/

- This is an initiative that embeds play into public spaces by transforming everyday spaces such as supermarkets, bus stops, and parks in order support children's learning.

- They co-create these experiences with communities. They focus on "communities in need."

- They discuss some creative examples of how they have done this and provide research evidence of the effectiveness, building on the following principles of how children make play: (1) fun, (2) active, (3) engaging, (4) meaningful, and (5) socially interactive.

- They focus on the following: collaboration (building something together), communication (talking, writing, listening), content (academic skills, learning facts, or acquiring self-regulatory behaviors), critical thinking (sifting through information and problem solving), creative innovation (thinking of new and original ways to solve problems), and confidence (persisting through failure). Evidence has shown that play is best for learning these skills when it is joyful, meaningful, socially interactive, actively engaging, and iterative.

Rogowsky, B.A., Terwilliger, C.C. Craig, Young, A. & Kribbs, E.E. (2018) Playful learning with technology: The effect of computer-assisted playful instruction on literacy and numeracy skills of preschoolers, International Journal of Play, 7:1, 60-80, DOI: 10.1080/21594937.2017.1348324

- This quantitative study examined the effects of computer-assisted instruction – framed as playful activity and presented via an e-tablet – on the literacy and numeracy skills of preschoolers enrolled in a private, suburban childcare center in the eastern United States.

- Two groups [comparison (n = 23) and computer-assisted (n = 24)] participated in this 11-week study. All children engaged with self-selected, imaginative learning centers. Additionally, the computer-assisted group completed 10 minutes of daily, individualized instruction using interactive, educational software.

- Scores on achievement tests were collected at the beginning of the study and immediately after the intervention. The two groups were compared on achievement of literacy skills (e.g., letter–word identification, picture/definitional vocabulary, phonological awareness) and numeracy skills (e.g., number recognition, counting, sizes/comparisons, applied problems, quantitative concepts, shapes). Results revealed significant differences between the groups on post-achievement tests, indicating that play-basedlearning through educational software may enhance literacy and numeracy skills among preschoolers

Shine, S. and Acosta, T.Y. (2008). Parent-child social play in a children's museum. Family Relations: Interdisciplinary Journal of Family Science. 49 (1): 45-52. https:// doi.org/10.1111/j.1741-3729.2000.00045

- Two studies examined pretend play in families visiting a children's museum. In Study One, families were observed visiting an exhibit inviting visitors to try on roles. Parent-child play was found to be brief, sporadic, and not dependent on prompting or reinforcement.

- In Study Two, families were invited to visit four exhibits and parents were interviewed. Parents were found to prompt, support, and observe more than engage in pretend play. Implications for family educators and museum designers are discussed.

Whitton, N. (2018). Playful learning: tools, techniques, and tactics. Research in Learning Technology, 26:

- Over the past decade, there has been an increased use of play-based approaches to teaching and learning in higher education. Proponents argue that creating 'safe' playful spaces supports learning from failure, management of risk-taking, creativity and innovation, as well as increasing the enjoyment of learning for many students. However, the emergent field of play-based learning in adulthood is under-explored, and there is a lack of appreciation of the nuanced and exclusive nature of adult play.

- This article first examines the theoretical background to the field, providing an initial definition of 'playful learning' and presenting a hypothesis of why play is important for learning throughout the life course.

- Although focused on adult learning, there are possible applications to the adults that support children in their learning, in and from museums, since research shows that adults visiting museums with children, even children's museums, that ostensibly include playful learning goals, are sometimes challenged to understand the role of play in their children's learning, and likely do not consider it in their own.

- Drawing on play-based learning literature and empirical experience, the author frames playful learning in the context of adults, specifically in higher education, in terms of three categories: playful tools, playful techniques, and playful tactics (see Table 1 below with reference to her work). Although she suggests this taxonomy is perhaps only relevant to adults in higher education contexts, it seems applicable to thinking about play-based learning in a museum as well.

- Playful tools describe the playful objects, artefacts and technologies that signify the existence of a playful learning environment and can be used to encourage or develop playfulness. Importantly, she makes a point that she considers technologies not limited to digital artefacts but also objects that are engineered to foster play, noting that there are clearly many developments in digital gaming and simulations that could be considered play-based learning, but to limit the scope of playful technologies to digital would be unnecessarily restrictive, particularly since there is a resurgence in the use of traditional games and toys such as Lego in higher education.

Table 1. Playful learning tools, techniques, and tactics.

Playful learning...	Description	Examples
Tools	Objects, artefacts and technologies that signify a playful environment.	Games Toys Simulations Puzzles Virtual environments
Techniques	Pedagogies and learning approaches that facilitate play.	Role play Making Performance Problems Quests
Tactics	Mechanics and attributes that engender playfulness.	Surprise Humour Chance Competition Storytelling Mystery Badges

Citation: Research in Learning Technology 2018, **26**: 2035 - http://dx.doi.org/10.25304/rlt.v26.2035

- The article concludes by highlighting three central issues for this emerging field: lack of a research trajectory; the language of play; and the unacknowledged privilege inherent in the use of play-based learning.

Family Learning

Ash, D. (2004). How Families Use Questions at Dioramas: Ideas for Exhibit Design. *Curator: The Museum Journal*, 47(1), 84–100. https://doi.org/10.1111/j.2151-6952.2004.tb00367.x

- This study examined the role of questions in advancing family science, specifically around biology, conversation and how it can be used as a tool to assess family engagement with an exhibit.
- They conducted an in-depth study of families with children ages 4-8 years old as they interacted with diorama exhibits at the Natural History Museum of Los Angeles County.
- They analyzed family conversations for their use of questions.
- Effective questions are ones that move the conversation forward and allow for multiple people to engage. They also allow for making connections to prior experience and knowledge.

- Open-ended questions are an example of an effective strategy.
- Questions can be used by adults to assess children's understanding and can inform how to move the conversation forward.

Bachman, J. & Dierking, L.D. (2011). Reframing parent involvement: Museums and home-educating families. *Museums and Social Issues*, 5(1): 51-66.

- A sub-study within a Ph.D. dissertation focused on home-educating families; What do home-educators want museums to know about them?
  » Treat as equals (parents are capable teachers & co-learners)
  » Want extended experiences (pre-post resources, connect to other museums /libraries, community service)
  » Age does not connote "grade" level.
  » Children and adults enjoy complexity--don't over simplify.
  » Special experiences are important--meet a curator, researcher, exhibit designer, peek behind scenes
  » Affordability/access for rural families

Borun, M., & Dritsas, J. (1997). Developing family-friendly exhibits. *Curator: The Museum Journal*, 40(3), 178–196.

- This article focused on identifying components of successful family learning exhibits, as a part of the US-National Science Foundation (NSF)-funded PISEC (Philadelphia-Camden Informal Science Education Collaborative) Family Learning Project.
- In a study researchers identified seven exhibit characteristics that support active family learning:
  » multi-sided: family can cluster around exhibit.
  » multi-user: interaction allows for several sets of hands (or bodies)
  » accessible: comfortably used by children and adults.
  » multi-outcome: observation and interaction are sufficiently complex to foster group discussion.
  » multimodal: appeals to different learning styles and levels of knowledge.
  » readable: text is arranged in easily understood segments; and
  » relevant: provides cognitive links to visitors' existing knowledge and foster group discussion; experience.
- Four informal science learning institutions prototyped exhibits that incorporated at least some of these components.
- Evaluation data examined how families interacted with the prototypes, what key ideas they took away, and their general experience with the exhibit.

- Incorporating these components led to exhibits having more "attracting, holding, and communicating power." They increased family interaction. And it supported families in learning about the key ideas of the exhibit.

Callanan, M., Jipson, J. L., & Soennichsen, M. (2002). Maps, globes, and videos: Parent – child conversations about representational objects. In S. Paris (Ed.), Perspectives on Children's Object-Centered Learning in Museums (pp. 261–283). Erlbaum.

- Understanding the symbolic nature of representational objects including maps, globes, and video is challenging for preschool aged kids.
- This study explored one way in which children might learn about the symbolic relationships of representation objects; how might parents' talk about such objects play a role?
- The study involved 42 families with children of varying ages.
- Families were video recorded as they interacted with exhibits at the Children's Discovery Museum of San Jose. Exhibits ranged in the type of representational object used: (1) maps and aerial photographs, (2) globe, and (3) video (camera is mounted on a train as it goes around a track, sending an image to a monitor).
- Across all three exhibits, families rarely explicitly explain the objects as symbols. Rather they tended to label specific parts of the object and make it familiar to their child. (e.g., looking at an aerial photo, the parent might point out where the child's school is).
- When families were at the exhibits with either the map, aerial photo, or video, they tended to not refer to the object itself, but instead talked about what was depicted in the map and photo,
- At the globe exhibit, parents tended to talk about the globe itself rather than what it represents. Perhaps because they assume their child is already familiar with the symbolic nature of globes.
- The type of representational object impacted family conversation.
- When designed exhibits, museums can consider how children understand representational objects of different kinds and the importance of family conversation on children's learning.

Dierking, L.D. (1989). The family museum experience: Implications from research. *Journal of Museum Education*, 14:2, 9-11, DOI: 10.1080/10598650.1989.11510106.

- This article focuses on the family museum experience to date and its implications for museum educators, with three sections: (1) Characteristics of families that influence their informal learning setting visits (2) Behaviors of families in informal learning settings, and (3) Implications of these findings for museum educators.
- Family learning is influenced by a number of variables including the visitor's prior knowledge and experience, the type of exhibit, the gender and age of the parents and children interacting, and at what point during the visit families encounter a particular exhibit.
- Implications for museum educators included five important points to consider in the design of exhibition spaces and family programs.
    » A family comes to the museum with its own agenda, and, rather than fighting it, try to accommodate it.

Dierking, L.D. & Falk, J.H. (1994). Family behavior and learning in informal science settings: A review of the research, *Science Education*, 78(1):57-72. 1994.

- This review discusses the importance of family learning in free-choice learning settings, first noting how critically important it is to clarify how family is defined in the various studies, most of which are: a "family" group is a social group containing at least one child and one adult.
- It also notes that although families come in many shapes and sizes, many of the more systematic studies restricted themselves to investigating families with no more than four adults and no more than five children for ease of data collection, or even focus on adult-child pairs.
- Also, because these studies were conducted with self-selected, casual visitors, article also notes that most of the families studied were middle class, White (Caucasian) families as these kinds of families represented the bulk of museum users in 1989, suggesting this as an issue of great concern to the informal science community, many of whom are attempting to increase public visitation by underrepresented audiences and highlighting that as family audiences expand to include traditionally underrepresented groups, it will be important to broaden studies to include these families as well to ensure that findings are generalizable.
- Review is divided into the following sections: (1) studies of family group interactions, time allocation, and agendas in informal science settings; (2) studies investigating family learning in informal science settings and (3) Conclusions and implications for science teaching and learning, as well as further research.
    » Families are attending to exhibitions, discussing content within them, and interacting with individual exhibits in ways that strongly suggest learning has occurred.
    » Parents, and to a lesser extent children, are attempting to relate the information contained within individual exhibits to their previous knowledge and experience, reinforcing the importance of the visitor's prior knowledge and experience on the museum visit.
    » Family learning involves both cognitive and affective domains and appears to be socially mediated.
    » In most situations research observed that mothers were much less likely than other family members to choose what exhibits to view and more likely to follow other members of the group to the exhibits; they also appeared to be interacting at higher

cognitive levels with sons than daughters, but such gender-based interactions seem much more complex than originally thought and deserve further investigation.

  » There was modest evidence that pre-activity instruction for parents may be useful in enhancing the learning of children within a family, suggesting this as an area of further study.

  » When more naturalistic methodologies were utilized enabling researchers to analyze the family museum experience within its own rich social and physical context, there was evidence of learning.

Dierking, L.D. (2004). Family Learning 101 – Engage Families. Engage Families: A Project of the USS Constitution Museum. Retrieved May 25, 2022, from https://engagefamilies.org/family-learning-101/

This resource is one product of the USS Constitution Museum's *Engage Families!: Successful family programs in museums and libraries* project, funded by the US-Institute of Museum and Library Services (IMLS)' National Leadership program. The goal of the project was to understand and effectively support family engagement in cultural institutions, particularly history museums.

- Discusses much of the research around family learning. She argues that family members support children in developing a joy for learning. It is the first learning group we belong to. And it takes place throughout our lives.

- Families together construct knowledge and understanding, which becomes part of their shared family narrative and a resource they can tap into in the future.

- Defining "family" needs to be broad, allowing groups to self-define.

- Learning is seen as rather broad; not just limited to learning facts, but it also includes attitudes, values, beliefs, understanding of how one thinks, etc.

- Learning happens within everyday contexts.

- Museums are settings that enable families to learn together. And families are an important audience for museums. Children who attend a museum with their family are more likely to visit these institutions as an adult as compared to those who attend with school groups.

- Family engagement with museum components is observed after the visit.

Dierking, L.D., Andersen, N., Ellenbogen, K., Donnelly, C., Luke, J., and Cunningham, K. (2005) The Family Learning Initiative at The Children's Museum of Indianapolis: Integrating Research, Practice & Assessment, *Hand-to-Hand.* Association of Children Museums.

- This article describes the Family Learning Initiative initiated in 2001 by The Children's Museum (TCM) of Indianapolis and the Institute for Learning Innovation, Annapolis, MD. The Initiative was a multi-year systemic research, evaluation and professional

- development effort designed to investigate family learning at TCM and the role that the museum plays in facilitating that learning.

- In addition to research, evaluation and professional development, a fundamental decision was made by TCM and the Institute that an important outcome of the collaboration would be its influence on practice; by continually assessing and identifying strategies for effectively enriching family learning, TCM staff hoped to gain concrete suggestions for how to enhance their efforts in this arena. There were five long-term goals for the Initiative:

  » Determine the baseline perceived learning needs and expectations of visiting families.

  » Assess the current impact of TCM's experiences on family learning.

  » Build internal capacity within staff to facilitate family learning and conduct meaningful short- and long-term assessments of the influence of TCM experiences on this learning.

  » Create a structure for systematically assessing long-term impact of all future TCM experiences on family learning.

  » Reinforce and enhance TCM's role as a leader, locally and nationally, in free-choice learning in general and family learning in particular.

The Family Learning Initiative team also created a staff training guide that identified the following characteristics of family learning:

- Family learning is playful, fun, and a social experience.

- Family learning is influenced by the ages of the children and adults in the group

- Families all learn in different ways.

- Families find value in their own personal observations and experiences by working, talking, and solving problems together

- Families value conversation.

Eberbach, C., & Crowley, K. (2005). From living to virtual: Learning from museum objects. *Curator: The Museum Journal*, 48(3), 317–338.

- This study focused on family learning in a botanical garden and how family conversations around exhibits varied depending on whether the plant type was living, a model, or virtual.

- The type of learning focused on was building explanations about pollination.

- There were 12 families with children ages 6-9. Each family interacted with each type of plant (living, model, and virtual).

- Family conversations were video recorded and later analyzed for the frequency and types of explanations discussed.

- Types of explanations included:

- » Analogical explanations = those in which one thing is like something else.
- » Principled explanations = those in which families either literally or conceptually refer to an organizing scientific principle (e.g., evolution, or genetics).
- » Causal explanations = those in which X causes Y, or X needs Y to do Z.
- » Process explanations = accounts of unfolding or sequential events that did not cast one event as a cause and one as an effect.

- Findings:
  - » Process explanations were more frequent overall.
  - » Model plants supported more process explanations than did the living plants.
  - » the model and virtual plants supported more connections to school than to everyday, informal contexts.
  - » Family conversations around model and virtual plants were similar.
  - » the living plant supported more connections to everyday experiences than the virtual plan.

Falk, J.H. (1995). Factors influencing African American leisure time utilization of museums *Journal of Leisure Research, 27*(1): 41-60. DOI: 10.1080/00222216.1995.11969976

- This US-NSF-funded study investigated variables that influence the utilization of museums by African Americans. A sample of 333 African Americans from six Eastern U.S. communities were interviewed at home about their leisure activities, particularly, their use of museum-like settings.
- Key variables that influenced visits to museums were income, education, the community in which individuals lived, childhood experiences and participation in church-related activities. Although SES, cultural differences and latent racism influenced whether African Americans used museums presently, historic access to museums during childhood were equally important. These factors included whether there were museums in the community, as well as lack of access due to segregation, tacit racism/exclusion, SES, and education.
- Visiting museums as a child with one's family correlated more highly with adult use of museums among the African Americans in this sample, than did visiting these institutions with a school group.

Gutwill, J. P., & Allen, S. (2010). Facilitating family group inquiry at science museum exhibits. *Science Education, 94*(4), 710–742; https://www.exploratorium.edu/sites/default/files/pdfs/GIVE-at-explo.pdf

- This study was part of the US-NSF-funded Group Inquiry by Visitors at Exhibits (GIVE) project at the Exploratorium. The project aimed to create experiences to teach visitors an effective inquiry process.

- They asked if intergenerational groups (e.g., families) can be coached by museum staff to learn inquiry skills? How can such an intervention affect inquiry behaviors at a new exhibit? What components of the intervention are most effective?
- There were two Inquiry Games, both focused on proposing actions and interpreting results.
  - » Juicy Question game (a more collaborative game), families take turns sharing a question they have about the exhibit and together they investigate.
  - » Hands-Off game (a more individualized game), anyone at any time can call "hands off!" and others stop using the exhibit to listen to the caller either propose something to investigate or something they discovered about the exhibit.
- There were 200 families. 50 engaged in the juicy question game, 50 in the hands-off game, and the rest in two types of control conditions.
- Families were video recorded engaged in exhibits in a separate area of the museum. They engaged with 4 exhibits – the first was a "pre-test", in the next two they learned the inquiry game, and the fourth exhibit was used to see if they used the inquiry skills. Some families were later interviewed.
- They found that families who learned the inquiry games improved their inquiry more than the other families. However, the Juicy Question game was most successful in improving families' engagement in inquiry. They argue that it was most successful because it required all family members to participate and work together.

Hood, M.G. (1989) Leisure criteria of family participation and nonparticipation in museums, *Marriage & Family Review*, 13:3-4, 151-169, DOI: 10.1300/J002v13n03_09

- Six attributes of leisure participation are identified as basic criteria for leisure choices. Criteria valued by the family-centered audience differed from those prized by museum programmers and frequent museum visitors.
- The family audience was primarily interested in social interaction, active participation, and entertainment values in leisure, while museum staff focus on providing learning opportunities. Changing family structures and lifestyles challenge museums to offer experiences that new styles of families will find appealing and content that frequent museum visitors seek and find satisfying.

Jensen, N. (1994). Children's perceptions of their museum experiences: A contextual perspective. *Children's Environments, 11*(4), 300–324.

- This study explored from contextual and constructivist perspectives how 30 9–10-yr.-olds perceived their experiences in museums in relation to the other places they visit. The Ss tended to categorize places by their relationship to them, placing museums most frequently in groupings organized by quality descriptors, when they visit, and social context.
- They perceived and valued museums as places to look at unique, special things of

interest to them. Most Ss preferred visiting museums with family and friends, with control of their actions and experience emerging as a key issue. Personal interests and family and cultural background emerged as the most important factors influencing their museum experiences. The Ss viewed museums, along with schools and libraries, as places for learning but were divided in their designations of museums as fun, boring, or a combination of the two. (PsycINFO Database Record (c) 2016 APA, all rights reserved)

Luce, M. R., Goldman, S., & Vea, T. (2017). Designing for Family Science Explorations Anytime, Anywhere: DESIGNING FOR FAMILY SCIENCE. *Science Education, 101*(2), 251–277. https://doi.org/10.1002/sce.21259

- This study builds on the idea that families are an important context for children's learning, that effective learning builds on families' "funds of knowledge" or their cultural knowledge, practices, and expertise, and that learning can happen anywhere in the course of everyday family activities.

- They designed resources to support families in learning science in everyday environments. These resources ("Anytime, Anywhere" activity prompts and conversation starters) to support families in engaging in exploratory and open-ended activities.

- They focus on the idea of "scientific sensemaking", challenging the traditional view of science, often associated with school. This approach assumes that doing science is an "active process of questioning and exploration in which people's ideas are generated, discussed, and built upon. The emphasis is on reasoning and active exploration, rather than seeking one correct answer."

- Scientific sensemaking involves collaboration (family members as co-participants) and playfulness. Playfulness is used to make science less intimidating and as a way to facilitate learning because it is self-driven, exploratory, and open-ended.

- It's an in-depth study in which their video recorded 3 families with children 2-9 as they used the designed tool in a beach setting. They observed family interactions and conversations looking for family engagement in explaining, eliciting and evaluating ideas, collaborative exploration and sensemaking, and rescuing and sustaining interest.

- Activities involved (1) making observations of different sand patterns and thinking through explanations for those observations, (2) experimenting with making music different pieces of driftwood, (3) predicting and experimenting with throwing a ball into the ocean and seeing how wave patterns impact where it goes, (4) creating a story about the journey of found driftwood.

- These activities were found to encourage collaboration and playfulness while also showing how scientific thinking was reflecting in their conversations in emerging ways.

- Since science learning involves engaging with ideas over time and contexts, there were activities that remained unresolved but were set up for future learning opportunities.

- Some design recommendations that emerged included: (1) "Prompt exploration of specific phenomena in localized contexts, instead of abstract principles generalized across many phenomena"; (2) "Prompt exploration of phenomena for which nobody "knows the answer" and lessen the potential for one person to pre-emptively discount ideas"; (3) Prompt exploration of phenomena for which people will likely have multiple competing ideas to discuss."

McClain, L. R., & Zimmerman, H. T. (2014). Prior experiences shaping family science conversations at a nature center. *Science Education, 98*(6), 1009–1032. https://doi.org/10.1002/sce.21134

- In this study they examine the role of prior experiences in family science conversations and learning, viewing learning as a continuous process of constructing meaning out of present and prior experience and knowledge. This can happen collaboratively in social interactions.

- They view prior family experiences as important for learning because such shared experiences can act as tools for family conversations and the connections they make together.

- To support individuals in making meaning, informal learning educators can present stories☺ ones that are authentic, relevant, and relatable building on your specific audience's prior experience and knowledge.

- They explored the sources of families' prior experiences they referred to when on a nature walk and how prior experiences were used in family conversations.

- There were 16 families with children ages 3-15 years old and the study was conducted at the Shaver's Creek Environmental Center (SCEC). Families were video recorded as they went on a nature walk at SCEC.

- Family conversations were coded for references to different types of prior experiences. These included everyday experiences (e.g., dinner conversations, neighborhood walks, hobbies), design spaces (e.g., museums, playgrounds), programs for science learning, science and other media, and school. They also coded for references to things they experienced earlier on their walk.

- They found that families (adults and children) often referred to prior experiences on their walk. They argue that making these connections set them up for future learning. They also suspected that this happened often because there were few interpretive signs, so families relied on their own experiences to anchor and extend their learning. So not including signage supported families in making personal connections to nature.

- In terms of the source of the prior experiences, families almost exclusively referred to out-of-school settings rather than school. They most often referred to prior everyday experiences. The second most common were references to designed spaces (including informal institutions). Some families made references to something seen earlier in the day.

- References to prior experience helped to make more meaningful connections to the place. They also made these references to explain and defend their observations. Parents would sometimes prompt their child to share information they learned prior to the walk.

- They concluded that family science learning involved parents and children both actively participating and that prior experiences played an important role in shaping their conversation and learning.
- It is important for the field to understand how science learning (and learning in general) occurs in the settings that families navigate.

Middleton, M. (2022). Who's in a Family? Confronting Assumptions About Children and Their Caregivers. *Exhibition*, 55–62.

- This paper argues that museums make assumptions about who their visitors are, specifically as related to what a family is. And this assumption is reflected in exhibit design choices.
- The default definition of family is of a "nuclear family" with children with heterosexual, married parents.
- Families can also include a single parent, multigenerational households, same sex parents, etc.
- It presents a "Family-Inclusive Language Guide", which can be used in creating signage, to broaden definitions of "family" to be inclusive of many configurations and relationships.
- Use inclusive language:
  » Use "grownup," "adult", or "caregiver" rather than "parents", "mom", or "dad."
  » Use "children" rather than "son" or "daughter"
  » Use "family" rather than "extended family."
  » Don't talk about family resemblance.
  » Use "family members" rather than "members of a household."
- Choose visuals intentionally and consider whether visuals assume a certain definition of family.
- Design exhibit spaces to accommodate larger families.

Moussouri, T. 2003. Negotiated agendas: Families in science and technology museums. *International Journal of Technology Management 25(5) DOI: 10.1504/IJTM.2003.003114*

- This paper argues for the importance of museum professionals and policy makers to understand the expectations and perceptions of family groups. Family agendas influence the way the visit is perceived and accounted for.
- In turn, the museum agenda – that is the overall aim of the museum, as well as its expectations for the visitor experience – influences the agenda of the family.
  » This paper aims to give an insight into how family groups make sense of their visit to a hands-on museum and to discuss their experience in their own terms, including their perceptions of interactive science exhibitions.

Pattison, S.A. & Dierking, L.D. 2012. Exploring staff facilitation that supports family learning. *Journal of Museum Education, 37(3): 69-80.*

- Article discusses a qualitative master's study of 63 video-taped unstructured, informal interactions between staff and families in a science center, focusing particularly on the role of adult family members. Despite the prevalence of these interactions little research has been conducted in the area. This publication described the study and its findings, highlighting their implications for professional learning efforts with staff.
- It was conducted in two Oregon Museum of Science & Industry (OMSI) exhibitions: the Chemistry Lab and the Physics Lab, in which staff move around, approaching families informally, offering help and asking questions as they interact at individual exhibits
- Findings showed the ways in which staff facilitation interacts with the social context of family learning. The staff agenda was to "teach" the family, usually the child(ren), about the chemistry and physics principles they were exploring. If this was a goal of the family, interactions were successful, but when this agenda did not align with the family, the interactions were problematic. This demonstrated the critical role of negotiation between staff and family, particularly negotiating the role of the family facilitator vis-à-vis the staff member.
- The primary family facilitator (often the adult, although not always) were gatekeepers to the interaction; if the family facilitator was ignored or only partially acknowledged, interactions with staff were brief and even contested; in turn, staff facilitation was only effective if the family facilitator fully acknowledged and reinforced the staff member's role.
- The most effective facilitation occurred when the staff facilitator and family facilitator collaborated, or the staff member recognized that the family facilitator needed no assistance and moved on, suggesting that to successfully facilitate family learning, museum educators must carefully consider the role of family facilitators, and the unique social context of family learning. At the time, Pattison worked at OMSI and offered workshops sharing these findings, including videos of interactions, with staff facilitators.

Pattison, S.A. & Dierking, L.D. 2013. Staff-mediated learning in museums: A social interaction perspective. *Visitor Studies, 16(2): 117-143. 69-80.*

- Article discusses the previous qualitative study of video-taped unstructured, informal interactions between staff and families in a science center, focusing particularly on the role of adult family members. This publication focused more deeply on the theoretical underpinnings of the study, framed within everyday social interaction, sociolinguistics, and mediated discourse literature. Everyday social interaction and sociolinguistics research has rarely been applied to studying family learning in free-choice settings, but offered insights into the rules and patterns that govern everyday interactions, and how they shape unstructured staff-visitor interactions.

- Three broad research questions guided the study:
  » What is the nature of unstructured interactions between museum staff and family groups in science centers?
  » How do staff members and family groups initiate unstructured interactions in these settings?
  » How do families and staff negotiate roles and goals during unstructured interactions in these settings?

- Close video-analysis revealed the complexities of staff-family interactions and highlighted the strong role of negotiation patterns throughout. Three phases of role negotiation emerged: (a) initiating the interaction, (b) facilitating learning, and (c) introducing new goals. During each of these phases, staff and family members used social practices, appropriate in both everyday settings and, especially, museum contexts, to assert, support, and contest roles and to negotiate changing goals that aligned with family or staff goals. Findings highlighted the importance of opening sequences such as greetings; the negotiation of roles and relationships; and nonverbal communication between staff and family facilitators.

- More generally, the findings highlight that understanding the social nature of staff-family interactions (the "how"), may be as critical as studying the educational content of staff-facilitated activities and programs (the "what").

Pattison, S.A., and Dierking, L.D. Early childhood science interest development: Variation in interest patterns and parent–child interactions among low-income families. *Science Education*. 2019; 103: 362– 388. https://doi.org/10.1002/sce.21486.

- Fostering interest in science is critical for broadening engagement with science topics, careers, and hobbies.
- Research suggests that these interests begin to form as early as preschool and have long-term implications for participation and learning. However, little research has focused on the processes that shape interest development at this age when children's exposure to science primarily occurs during family-based learning experiences.
- This article describes a qualitative study with seven low-income mothers and their four-year-old daughters from Head Start to (a) develop a descriptive understanding of science-related interest development for preschool children from traditionally underserved communities and (b) identify differences across families that might explain the variation in children's interests.
- The study was conducted over 5 months and included two in-depth interviews and four videotaped sessions in which families engaged in science-related activities (reading a book, doing an experiment, visiting a science centre, etc.).

Interviews suggested that science-related interests sparked by the sessions fell along a continuum, from *focused* interests specific to the materials provided during the sessions, to *broad* interests extending to more general topics and activity types.

We also found important variation across families related to mothers' expression of affect, their involvement and leadership styles, and their approach to re-engaging children when they lost interest or changed focus.

Siegel, D., & Dierking, L.D. (2022). *Designing Exhibitions That Engage Children by Optimizing Family Interaction.* 10.

This study was part of the US-NSF-funded collaborative project called *Lineage: A Cross-Platform Learning Experience Exploring the History of Life on Earth*. This initiative aimed to develop a comprehensive educational and media outreach to engage individuals and families in learning about deep time, paleontology, and evolution, as well as the present and future of life on Earth and was linked to the 2019 opening of Deep Time, the reimagined fossil hall of the Smithsonian's National Museum of Natural History (NMNH). Exhibits were designed for family interactions.

- The study explored how different exhibit design approaches supported different family interactions and learning. The two design approaches they compared were a hands-on exhibit and a virtual reality exhibit. Both exhibits covered similar content.
- The study included 49 families with kids ages 8-12 years old.
- Families engaged in either the hands-on or VR exhibit.
- Families were video-recorded, and their interactions were later analyzed. Families were also interviewed after the experience, and some were interviewed a couple of weeks later.
- Findings included:
  » Families learning differed between the exhibit types. Both exhibits supported learning. However, the hands-on activity tended to support learning about scientific processes, while the VR activity supported learning about scientific practices.
  » The structure of the two exhibits led to adults and children taking on different roles and different types of communication. In the hands-on exhibit, families were able to use verbal and nonverbal communication. The VR exhibit only allowed verbal communication.
  » Adults' ability to facilitate children's learning was important at both exhibits.
  » Connecting to children's prior knowledge and shared family experiences was important to learning at both exhibits.
- Recommendations included:
  » Families can benefit from engagement in both exhibits since they build on each other.
  » To support adult facilitation, it could help to have prompts that support further inquiry and critical discussions.
  » It is important to provide space for productive struggle when learning.

Siegel, D. R., Esterly, J., Callanan, M. A., Wright, R., & Navarro, R. (2007). Conversations about Science across Activities in Mexican-descent Families. *International Journal of Science Education, 29(12), 1447–1466.* **https://doi.org/10.1080/09500690701494100**

- This study focused on Mexican American families and examined the relationship between maternal schooling background and parents talk about scientific explanations and their interaction style with their children during a home science activity and in an open-ended visit to a children's museum.
- This was based on the idea that schools structure our interactions and behaviors. And that experience in the school environment might impact family interactions.
- The study included 40 Mexican American families with children 3-9 years old.
- The "higher school group" included mothers with 12-16 years of schooling and the "basic schooling group" included mothers with 3-11 years of schooling.
- Family engagement in the activities were video recorded for analysis.
- There was no relationship found between maternal level of schooling and parent talk about scientific explanations.
- Interaction styles focused mainly on didactic and collaborative interactions.
- Families were more didactic (teacher-like) in the home task than at the museum.
- Across the two activities, mothers who had more experience with schooling tended to be more directed with their children.
- Mothers were also more didactic/directed in the more structured tasks and more collaborative in unstructured tasks.

USS Constitution Museum (2018). *Engage Families: A Guide to Family Engagement in Exhibits and Programs.* **https://engagefamilies.org//wp-content/uploads/dlm_uploads/2018/05/Engage-Families-Booklet.pdf**

- This dissemination guide, funded by the IMLS' 21st Century Museum Professionals program, builds on the USS Constitution Museum's family learning initiative and the family learning research of Dierking and Borun, both advisors on the project. The following are key recommendations for designing for family learning in history museums.
- Family engagement in museums looks like:
  » All ages are actively participating in the experience.
  » Everyone feels there is something for him or her.
  » Intergenerational conversations are taking place.
  » Adults and children are learning together.
  » It is an enjoyable, collaborative, social experience.

- To make family-friendly content:
  » Less is more.
  » Make connections (how to make it personal and relevant)
  » Lighten up (rather than dumb down)

- Design strategies for exhibits:
  » Multi-user
  » Multi-sided
  » Multimodal
  » Encourage conversation.
  » Multi-outcome
  » Authentic and distinctive
  » Relevant
  » Accessible
  » Fun and play

- Program facilitation strategies
  » Thank families for attending.
  » Invite all to participate
  » Honour each family
  » Prompt conversation
  » Be flexible.
  » Have fun.

Zimmerman, H., Reeve, S., & Bell, P. (2008). Distributed Expertise in a Science Center: Social and Intellectual Role-Taking by Families. *Journal of Museum Education, 33(2), 143–152.* **https://doi.org/10.1179/jme.2008.33.2.143**

- They explore the social nature of learning in museums, focusing on how families work together to learn science (specifically biology) and how each individual family member contributes to the ongoing discussions.
- They ask what the evidence for biology knowledge is in family interactions in a science center and they examine the different ways that family members contribute to these conversations.
- They focus on contributions that move the conversation forward. These might include "suggesting a topic for discussion, asking a clarifying question, making a statement of fact, re-voicing an idea, providing evidence for a claim, disputing someone else's claim, making a prediction, or sharing an observation or inference."

- The study included 15 families with at least one child between 5 and 12 years old. Family interactions while they engaged with exhibits at a science museum were video recorded and later analyzed.

- Family members together build collective explanations. Expertise in the area that was used to push the conversations forward were seen to be distributed across adults, children, and the exhibits themselves as they moved through the museum.

- It is important to design learning environments that provide opportunities for children to actively participate, like other family members, in the larger family discussion.

Zimmerman, H. T., & McClain, L. R. (2016). Family learning outdoors: Guided participation on a nature walk. *Journal of Research in Science Teaching, 53*(6), 919-942.

- This research project examined how guided participation processes support the use of cultural tools (such as scientific equipment) during a nature walk at one nature center.

- The paper analyzed family interactions outdoors using micro-ethnographic methods. An informal learning framework based on guided participation and scientific tools (referred to as cultural tools) allowed for an in-depth investigation of social facilitation used by a working-class family: a grandmother, a mother, and two young sons.

- Researchers identified two guided participation processes that facilitated the use of these tools in this family:

  » Facilitating physical movements related to using scientific tools (e.g., magnifying glasses, field guides, binoculars, etc.).

  » Balancing access to tools to reflect family goals for both a social experience and the support of science interests.

- Suggest that trail-based designed learning settings where outdoor explorations occur are important, but understudied, sites of learning for rural families.

- Implications of the study included the analytical importance of the constructs of scientific (cultural) tools, guided participation, and embodied science knowledge for advancing research on family learning related to biology and environmental sciences.

- The research also suggested an expanded view of what counts as an informal science learning institution by including nature trails and related outdoor spaces alongside museums, science centers, and zoos to represent the everyday learning activities of rural families.

Principle Two: Honouring Indigenous Ways of Knowing, Being and Doing

Kinzel, Cheryl (2020) Indigenous Knowledge in Early Childhood Education: Building a Nest for Reconciliation. In *Journal of Childhood Studies* 45, number 1 (2020): 19-32.

- The article proposes that early childhood education needs to be based on three fundamental ideas: early childhood education needs:
  - » The promise of transformative learning,
  - » An acceptance of the truths and realities of Canadian history,
  - » The necessity of experiencing Indigenous knowledges.

- Knowledge contains power, it is not only socially/contextually situated – western focused knowledge excludes Indigenous knowledge from formal and informal learning environments.
- Reconciliation between Indigenous and non-Indigenous peoples require social justice within education.
- Non-Western/European participants rarely see their values or belief systems in institutions or education systems.
- Indigenous knowledge has not been seen as legitimate ways of being, knowing and doing – the erasure of this education has created rampant misunderstandings.
- Stories are a holistic way to understand the world around us and its functions.
- A Social Justice focus in critical pedagogy is an integral part of Indigenous methodology.
- Reconciliation centres on the importance of truth telling, healing and partnerships between Indigenous and non-Indigenous peoples.

Robertson, Brye (2019) Indigenous Ways of Knowing: The Early Learning Perspective. Aecea.ca. *Association of Early Childhood Educators of Alberta.* Published on May 5, 2019. Accessed on May 7, 2022. https://aecea.ca/sites/default/files/Indigenous%20Ways%20of%20Knowing_0.pdf

- Education has been historically used to assimilate Indigenous people into Anglo-Canadian society.
- There is a large gap in Indigenous children in classrooms – disparity could be indicative of economic status, lack of Indigenous Culture/Learning, lack of resources, cost of childcare.
- Holistic ways of viewing health align with Indigenous ways of knowing: "children's well being is a holistic experience that is supported through the health and development of all aspects of self."
- The inclusion of parents/guardians in childcare programs is important in child rearing – it takes a community to raise a child, however; family holds a key role.

- Connection to culture and land is critical in order to create a sense of belonging. Belonging is being accepted. Belonging is a feeling of reciprocity and acceptance in a community.
- Indigenous cultures/traditions/histories are vast – it is a common western mistake to lump all knowledge as from the same people, i.e., Indigenous as one entity.
- Outdoor play is important, not only for socialization and creating a respect for the environment – but showcasing life cycles and the purpose that all things hold.
- Stories are often told through art – when creating learning environments, make sure to let the children paint or draw a story.

Tsethlikai, Monica. (2015) The Cultural Patterning of Cognitive Development. In *Human Development* 58 (2015): 97-102.

- Colonization and cultural genocide have greatly impacted Indigenous early learning.
- "Indigenous children who are culturally engaged are more likely to learn through watching others and listening".
- Non-Indigenous researchers have not focused on ways in which speaking plays in the development of self-regulatory skills.
- Storytelling, or the act of, is critical in 'other-regulation': all stories create lessons for listeners to learn.
- Easily understood speech patterning, organization and structuring of stories allows children to recite, memorize and understand the moral of the story.
- "Other activities require children to learn complicated rituals and ceremonies through participation and expect children to learn from listening to and observing elders".
- Regardless of cultural backgrounds, children were able to follow critical speech patterns in storytelling.
- Storytelling is critical in children's learning – it can convey meaning in ways that written narratives cannot.

Barton, Georgina and Robert Barton. (2017) The Importance of Storytelling as a Pedagogical Tool for Indigenous Children. In *Narratives in Early Childhood Education: Communication, Sense Making and Lived Experience*. Edited by Susanne Garvis and Niklas Pramling. London, United Kingdom: Routledge.

- Storytelling is a way of preserving culture – stories hold a central role in the socialization of learners.
- Stories:
  - » Illustrate a principle.
  - » Stimulate other learning and activity.
  - » Engage in creative and imaginative learning.

- Assist in developing a positive attitude towards teachers and schools.

- Help explain abstract ideas or concepts.

- Storytelling without the use of texts allows children to recall the story more effectively, creatively, and further allows for a language complexity and story comprehension.

- Stories hold a multitude of purposes: 'teaching, remembering, healing, sharing history, meaning, making decisions, religious practice and ceremony, establishing and maintaining boundaries and relationships within the context of culture...'.

- Storytelling gives children agency – "we are all experts of our own experience".

- Story is an important way to convey ritual, knowledge and meaning.

- Indigenous cultures or Knowledge is not drawn on within western education (for the most part) outside performance by non-Indigenous educators.

- Facts alone present 'lifeless' information. However, through story – facts take on life and meaning. Education through oral narrative not only allows students to take on narrative responsibility – but it draws links in the child's own knowledge and experience.

Peltier, Sharla Mskokii. (2021) The Child Is Capable: Anishinaabe Pedagogy of Land and Community. In *Frontiers in Education 6*: 1-9.

Decolonizing education is imperative – there is value in Indigenous learning methods, by unlearning current knowledge practices – a shared space between western and non-western practices can be attained.

- Indigenous Knowledge is a lived process, the spirit of learning is continual and animated.

- "A person's ability to make good decisions is a reflexive process stimulated from careful listening and respect for Elders' stories and insight into personal lived experiences."

- There is relationality between the Individual and more-than-human: "I am the water. I am the land. What I do to the water I do to myself. What I do to the land I do to myself."

- Indigenous knowledge is a lifelong learning process of collectivity – in contrast to Western Knowledge practices that exemplify sequential skills to master a specific subject.

- Education systems have created a "cognitive imperialism" – in which Western thought and language are positioned as superior to Indigenous, Indigenous knowledge and language is portrayed as disposable.

- "As new understandings facilitate the resolution of historical trauma and strengthening of healthy relationships, we can collectively promote biophilia (the love of nature) and Indigenous Knowledge and pedagogy".

- "For learning to be relevant to Indigenous people, it must be rooted in language and culture; experiential in nature; Wholistic; community-based; lifelong; spiritually oriented; rooted in a combination of Indigenous and Western knowledge".

Absolon, Kathy (2020) Indigenous Wholistic Theory: A Knowledge Set for Practice. In *First Peoples Child & Family Review* 5, number 2: 74-87.

- "Wholistic theory includes an intermixing and consideration of time and space: the past, present, future; directions and doorways of life; the ecology of creation such as earth, sun, water and air and all their occupants; and values that retain the balance and harmony of all of the above"

- The Medicine Wheel is a prime example of holistic Indigenous theory – it encompasses our space within the whole, the influences of the elements on the collective being. It showcases the interconnections of the self, community, nation and creation.

- "If we know who we are, that all life is connected through spirit, and if we learn how to live good lives, then by extension we will act responsibly toward the creation of harmonious and sustainable (healthy) relationships in this world" – Dawn Marsden.

- Critical reflection and discourse create pathways for decolonization without replicating colonialism.

- The Medicine Wheel is split into four separate parts – each one important to the whole.

- "Holistic theory of Waabinong/Eastern Doorway is firmly rooted in Spirit, Beginnings and History. Key ideas are:

  - Beginning and Rebirth

  - Inclusion and respectful acknowledgement of Spirit

  - Spirituality is connected to healing

  - Establish your location and position within yourself practices

  - Acknowledge your genealogy of knowledge

  - Recognize the legitimacy of Indigenous epistemologies, worldviews and knowledge

  - Understand the history of Indigenous peoples and how it predates colonization

  - Identity

  - Develop a knowledge about the history of colonization and its oppression

- Zhaawnong/Southern Doorway acknowledges emotional aspects of the whole,

  - Calls for renewal at relational levels

  - Attends to relationships

  - Integrates understanding of diverse relationships

  - Understands kinship systems as moving beyond genetics

  - Identifies community strengths and resources

  - Collaborates with community to foster healing relationships

  - Utilizes methods that support healthy relationship building

  - Acknowledges the role and contribution of Elders and protocols

  - Contextualizes issues within a socio-political analysis of social problems facing

Indigenous peoples today.

- Niingaabii'ong/Western Doorway – acknowledge the mental aspects of the whole where reason and respect are addressed.
  » Recognize ancestors, ancestral knowledge, and power
  » Acknowledge the mental aspects and power of knowledge
  » Asserts and respects Indigenous knowledge and ways of knowing
  » Applies a critical analysis and knowledge of the political contexts of practice
  » Develops critiques of the mechanisms of colonialism and engages in critical theory and critical education with Indigenous communities
  » Is anti-colonial in practice and works to counter colonial ideologies
  » Acknowledges the ancestors and cycles of life and death

- Giiwedinong/Northern Doorway – where methods of practice and action are.
  » Recognizes the healing in being and doing
  » Calls for action and movement
  » Acknowledges the collective work
  » Addresses methodologies of practice from Indigenous frameworks
  » Healing as restoration of balancing utilizing wholistic tools such as the Medicine Wheel
  » The diversity within Indigenous contexts
  » Encourages a socio-economic analysis of contemporary conditions."

- At the center of the medicine wheel in which all four corners touch is the self, the Shkode. Each doorway is insufficient on its own – each is interconnected to the Shkode.
- Indigenous knowledge is lived – it is an all-encompassing knowledge set.
- To turn knowledge into practice – individuals must be able to attend ceremonies in which they pick up their knowledge bundles.

SD68NanaimoLadysmith. *Indigenous Storywork in Practice*. Youtube.com. Accessed on May 14, 2022. https://www.youtube.com/watch?v=DyKsCsZnRHI

- Stories build on seven principles of respect, responsibility, reciprocity, reverence, holism, interrelatedness, and synergy.
- Repetition is beneficial, as it helps embed stories.
- Inclusive education is engaging the learner: making them think, feel, soothe and plan future actions.
- The framework of Indigenous stories sometimes ends abruptly; we need to become story ready – how do we understand the colonial impact and apply the stories as a

way of life.

- Becoming story ready: understand colonial impact, appreciate indigenous knowledge systems, value relationships, learn the 'core' of the story.
- There's an interrelationship with the listener and the story – the listener can place themselves in the story and learn from it; we can connect emotionally.
- Pedagogy and Networks: Land-based, experiential, intra/intergenerational, holistic and relational.
- Story based education showcases how colonialism has impacted us all, both Indigenous and non-Indigenous.

National Centre for Collaboration in Indigenous Education. *Dr. Jo-ann Archibald on Indigenous Storytelling*. Youtube.com. Accessed on May 14, 2022. https://www. youtube.com/watch?v=5rSHifM35i4

- Storywork aims are multi-dimensional. Indigenous stories help us become the best person we can possibly be. It allows us to develop our values, beliefs and inter-relations with people and the environment.
- An important goal is that Indigenous stories are reminders of ecological, societal and moral values.
- Students develop cultural respect through storywork.
- Understand the Four Rs: Respect, Responsibility, Reverence, Reciprocity.
- Stories are an act of resistance.
- Many stories are based on kinship to the environment or place names.
- Holism in the context of storywork is the way of strengthening our emotional, physical and spiritual selves. There are circles of influence, self-family-wider society.
- Stories without clear endings are signals for the listener to engage with the story: what can the character do or should've done.

Tsethlikai, Monica (2015) The Cultural Patterning of Cognitive Development: Commentary on Allen and Lalonde. In *Human Development* 58: 97-102.

- Cognitive development should be understood as continuously evolving.
- Cognitive development is impacted both by the people and the tools they use – moments of instruction are transformed over an individual's lifetime, who then pass it on to the next generation.
- Indigenous children are more likely to learn from observing, listening, and utilizing non-verbal communication.
- Grounded cultural practices evolve over generations – the practices in place shape how children learn 'despite drastic changes in the sociocultural norms for some of these children and in the daily educational experiences of all of the children.'

- Storytelling contains patterned speeches from characters, recurring statements – all of which allow the narrator to emphasize meaningful aspects of stories.

- Stories generally have recurring number sequences.

- The use of speech patterns by educators allows students to memorize and internalize lessons.

- Children of different cultures understood the conveyed meaning within stories – culturally based methods of instruction are cognitively beneficial.

Battiste, Marie (2002). *Indigenous Knowledge and Pedagogy in First Nations Education: A Literature Review with Recommendations.* **Prepared for the National Working Group on Education and the Ministry of Indian Affairs, Indian and Northern Affairs Canada (INAC). Ottawa, Canada: Apamuwek Institute.**

- Indigenous Knowledge is often oral and symbolic – passed from one generation to the next through 'modeling, practice and animation.'

- "Indigenous knowledge fills the ethical and knowledge gaps in Eurocentric education, research and scholarship". Indigenous knowledge provides a voice to cognition.

- Immediate challenges to Indigenous knowledge are how to place 'colonial legitimacy, authority and disciplinary capacity' within its pedagogies.

- Indigenous Knowledge is important in applications of the conservation and sustainability of biological diversity.

- Eurocentric knowledge has displaced Indigenous Knowledge, failing generations of Indigenous children.

- In order for Indigenous knowledge to become equal within the Eurocentric dominated education spaces – "educators must be made aware of the existing interpretative monopoly of Eurocentric education and learn how the fundamental political processes of Canada have been laced with racism".

- Eurocentric authors have taken three main approaches to Indigenous Knowledge: "tried to reduce its taxonomic categories, reduce its quantifiable observable empirical elements, assume that the knowledge has no validity except in the spiritual realm".

- Indigenous Knowledge is tied to landscapes, landforms and biomes.

First Nations Education Steering Committee (2002) First People's Principles of Learning. *Fnesc.ca.* **Accessed on May 15, 2022. http://www.fnesc.ca/wp-content/uploads/2020/09/FNESC-Learning-First-Peoples-poster-11x17-hi-res-v2.pdf.**

- "Learning ultimately supports the well-being of the self, the family, the community, the land, the spirits and the ancestors."

- "Learning is holistic, reflexive, reflective, experiential and relational".

- "Learning involves generational roles and responsibilities."

- "Learning recognizes the role of Indigenous Knowledge."

- "Learning is embedded in memory, history and story".

- "Learning involves patience and time."

- "Learning involves recognizing the consequences of one's actions".

- "Learning requires exploration of one's identity".

- "Learning involves recognizing that some knowledge is sacred and only shared with permission and/or in certain situations".

Tam, B., L. C. Findlay and D. Kohen. (2017) Conceptualization of Family: Complexities of Defining an Indigenous Family. In *Indigenous Policy of Journal 28,* **number 1: 1-19.**

- Western conceptualizations of the 'nuclear family' cannot be applied to Indigenous families wholly.

- Multigenerational and non-related households are common among many Indigenous communities. There is a greater diversity, in many instances, in Indigenous households as compared to Western.

- In rearing a child, they may have several adults responsible for their rearing.

- Indigenous men and women are less likely to be married than western. Indigenous couples are more likely to be in a common-law relationship rather than a marriage relationship.

- Customary adoption is sometimes common, particularly with Inuit communities. This entails adoption without administrative or institutional overheads.

- Legal status may impact who is considered Indigenous and non-Indigenous. The Indian Act stripped the rights of being Indigenous from many women – it still continues to impact non-status offspring, though steps were taken to restore 'some' status through Bill C-31 in 1985.

- The Indigenous kinship system offers broad social ties to who is considered family, sometimes kinship is an earned role within the family from an outside non-relative.

- "Generally, Indigenous peoples have a higher rate of mobility than non-Indigenous peoples".

First Nations Education Steering Committee (2012) *In Our Own Words: Bringing First Peoples Content to the K-3 Classroom.* **Vancouver, Canada: FNESC.**

- Authentic First Peoples texts are historical or contemporary text created by or through substantial contributions by First Nations peoples.

- Both Indigenous and non-Indigenous students gain a greater appreciation of Indigenous culture and knowledge through the use of Authentic First Peoples texts.

  » First Nation worldviews are primarily composed of: Connection with the land and

environment; the nature and place of spirituality as an aspect of wisdom; the nature of knowledge – who holds it, what knowledge is valued; the role of elders and knowledge-keeps; the relationships between individuals, family and community; the importance of oral tradition; the experience of colonization and decolonization; humour and its role

» An effective integration of First People's learning methods will include: A commitment to learner centeredness; a focus on experiential learning rather a reliance solely on teacher led discussions; an emphasis on the awareness of self and other in equal measure; a recognition of the value of group process

» A recursive approach to resources; support for various forms of education representation (drama, media, art, dance, song, etc.).

- The maintenance of storytelling is critical – First Peoples texts should provide ways in which the student can experience the story.

- Listening is critical – the students/educators should incorporate meaningful listening activities when possible.

- TEK – Traditional Ecological Knowledge: local knowledge based on people's relationship to place. It's understanding the ecosystem around you, the living relationships of all things within including yours.

- If possible, learning should be taken outdoors to make connections with the land and place.

People for Education. (2022) *What Matters In Indigenous Education*. peopleforeducation.ca. Accessed on May 22nd, 2022. https://peopleforeducation. ca/report/what-matters-in-indigenous-education/#chapter2.

- Diversity and differential learning are foundational.

- Learning is linked to a student›s lived experiences.

- Teaching and learning practices are evidence based.

- Shared leadership is the reality between admin and staff.

- Professional development is ongoing where data is a critical feature.

- Relationships are collegial and student learning, as well as community, is a key underpinning.

- Parental and community engagement plans honour differences.

- Global citizenship and environmental stewardship connections.

Brockenleg, Martin, School District 27 Residential Schools and Reconciliation. *First Nations Principles of Learning*. Youtube.com. Accessed on May 28, 2022: https://www.youtube.com/watch?v=0PgrfCVCt_A

- Learning is holistic, reflexive, reflective, experiential, relational, focused on connectedness, reciprocal relationships and a sense of place.

- Learning ultimately supports the wellbeing: of the self, the family, the community, the land, the spirits, the ancestors

- What the ancestors were skilled at was teaching the person's 'heart'.

- Learning involves: Recognizing that some knowledge is sacred and only shared with permission and in certain situations

- There are four kinds of experiences that create a strong human being: Significance – learning requires exploration of identity, Competence, Power and virtue.

- Belonging lets you know how important you are, mastery is how you experience what you know, independence in knowing that you are responsible for yourself, generosity is understanding your goodness.

- Empowerment is typical of Child upbringing.

- When a child is in crisis – caregivers respond by unbelonging, the wrong response in creating belonging is school suspension, timeout, etc. etc. When a child is in crisis – the correct response is surrounding them with special connections.

National Centre for Collaboration in Indigenous Education. *Indigenous Land-Based Education Pedagogy*. Youtube.com. Accessed on May 29, 2022: https://www. youtube.com/watch?v=qEWwQGj6z6g

- Learning is how you contribute to not only your own learning, but to also how you reciprocate that knowledge to the band, nation.

- Relationship building is necessary in order to create good sources. It is not just the individual – relationships sustain the knowledge.

- Land based education is geared towards preservation and conservation - how we can protect the environment/species, how to live off the land, what lessons we can learn from the land, how do we co-exist with the land, how do we create self-sufficiency.

- Land and language are the first teachers.

- Innovative teachers will follow the students as they work, to provide curriculum building around the students.

- Sustain the relationships with your knowledge sources.

- Reciprocal knowledge – teach and receive the knowledge, intercultural learning is important.

- Sourcing your knowledge from a wide collective, centering your culture and community within that knowledge and sharing that knowledge intergenerationally is important.

The Pathway to Stewardship and Kinship. *Indigenous Insights for Outdoor Learning*. Youtube.com. Accessed on May 29, 2022. https://www.youtube.com/watch?v=N_ QpeuD4Pw0

- Bring in land acknowledgements – easy way to bring Indigenous knowledge into the

classroom. When speaking of land acknowledgement – speak to the relations of the different things around you (flora and fauna).

- Allow nature to teach you first, we're all students in nature.
- Embrace learning together.
- Incorporate respect of the environment into your teachings. Connect to the environment, preserve the environment.
- Be intentional about taking things from the land, it must serve a purpose. We don't take things just because they look 'pretty'.
- Think about what you can give back to the land – restore land, plant seeds, pick garbage, propagate the plants.
- Discuss connections to animals and plants in nature. Talk about how everything is intertwined. Why are they in the tree, how does it connect to the weather patterns?
- The land creates invitations to the classroom, understand how it does and how you can reciprocate that knowledge.

Play is the Way. *How Play is The Way Embeds Indigenous Education.* **Playistheway. ca. Accessed on May 29, 2022. http://www.playistheway.ca/indigenous-education. html.**

- Students "learn to question the motives behind behaviour and learn to see challenges from all perspectives; thus, further developing their social-emotional skills."
- "Play Is the Way seamlessly, through Life raft activities, incorporates story telling (character teaching) by Elders, Trauma Informed Practice through an aboriginal lens, deep connections to Truth and Reconciliation and Indigenous soothing practices to help students self-regulate and soothe when anxiety is high, when childhood trauma breaks the surface, or when conflicts arise."

SD68NanaimoLadysmith. Indigenous Knowledge in Education with Marie Battiste. Youtube.com. Accessed on May 30, 2022. https://www.youtube.com/ watch?v=k7fuk3-ysHs

- Indigenous knowledge systems (IKS) are place based cultures.
- Among the shared experiences of First Nations, Metis and Inuit are colonization, marginalization, powerlessness, exploitation, racism, violence and cultural imperialism.
- "Canadians have been denied a full and proper education as to the nature of Aboriginal societies, and the history of the relationship between Aboriginal and non-Aboriginal peoples." – TRC, p.25
- Cognitive imperialism results in damaged identities, negative self-concept, and lack of confidence.
- "Every researcher/student has been a victim and beneficiary of the same educational system."

» Why do Canadians know so little about Indigenous peoples? Indigenous peoples are seen in fragmented chunks. Also, texts, media, education, research, professions, stereotypes, deficit discourses, framing blame for the causes of their oppression or problems the system creates.

- "National school curricula and textbooks have been key tools of Canada's 'aggressive assimilation policy'.
- "Curricula is contextualised to power and privilege."

Empowering the Spirit. *Cultures of Belonging.* **Empoweringthespirit.ca. Accessed on June 11, 2022. https://empoweringthespirit.ca/cultures-of-belonging/**

- Character education must involve everyone: school staff, parents, community members, students.
- This integration must become part of the curriculum.
- Teach a sense of cohesiveness, it needs to be fully understood and lived.
- There are four basic needs of all children: belonging, mastery, independence and generosity.
- The Seven Sacred Teachings – a set of teachings on human conduct towards each other.
- "Indigenous Metissage is a place-based approach to curriculum informed by ecological and relational understanding of the world."
- Diverse societies and the space between them contribute to the development of dialogue.
- A web of kinship is more than just human relationships, it's a web that connects us to all things.

CASS. *Learning from the Land.* **Cass.ab.ca. Accessed on June 11, 2022: https://cass. ab.ca/indigenous-education/learning-from-the-land/**

- "The land is a sacred trust from the Creator. The land is the giver of life like a mother. The ecological aspect of Indigenous knowledge is all about the land. The land is a source of identity for Aboriginal People." – Dr. Leroy Littlebear
- Reciprocity, respect, balance, and connection to spirituality are central to learning from the land.
- "Learning from the land is becoming more commonplace within education systems because it presents an opportunity for educators and students to learn more about the histories and stories of the land and people while meeting curricular outcomes."
- "The connection to the land has been disrupted through policies of colonization, assimilation, and attempted genocide. Forced disconnection from the land has caused spiritual, emotional, physical, and mental damage to many Indigenous Peoples."
- "For Indigenous Peoples' continued existence – throughout the world – land is a prerequisite. It is essential because Indigenous Peoples are inextricably related to land:

it sustains our spirits and bodies; it determines how our societies develop and operate based on available environmental and natural resources; and our socialization and governance flow from this intimate relationship. Because of that intimate relationship, the land is rendered inalienable: it is a natural right, a right essential for the continued vitality of the physical, spiritual, socio-economic and political life and survival of the Indigenous Peoples for generations to come." – Metis National Council

Early Years Study. *Becoming a Capable Child*. Earlyyearsstudy.ca. Accessed on June 11, 2022. https://earlyyearsstudy.ca/report_chapters/a-child-is-a-capable-person/

- "Capable person" began in the Northwest Territories Indigenous curriculum in the mid 1990s.

- Capable person – has integrity in relationships, honours the self, land and honours the spiritual world.

- Tipi metaphor covers four structures, the centre with the groundings of self and identity,

- The tripod of relationality, the spirals from the centre of the narrative space with other influences of ancient and spiritual teachings, canvas that represents the outside influence.

- "Among the Dene, it is said that the child is born with integrity. The child has worth. It is the birthright of the Dene child to be acknowledged and respected for this. The child who is not respected cannot become what it is meant to be … [that is] a capable person." – Dene Kede Curriculum

- Educators need to practice wakefulness in integrating culturally relevant approaches as they relate to the early years.

- Key Indigenous values and beliefs relating to children: reverential attitude toward the child, parents as the first teachers, grandparent's love as the closest love the creator has, critical importance of identity and self, honouring place, people and history, spiral guides and spiral learning, spirituality as an extension of culture, welcoming early environments for children, family, community and elders.

- By balancing these approaches, educators will create conditions that shape the development of Indigenous children.

Morcom, Lindsay A. (2017) Indigenous Holistic Education in Philosophy and Practice, with Wampum as a Case Study. In *Foro de Educación* 15, number 23: 121-138.

- In addition to being holistic, Indigenous educational philosophies also view learning as personal, subjective, spiritual and transformative.

- The last residential school closed in 1996, despite this – educational gaps still exist between indigenous and non-indigenous students.

- Since 1972, the Assembly of First Nations has encouraged the development of culturally based education for Indigenous children.

- To understand Indigenous educational philosophies, it is vital to understand the concept of holism. Holism refers to the self, it refers to connections to the community, other living things, earth, nature and spirituality.

- Western education tends to focus on the intellectual, particularly that scientific knowledge is neutral and objective.

- Holistic learning is connected to the family and community. Most Indigenous societies are collectivist.

- It is important to foster egalitarianism in the classroom.

- Schooling is integral to the community – not separate from it.

Interdisciplinary Education

Interdisciplinary exploration promotes the development of knowledge, insights, problem solving skills, self-confidence, self-efficacy, and a passion for learning - common goals of museums.

Caldwell, W (2015). Multi/Trans/Inter Disciplinary. What's the difference? Lakehead University Blog retrieved May 1: https://blogs.lt.vt.edu/grad5104/multiintertrans-disciplinary-whats-the-difference/

- Multidisciplinarity contrasts disciplinary perspectives in an additive manner, meaning two or more disciplines each provide their viewpoint on a problem from their perspectives. Multidisciplinarity involves little interaction across disciplines.

- Interdisciplinarity combines two or more disciplines to a new level of integration suggesting component boundaries start to break down. Interdisciplinarity is no longer a simple addition of parts but the recognition that each discipline can affect the research output of the other.

- Transdisciplinarity occurs when two or more discipline perspectives transcend each other to form a new holistic approach. The outcome will be completely different from what one would expect from the addition of the parts.

Ciferri, A and Soldi, A. (2021): Interdisciplinary education and authentic development. *International Review of Education* (2021) 67:533–549. Retrieved May 1, 2022:https://doi.org/10.1007/s11159-020-09879-2

- Results of a research project designed to promote the concept and the implementation of an integrated approach to foster "authentic development."

- They note: Interdisciplinary study allows for synthesis of ideas and characteristics from many disciplines which addresses learners' individual differences and helps to develop important, transferable skills.

- Researchers' (working in Spanish in Central America) goal was the successful promotion of harmony and stability within today's multi-ethnic communities. This requires an understanding of the events and the struggles that caused the creation of new cultures. This insight derived from experience with development projects in Central and South America which have a new discipline, authentic development.
- This new discipline should be taught through and based on principles conducive to achieving harmonious economic development paced to social development, able to mitigate ethnic and class conflicts and foster evolved, rather than uprooted, cultural values.

Jones, Casey (2009) "Interdisciplinary Approach - Advantages, Disadvantages, and the Future Benefits of Interdisciplinary Studies," ESSAI: Vol. 7, Article 26. Available at: http://dc.cod.edu/essai/vol7/iss1/26

- There are many statistical reports which conclude that students of interdisciplinary techniques have higher test scores in both core knowledge and critical thinking problems.
- With interdisciplinary instruction, students become more involved in their learning and teachers can work toward eliminating discipline lines.
- Students become independent, confident individuals who 'learn how to learn' and develop lifelong learning skills"
- Students who are taught with an interdisciplinary technique in which the students master higher order thinking skills and integrated pedagogy become very attractive to top colleges and wealthy businesses.

Klein, J. (2008). Evaluation of Interdisciplinary and Transdisciplinary Research A Literature Review. *Am J Prev Med* 2008;35(2S): S116 –S123)

- Interdisciplinary and transdisciplinary learning calls attention not only to outcomes but also to the quality of the process
- Highlights a number of evaluation questions aimed at fostering integration and building relationships among organizational, methodologic, and epistemological components of a project or program. Is the spectrum of disciplines and fields too narrow or too broad for the task at hand? Have relevant approaches, tools, and partners been identified? Is the structure flexible enough to allow for shifting groupings of individuals and context-related adaptations, deletions, and additions? Has synthesis unfolded through patterning and testing the relatedness of materials, ideas, and methods? Have known integrative techniques been utilized, such as the Delphi method, scenario building, general systems theory, and computer analyses of stakeholders' perspectives? Is there a unifying principle, theory?
- Process requires different leadership: managing tensions in balancing acts, consensus building, integration, interaction, common boundary objects, shared decision making, coaching the process.

National Academies of Sciences, Engineering, and Medicine. 2018. *The Integration of the Humanities and Arts with Sciences, Engineering, and Medicine in Higher Education: Branches from the Same Tree.* Washington, DC: The National Academies Press. https://doi.org/10.17226/24988.

- Evidence indicates that approaches that integrate the humanities and arts with STEM have been associated with positive learning outcomes: increased critical thinking abilities, higher-order thinking and deeper learning, content mastery, problem solving, teamwork and communication skills, improved visuospatial reasoning, and general engagement and enjoyment of learning.
- The integration of STEMM content and pedagogies into the curricula of students pursuing the humanities and arts may improve science and technology literacy and can provide new tools and perspectives for artistic and humanistic scholarship and practice.
- The integration of the arts and humanities with medical training is associated with outcomes such as increased empathy, resilience, and teamwork; improved visual diagnostic skills; increased tolerance for ambiguity; and increased interest in communication skills.
- An important observation was that the kinds of outcomes associated with certain integrative approaches in higher education—including written and oral communication skills, teamwork skills, ethical decision making, critical thinking, and the ability to apply knowledge in real-world settings— are the educational outcomes that many employers are asking for today

Repko, Allen (2009), Interdisciplinary Research: Process and Theory. Sage Publications.

Interdisciplinary Learning supports:

1. Perspective-Taking Techniques (Baloche, Hynes, and Berger 1996): The capacity to understand multiple viewpoints on a given topic including an appreciation of the differences between disciplines and especially their perspectives on how to approach a problem and their rules of evidence.

2. Development of Structural Knowledge: Composed of two elements, declarative knowledge (i.e., factual information) and Procedural Knowledge (i.e., process-based information), which are needed to solve complex problems.

3. Integration of conflicting insights from alternative disciplines: Ideas from a variety of disciplines may present alternative perspectives and predictions. The intellectual challenge is to find ways to account for these which entails careful and creative thinking rather than revert to a single disciplinary explanation

4. Interdisciplinary Understanding: Entails seeing an issue from an array of perspectives and recognizing how each of the alternative approaches influences one another.

Repko, Allen (2008) Assessing Interdisciplinary Learning Outcomes, *Academic Exchange Quarterly.* **Rapid Intellect.**

Declarative Knowledge: Students learn how and why things work the way they do

Procedural knowledge: Learners identify and understand the steps necessary to arrive at a solution

Structural Knowledge (the goal): Learners can combine both declarative and procedural knowledge to solve complex problems.

Science Education Center at Carleton College: Why Teach with an Interdisciplinary approach? Retrieved: https://serc.carleton.edu/econ/interdisciplinary/why.html May 17, 2022

Asserts that interdisciplinary instruction fosters advances in cognitive ability and other educational researchers (Kavaloski 1979, Newell 1990, Field et al. 1994, Vess 2009) have identified a number of distinct educational benefits of interdisciplinary learning including gains in the ability to: Recognize bias; Think critically; Tolerate ambiguity; Acknowledge and appreciate ethical concerns.

- Helps Students Uncover Preconceptions or Recognize Bias
- Advances Critical Thinking and Cognitive Development
- Helps Students Tolerate or Embrace Ambiguity
- Helps Students Appreciate Ethical Dimensions of Concerns

Promotes *Significant Learning:*

- » **Foundational Knowledge** – acquiring information and understanding ideas
- » **Application** – acquiring an understanding of how and when to use skills
- » **Integration** – the capacity to connect ideas
- » **Human Dimension** - recognition of the social and personal implications of issues
- » **Caring** – acknowledgment of the role of feelings, interests, and values
- » **Learning** *How-to-Learn* – obtaining insights into the process of learning

Smothers, A (2020) Transdisciplinary and Interdisciplinary Approaches. Center for Innovative Teaching and Learning, Western Illinois University.

Available: https://citl.news.niu.edu/2020/11/17/transdisciplinary-interdisciplinary/

- Interdisciplinarity means teaching across disciplines, generally by using a common theme, topic, or issue. A single disciplinary approach has limitations, particularly as it is concerned with the norms of that one particular discipline, ignoring other disciplines' contributions to the issue or potential solutions. Through interdisciplinarity, students can look at the same theme, issue, or topic from the perspectives of different, individual disciplines.

Transdisciplinary requires collaboration *between* disciplines to create a cohesive curriculum in which students *collaborate* to solve multifaceted problems. Transdisciplinarity requires innovation, cooperation, and intentionality.

- Many of today's global problems are just too complex to be solved by one specialized discipline. These multifaceted problems require transdisciplinary solutions. While throughout the 20th century, ever-greater specialization was encouraged, the next century will see transdisciplinary approaches take center stage.

Suddreth, Anna (2022) A Guide for Interdisciplinary Learning and Teaching: https://xqsuperschool.org/rethinktogether/interdisciplinary-teaching-and-learning/#:~:text=What%20Is%20Interdisciplinary%20Teaching%20and,about%20 issues%20and%20solve%20problems.

Retrieved May 17, 2022

- Compared to traditional approaches, an interdisciplinary approach expands *what* students learn by allowing them to tackle problems that don't fit neatly into one subject. It also changes *how* students learn by asking them to synthesize multiple perspectives, instead of taking what they're told by a teacher at face value.

Principle Three: Effective Facilitation

Anderson, A., Kollmann, E.K. Beyer, M., Weitzman, O., Bequette, M., Haupt, G. and Velázquez, H. (2021. Design strategies for hands-on activities to increase interest, relevance, and self-efficacy in Chemistry. *Journal of Chemical Education, 98*(6), 1841-1851. DOI: 10.1021/acs.jchemed.1c00193.

Chemistry is a vital and highly relevant field of science that is under-represented in science centers and museums. Amidst concerns that the public is ambivalent about the chemistry field, the *Explore Science: Let's Do Chemistry* project sought to understand how to design hands-on activities that could increase the feelings of interest, relevance, and self-efficacy around chemistry.

- Using design-based research, the team tested and refined a variety of activities while simultaneously creating a framework for future use about content and format strategies that increase interest, relevance, and self-efficacy. Science museum visitors tested these activities and were interviewed afterward to learn whether or not they had experienced any changes in their attitudes toward chemistry and what about the activity contributed to these feelings.

- Data indicated that the types of content embedded in an activity influence increased feelings that chemistry is relevant and interesting, while the format used in an activity contributes to increased interest and self-efficacy around chemistry. The design framework created from these findings can be used by other chemistry educators to develop additional chemistry outreach activities that support increased interest, relevance, or self-efficacy in participants.

Emily Harris & Mark Winterbottom (2018) 'Why do parrots talk?' Co-investigation as a model for promoting family learning through conversation in a natural history gallery, *Journal of Biological Education,* **52:1, 89-100, DOI: 10.1080/00219266.2017.1408934**

Research into how and what families learn in science museums and other informal science learning settings suggests that parent-child interactions play an important role in shaping children's learning experiences. This case study worked to analyse learning happening within family groups during a visit to a traditional museum natural history gallery. Findings indicate that families adopt a range of interactional approaches for building meaning together in a museum gallery. These approaches fell along a spectrum that varied according to the level of co-investigation and co-operation between group members. Family learning can be supported in informal learning contexts through simple, low-cost learning strategies that encourage dialogue and co-investigatory behaviours.

Pattison, S.A. & Dierking, L.D. 2012. Exploring staff facilitation that supports family learning. *Journal of Museum Education, 37*(3): 69-80.

- Article discusses a qualitative master's study of 63 video-taped unstructured, informal interactions between staff and families in a science center, focusing particularly on the role of adult family members. Despite the prevalence of these interactions little research has been conducted in the area. This publication described the study and its findings, highlighting their implications for professional learning efforts with staff.

- It was conducted in two Oregon Museum of Science & Industry (OMSI) exhibitions: the Chemistry Lab and the Physics Lab, in which staff move around, approaching families informally, offering help and asking questions as they interact at individual exhibits

- Findings showed the ways in which staff facilitation interacts with the social context of family learning. The staff agenda was to "teach" the family, usually the child(ren), about the chemistry and physics principles they were exploring. If this was a goal of the family, interactions were successful, but when this agenda did not align with the family, the interactions were problematic. This demonstrated the critical role of negotiation between staff and family, particularly negotiating the role of the family facilitator vis-à-vis the staff member.

- The primary family facilitator (often the adult, although not always) were gatekeepers to the interaction; if the family facilitator was ignored or only partially acknowledged, interactions with staff were brief and even contested; in turn, staff facilitation was only effective if the family facilitator fully acknowledged and reinforced the staff member's role.

- The most effective facilitation occurred when the staff facilitator and family facilitator collaborated, or the staff member recognized that the family facilitator needed no assistance and moved on, suggesting that to successfully facilitate family learning, museum educators must carefully consider the role of family facilitators, and the unique social context of family learning. At the time, Pattison worked at OMSI and offered workshops sharing these findings, including videos of interactions, with staff facilitators.

Pattison, S.A. & Dierking, L.D. 2013. Staff-mediated learning in museums: A social interaction perspective. *Visitor Studies, 16*(2): 117-143. 69-80.

- Article discusses the previous qualitative study of video-taped unstructured, informal interactions between staff and families in a science center, focusing particularly on the role of adult family members. This publication focused more deeply on the theoretical underpinnings of the study, framed within everyday social interaction, sociolinguistics and mediated discourse literature. Everyday social interaction and sociolinguistics research has rarely been applied to studying family learning in free-choice settings, but offered insights into the rules and patterns that govern everyday interactions, and how they shape unstructured staff-visitor interactions.

- Three broad research questions guided the study:

  » What is the nature of unstructured interactions between museum staff and family groups in science centers?

- How do staff members and family groups initiate unstructured interactions in these settings?
- How do families and staff negotiate roles and goals during unstructured interactions in these settings?

- Close video-analysis revealed the complexities of staff-family interactions and highlighted the strong role of negotiation patterns throughout. Three phases of role negotiation emerged: (a) initiating the interaction, (b) facilitating learning, and (c) introducing new goals. During each of these phases, staff and family members used social practices, appropriate in both everyday settings and, especially, museum contexts, to assert, support, and contest roles and to negotiate changing goals that aligned with family or staff goals. Findings highlighted the importance of opening sequences such as greetings; the negotiation of roles and relationships; and nonverbal communication between staff and family facilitators.

- More generally, the findings highlight that understanding the social nature of staff-family interactions (the "how"), may be as critical as studying the educational content of staff-facilitated activities and programs (the "what").

Schlüter, B., Strippel, C. G.; Lewalter, D., Sommer, K. (2022) Everybody Wants to experiment: Assessing Motivation to Participate in a chemistry Family Learning Course. *Journal of Chemical Education*, 2022, Vol.99 (9), p.3133-3142

This study investigated what motivated children and their parents to participate in a specific nine-month chemistry course designed for families. Children and parents displayed similarities and differences regarding their motivation to participate. They both assigned value to the dimensions of research and experimentation, individual learning and pursuing interests, social enjoyment, and social learning. However, there are striking differences in the order of these dimensions for each group. As such, children and parents should be regarded as two distinct target audiences for a family learning course.

Simmons, J. Campbell, T., Moss, D., Volin, J., Arnold, C., Cisneros, L., Chadwick, C., Dickson, D. & Freidenfelds, N. (2022): 'Part of our DNA': intergenerational family learning in informal science, *International Journal of Science Education*. DOI: 10.1080/21548455.2022.2099032

Families create contexts for learning to enhance and support the interests of their children, while simultaneously teaching language, morals, and culture. This research examines intergenerational family teams engaged in a long-term conservation project in their community. Intergenerational family teams shared narratives which were then analyzed using the cultural learning pathways framework. Family interactions are powerful influences on the identity development of children, not only in their academic development, but also in their moral, ethical, and social development.

Tett, L., & Macleod, G. (2020) Enacting home–school partnerships: the roles of headteachers, family-learning practitioners and parents, *Cambridge Journal of Education*, 50:4, 451-468.

This study into family-learning programmes (FLPs) in socio-economically disadvantaged areas in one Scottish city investigates what leads to more inclusive Home School Partnerships. Previous research has found that when educators hold a deficit conceptualisation of parents, there was a negative effect on the family's readiness to engage with the school. The study also underscores that adult's participation could be fostered by the acknowledgment of the adults' own knowledge and realisation that they were important actors in their children's education.

Tzou, C., Meixi, S. E., Bell, P., LaBonte, D., Starks, E., & Bang, M. (2019). Storywork in STEM-Art: Making, materiality and robotics within everyday acts of indigenous presence and resurgence. *Cognition and Instruction*, 37(3), 306–326.

This article presents findings from TechTales, a participatory design research (PDR) project where learning scientists, public library staff members, informal science educators, and staff members from Native-American-serving organizations collaborated to design a family-based robotics workshop that was grounded in storytelling. Through analyzing families-in-interaction through a sociocultural learning theory perspective as they constructed dioramas with robotics that told their family stories, we explore how cultivating consequential learning environments in STEM is intimately intertwined with historicity, knowledge systems, and the agentic positioning of learners to design new technologies. Using storywork as the design focus of building dioramas created learning environments where computer programing and robotics became dynamic tools toward family-making, collaboration, and the active presencing of Indigenous knowledge systems and cultural practices. Living and interrelating with story and its knowledge systems through making were enactments of Indigenous resurgence in everyday ways.

Principle Four: Storytelling/Narrative

Aerila, J.A., Rönkkö, M.L., and Grönman, S. (2016). Field Trip to a Historic House Museum with Preschoolers: Stories and Crafts as Tools for Cultural Heritage Education. *Visitor Studies*, 19(2), 144–55.

- Major research questions: How do the field trip to the historic house museum and a related story activity inspire children to tell stories? How do the artifacts of the historic house museum inspire children to design and produce a personal craft product?

- Evaluated the value of historic house and city museums' impact on Finnish students.

- Focus on cultural heritage education.

- Stresses that child-centered activities are key - worksheets are handy but there should be a balance of structured art-based activities and free exploration.

- Active interpretation was tracked, with stories and craft products being produced. The research showed that children had "a meaningful and active role in learning because they were allowed to act in the context of cultural heritage education."

Avraamidou, L., & Osborne, J. (2008). Science as narrative: The story of the discovery of penicillin. *The Pantaneto Forum*, 31.

- In this paper they discuss how narrative can be used in an exhibit to communicate science. They do this by focusing on a particular narrative-based exhibit at the Alexander Fleming Museum in London. The exhibit focused on the discovery of penicillin.

- They break down and explore narrative components. Based on research, they created a list of necessary narrative components. These include a purpose, chain of events, structure (beginning, middle, and end), time (in the past), agency, narrator, and reader. (Note that this is a very Western structure to stories).

Carter, D. (2018) Narrative Learning as Theory and Method in Arts and Museum Education. *Studies in Art Education*, 59(2), 126–44.

- This study looked at how preschool children use narrative to construct knowledge.

- The sample was eight 4-5-year folds and their teacher.

- The venue was at four museums in Stockholm: Stockholm Transport Museum, Swedish National Museum of Science and Technology, Swedish Museum of Natural History and the Vasa Museum.

- The interviews were 'ethnographic.'

- The results showed that children used narrative to represent themselves and their lives.

- They adopted new ideas and inserted them into their lives using narrative portrayed through drawing and conversation.

- There is also an emphasis on social learning.

Callanan, M. A., Castañeda, C. L., Solis, G., Luce, M. R., Diep, M., McHugh, S. R., Martin, J. L., Scotchmoor, J., & DeAngelis, S. (2021). "He Fell in and That's How He Became a Fossil!": Engagement With a Storytelling Exhibit Predicts Families' Explanatory Science Talk During a Museum Visit. Frontiers in Psychology, 12. https://doi.org/10.3389/fpsyg.2021.689649

- This study is part of a larger collaborative project between the Children's Discovery Museum of San Jose and University of California, Santa Cruz.

- This project results in an exhibition called Mammoth Discovery! It was designed around a serendipitous event in which fossilized mammoth bones were found near the museum. Their goal was to create a natural history style exhibition in a children's museum.

- The exhibition focused on (1) encouraging families to consider bones as evidence and how evidence can be used to answer questions and (2) telling stories.

- There are a number of exhibits that involve telling stories. These included stories about the life of the specific animal whose bones were found, how the bones were found, and how the bones came to the museum.

- This study involved families with children 3-6 years old and focused on one component – the Spin Browser – which was a hands-on exhibit where visitors can spin the dial and learn about the story of the mammoth. The story involves the mammoth living, then dying, becoming fossilized, then discovered, and then finding its way to the museum.

- They examined (1) how engagement with the Spin Browser might relate to family conversation about science in other parts of the exhibition (the fossil and replica bone exhibits) and (2) whether family narrative talk at the spin browser predicted family science talk at those other exhibits.

- Family interactions with the exhibits were video recorded and later analyzed.

- Family talk at the Spin Browser was coded for different things including their use of narrative (i.e., Stories about life, death, discovery of mammoth) and making connections (i.e., Links from Spin Browser to other exhibits or to previous experience).

- Family talk at the fossil and replica bone exhibits was coded for "explanatory science talk" which included causal explanations, talk about evidence, and personal connections.

- Families who visited the Spin Browser were more likely to engage in explanatory science talk than families who did not.

- Children's "connections talk" and parents' use of narrative at the Spin Browser led to more family engagement in explanatory science conversations at the fossil exhibits.

Dahlstrom, M. F. (2014). Using narratives and storytelling to communicate science with non-expert audiences. Proceedings of the National Academy of Sciences, 111(Supplement), 13614–13620. https://doi.org/10.1073/pnas.1320645111

- Stories, in contrast to the typical logical approach used with scientific thinking, tend to be more relatable to non expert audiences, and, in turn, may increase understanding and engagement

- They define narrative as having causal relationships between events over time with characters.

- They distinguish narrative and logical-scientific communication as follows:

  » Logical-scientific focuses on abstract generalizable truths (deductive reasoning). Narrative focuses on a specific case and one can generalize from that case (inductive reasoning).

  » Logical-scientific is context-free, whereas narrative is context dependent.

  » Logical-scientific aims to provide general and accurate truths. Narratives focus on individual specific experiences.

- The use of personification in stories is effective because it is easier for someone to identify with the content and empathize.

- Narratives are intrinsically persuasive.

Evans, E. M., Weiss, M., Lane, J. L., and Palmquist, S. (2016). "The spiral model: integrating research and exhibit development to foster conceptual change," in Cognitive Development in Museum Settings: Relating Research and Practice, eds D. M. Sobel and J. L. Jipson (New York, NY: Psychology Press), 36–64.

- Exhibit designers at the New York Hall of Science were designing an exhibition targeting families with children ages 5-12 about evolutionary concepts. They knew the concepts were difficult, especially for this age group.

- They used a storyline or narrative approach to convey these difficult concepts.

- Used a storytelling structure to scaffold children's learning about natural selection.

- They created a digital storybook screen that was played in a small theater. The story was the one place in the exhibition where the whole narrative of natural selection was told.

- A narrative structure tends to lead to anthropomorphic reasoning, so they needed to revise their language to avoid this, which included taking out language that referred to intentions or mental states.

- The storybook video provided context for the children to interpret the other exhibits and artifacts specifically as it related to understanding evidence as it related to evolution. This format as compared to other scaffolding approaches, led to an increase in children's understanding about evolution

Fisher, M., & Sastre, A. (2008). The Art of Storytelling: Enriching Art Museum Exhibits and Education through Visitor Narratives. Paper presented at the Museums and the Web conference, Montreal, Canada.

- Explores art-based programs that integrate storytelling at a large variety of contexts and institutions.

- Some programs include online and handheld technologies to tell stories.

- Visitors create their own narrative which adds to the existing authoritative museum narrative. This approach engages visitors

- They focus on a case study of the project (educational programs) "Art of Storytelling" at the Delaware Art Museum. This project targets children 8-12.

- The goal was to use storytelling to enhance youth's appreciation of art. They explored both the stories that are expressed through art and the stories behind artwork.

- Three components of the project (1) Podcast of stories from people all over the word. Used as a self-guided tour in the museum (2) The Picture a Story interactive kiosk. They create digital art and tell a story about it. (3) Website – listen to stories, tell stories about museum pieces, and use the web-based version of Picture a Story.

- They conducted an evaluation and spoke to the storytelling who contributed to the project and perhaps had an impact on their art appreciation. Most of them felt more connection to the museum and some of those people, an appreciation of art museums generally. Some reported looking at art in museums differently. Some look for the stories in the work, fewer people say that they find more personal meaning from their viewing or that it's fun to view art.

Fivush, R. (2008). Remembering and reminiscing: How individual lives are constructed in family narratives. Memory Studies, 1(1), 49–58. https://doi.org/10.1177/1750698007083888

- Autobiographical narratives are stories we tell about our lives and define who we are in relation to many levels of our context (family, community, etc.). They reflect a larger historical and cultural narrative as well as shape that changing narrative.

- From toddlerhood, we are participating in stories and by the end of the preschool years, we are actively engaging and contributing to these stories defining who they are. By adolescence, we link events across time and place in more complex ways.

- Children develop stories of themselves and their families through social Interactions with their families as they collaboratively reminisce. Each member contributes by providing their own interpretation of the events and building on each other.

- Autobiographical memories and reminiscing differ from recalling events. They involve interpretation and include the meaning and significance of the recalled events.

- Creating narratives of specific instances over time, allow families to construct a larger life narrative that defines oneself.

- Reminiscing is a common family activity. They can refer to anything from the day's events to family's past.

Pattison, S.A., Svarovsky, G., Ramos-Montañez, S., & Kirkland, P. (2020). Storybook STEM: Children's literature as a tool for supporting informal STEM learning. TERC. www.terc.edu/storybookstem/

- This report was the result of a convening of experts in early childhood reading, family learning, and informal STEM education with the goal of exploring how children's fiction can be used to support STEM learning for families with preschool age children. This group included researchers and practitioners.
- They initially administered a survey to learn how various fields are using children's books to support STEM learning for preschool age children and their families. They found that books are being used for a variety of audiences in different educational settings. They had a follow-up online forum to talk about themes that emerged from the survey. Themes that emerged from the forum were then used to plan the in-person convening of experts.
- Recommendations for research and practice. Many of these address issues around equity, diversity, and access. (These are taken from their executive summary)

  1. Rethink how stories are developed, including how families and scholars of color are represented and involved in the process of creating and selecting stories.

  2. Rethink what we mean by stories by connecting with both written and oral story traditions and creating space for families to tell their own stories. This will help families find relevance in the topic.

  3. Rethink our relationships with families. Move beyond viewing them as audiences and instead by engage them as key stakeholders throughout the development, implementation, and research process.

  4. Rethink how we measure success, including broadening our notion of STEM learning, connecting STEM and literacy, and attending to the goals of parents and children; and

  5. Rethink the connection between research and practice by better sharing what we already know and involving educators and other practitioners as partners in the research process.

Rounds, J. (2002). Storytelling in science exhibits. *Exhibitionist*, 21(2), 40–43.

- Exhibits including interactives often default to the information-transfer model of learning. Narratives might help to shift our approach.
- In contrast to traditional approaches to teaching science, narratives:
  » Focus on meaning rather than transferring information
  » Concerns itself with authenticity not accuracy

  » Focuses on the human rather than natural world
- Within informal learning settings, the active process of meaning making has been viewed as essential to learning
- Storytelling is seen as an accessible way for nonexperts to relate to and make meaning from the content
- This process involves contextualizing information and experiences and making them personally relevant by connecting them to prior experiences and knowledge.

Siegel, D. & Cid, C. (2018). Expert Storytelling and Family STEM Meaning Making in a Rural Community. Paper presented at the annual conference of the American Educational Research Association, New York, NY.

- This in-depth 6 workshop family STEM series focused on the use of STEM professional stories and inquiry-based activities to support family STEM learning and engagement. STEM professionals shared stories about "how they got here" and stories from their work.
- There were 2 cohorts of 7-9 families with children 8-10. Each family attended all 6 workshops.
- Families were interviewed each week after their workshop about their general experience in the workshop. They also were asked specifically about the STEM professional who attended the workshop that week.
- Families saw the STEM professionals as both knowledgeable and personable. The stories the STEM professionals shared engaged the families, they humanized the STEM professionals, families were able to connect to them through their stories, stories also supported learning about scientific practices, and it broadened families' perspective of different types of STEM professionals and fields and the path to work in this field.

Other References to Explore

Tzou, C.T., Rother, D., Starks, E., Meixi, Suarez, E., Rambayon, A., Bell, P., Twito, A., Peterson, S., Ortiz, S. M., & Bang, M. (2020). Trust the process: Developing STEM mindsets through family storytelling. Connected Science Learning (Volume 2.I1.P2). http://csl.nsta.org/2020/02/trust-the-process/https://www.nsta.org/connected-science-learning/connected-science-learning-january-march-2020/trust-process

Principle Five: Community Participation

Assembly of First Nations and the Canadian Museums Association (1994). Turning the page: Forging new partnerships between museums and First Peoples. Report on the Task Force on Museums and First Peoples.

- This document is the task force report describing the process and outcomes that emerged from consultations and deliberations between First Peoples and Museums, including the resulting recommendations for an ongoing working partnership.

- The report was prepared and endorsed by the Task Force on Museums and First Peoples, a national body made up of over 25 individuals from the Aboriginal and museum communities.

- Jointly organized by the Assembly of First Nations (AFN) and Canadian Museums Association (CMA), the Task Force has been consulting and deliberating for the past year.

- The Mission Statement for the Task Force was to develop an ethical framework and strategies for Aboriginal Nations to represent their history and culture in concert with cultural institutions.

- The major findings of the Task Force are:

  » Importance of cultural objects in museum collections, which represent cultural history and values, and are sources of learning, pride, and self-esteem. The primary concern of First Peoples is the importance of cultural collections to their own specific communities, but they recognize that these collections, and the institutions that care for them, serve a wider function, contributing to greater public education and awareness of the significant cultural contributions made by First Peoples.

  » Increased involvement of First Peoples in interpretation, including all facets of museum administration, research, public program and exhibition planning, and any presentations that result from such planning. There is agreement that increased involvement of First Peoples in museum work is essential to improve the representation and interpretation of First Peoples' histories and cultures in museums.

  » Improved access to museum collections, including not only human remains and artifacts, but also information associated with them including research results. photographs. works of art, and any other information related to First Peoples' culture and history held in cultural institutions. Access encompasses not only physical access to collections for purposes of viewing, research, making reproductions and ceremonial use, but also access to funding sources, policy development and implementation activities, as well as training and employment in museums and other cultural institutions.

  » Consensus on repatriation in favour of the return of human remains and illegally obtained objects along with certain non-skeletal burial materials and other sacred objects to appropriate First Peoples; there was some agreement on the return to originating communities of a selection of other objects considered to be of special significance to cultural patrimony.

  » Training for both First Peoples and non-Aboriginal museum personnel is critical, both to work in established museums and to develop museums in their own communities; First Peoples need training in all phases of museology and non-Aboriginal museum personnel need training in the cultures and values of First Peoples to better care for and interpret collections, as well as to work more effectively as partners with First Peoples Support for Cultural Institutions communities.

  » Support for cultural Institutions in supporting the efforts of First Peoples to manage and conserve their own cultural facilities in their own communities was stressed since community-based cultural centres and programs can reinforce positive identities, help to heal cultural dislocation and improve educational opportunities for children; these improvements also support the socio-economic goals of First Peoples' communities.

  » Urgent need for additional funding for projects involving First Peoples in existing Aboriginal or non-Aboriginal museums, as well as to assist First Peoples in establishing their own museums.

  » Need for governmental assistance in gaining access to and/or repatriating cultural objects held in international collections outside Canada.

Bevan B, Calabrese Barton A and Garibay C (2020) Broadening perspectives on broadening participation: Professional learning tools for more expansive and equitable science communication. *Frontiers of Communication*. 5:52. doi: 10.3389/fcomm.2020.00052.

- Professionals in varied fields within institutions/organizations argue that the work conducted for the public, rather than with the public, often tends to be designed for people like themselves—those already interested in, comfortable with, and engaged with the topic, organization, or institution.

- This means the work, ostensibly intended to broaden who engages, may in fact exacerbate, rather than reduce, disparities in terms of who has access to and engages/uses designed opportunities (museum experiences, for example).

- In this analysis, authors suggest that inclusive practices must be conceptualized as a process of cultural exchange, rather than as a process of translation. The goal is not to speak more simply or more loudly, but rather with more understanding and mutualism.

- The paper discusses the results of an exploratory project that developed a suite of tools designed to support professionals, in their case, science communication professionals, in reflecting on key structural barriers that operate in their institutions/organizations and foster non-inclusive activity.

- They conclude that more dialogic (ongoing back and forth communication between communicators and those with whom they are trying to communicate) strategies for professional learning among communicators can reveal biases, gaps between and among goals and reality, and other underlying practices that must be addressed to advance inclusive practice.

Falk, J.H. and Dierking, L.D. (2018). The sociocultural context: Museums in society. Chapter 3 in Learning from museums. 2nd Edition. Lanham, MD: Rowman & Littlefield.

- Societies are amid changes as great as any in history, changes which are directly influencing museums. As the economy shifts from one that is industrially based, to one that is information and knowledge-based, societies are transitioning into Learning Societies. Learning across the life span, in particular free-choice learning, is becoming fundamental as never before.

- Museums are currently riding a crest of unprecedented popularity driven by the new Learning Society. Americans in ever growing numbers are seeking out museums because they are widely perceived to be good places to go to satisfy the desire for high quality, enjoyable, learning experiences.

- As society is transformed by the Learning Society, not all citizens are equally benefiting. There is a growing rift between the learning "haves" and "have-nots;" a rift that ultimately affects all in society, including the museum community.

Falk, J.H. and Dierking, L.D. (2002). Lessons without limit: How free-choice learning is transforming education. Walnut Creek, CA: AltaMira Press (Rowman & Littlefield).

- This book is a guide to transforming the entire experience of learning across a lifetime, defining and describing free-choice learning, which is the who, what, where, with whom, and most importantly the why of choosing what to do in your learning time.

- It offers examples of how people learn every day--at home, at school, at work, and out in the world, from books, in museums, watching television, hearing a symphony, building a model rocket.

- The motivations and expectations may change over a lifetime but learning never stops; the book offers novel perspectives on the learning process so as to maximize a person's lifelong learning journey.

Fealing, K. H., Lai, Y., and Myers, S. L. Jr. (2015). Pathways vs. pipelines to broadening participation in the STEM workforce. *J. Women Minor. Sci. Eng.* 21, 271–293. doi: 10.1615/JWomenMinorScienEng.2015004760.

- This paper examines why women and minorities are underrepresented in science research careers. Although it focuses on STEM careers, the points made are very relevant to museum efforts to engage underrepresented communities.

- Authors argue that an underlying premise of virtually all major interventions designed to increase the representation of women and racial and ethnic minority group members in STEM careers (and perhaps in using and engaging with museums) is that there exists a dominant pipeline toward participation. The premise is that there is a conventional sequence of educational activities that might encourage engagement in museums and that such a sequence is effective in producing the desired results of increased visitation/use by underrepresented groups. An alternative model—the pathways model—suggests that there are multiple routes toward participation.

- This paper tests the hypothesis that the pipeline metaphor is the correct representation of the production of increased diversity, using the chemistry profession as the case study. Using data from the Integrated Public Use Microdata Series–Current Population Survey (IPUMS-CPS) March Supplement for the period 1968–2012, they estimate post-baccalaureate effects and wage impacts on the relative representation of women and minorities among those employed as chemists.

- They found large differences across racial, ethnic, and gender groups with limited evidence to support the pipeline argument. They were far more responsive than non-minority individuals in the impacts on wages. They also show that women and minorities are underrepresented at different critical transition points from high school, to college, to graduate school, or to the workforce (important to note that they focused on that pathway, rather than entry into the workforce without graduate school).

- However, the findings resonate with museum research that has identified different critical life cycle points when people, particularly infrequent users, are more likely to visit or use museums.

Ferguson H, Bovaird S, Mueller M. 2007. The impact of poverty on educational outcomes for children. *Paediatric Child Health*, 12(8):701-6. doi: 10.1093/pch/12.8.701. PMID: 19030450; PMCID: PMC2528798.

- Canadian authors discuss the fact that the unfortunate reality is that the income gap has widened between Canadian families and educational outcomes are one of the key areas influenced by family incomes.

- Children from low-income families often start school already behind their peers who come from more affluent families, as shown in measures of school readiness. The incidence, depth, duration, and timing of poverty all influence a child's educational attainment, along with community characteristics such as the number of cultural institutions, and their accessibility by low-income families, and the social networks available to these families, often referred to as cultural and social capital.

- Both Canadian and international efforts have shown that the effects of poverty can be reduced using sustainable community-wide interventions.

Hulchanski, J.D. (2010). The three cities within Toronto: Income polarization among Toronto's neighbourhoods, 1970-2005. Toronto: Cities Centre Press, University of Toronto.

- This report is a 2006 Census update of the Centre for Urban and Community Studies (now Cities Centre) Research Bulletin 41, The Three Cities Within Toronto: Income Polarization among Toronto's Neighbourhoods, 1970 — 2000, published in December 2007.

- It is one output of a multi-year project on neighbourhood change in greater Toronto over a 35-year period. The research was funded by the Community University

Research Alliance and the Public Outreach Grant programs of the Social Sciences and Humanities Research Council of Canada.

- The University of Toronto's Cities Centre and St. Christopher House were the lead partners in the research alliance — the Neighbourhood Change and Building Inclusive Communities from Within Community University Research Alliance. www.NeighbourhoodChange.ca

- Toronto's neighbourhoods fall into three clear groups based on income change, 1970 to 2005:
  » The first, which the report calls City #1, is a predominantly high-income area of the City of Toronto in which neighbourhood incomes have risen a great deal relative to the Toronto Census Metropolitan Area (CMA) average since 1970; these neighbour-hoods are generally found in the central city and close to the city's subway lines.

  » By contrast, City #3 is a generally low-income area of Toronto, in which neighbourhood incomes have fallen substantially over the past few decades, compared to the CMA average; these neighbourhoods are found mostly in the northeastern and northwestern parts of Toronto.

  » In between these two is City #2, a primarily middle-income area, where neigh-bourhood incomes have remained fairly close to the CMA average since 1970. While all cities can be divided into various groupings, the important finding in this research is the consistent trend over time: the three groups of neighbourhoods are changing at different rates and moving further apart.

  » The middle-income area of the city (City #2) shrank dramatically between 1970 and 2005, while the high-income area increased slightly, and the low-income area increased substantially.

  » Poverty has moved from the centre to the edges of the city. In the 1970s, most of the city's low-income neighbourhoods were in the inner city. This meant that low-income households had access to transit and services. Some of these neighbourhoods have gentrified and are now home to affluent households, while low-income households are concentrated in the northeastern and northwestern parts of the city (the inner suburbs), with relatively poor access to transit and services.

  » These are long-term trends. The study examined trends for a 35-year period and found most of the changes to be persistent. The polarization of the city into wealthy neighbourhoods and greater numbers of low-income, under-resourced neighbourhoods is continuing and middle-income neighbourhoods are disappearing.

  » The segregation of the city by income is not inevitable or irreversible. These trends could be slowed or reversed by public policies that would make housing more affordable to low-income households, by efforts to expand access to transit and services in neighbourhoods where the need is greatest, and by renewing the aging high-rise neighbourhoods scattered throughout City #3 (e.g., by the Tower Neighbourhood Renewal initiative: www.TowerRenewal.ca).

» Although this report is almost two decades old, these patterns remain, and the report is used by researchers and practitioners engaged in community participation work.

Institute for Learning Innovation. 2020. Equity Statement. Beaverton, OR: Institute for Learning Innovation.

- In this 2020 equity statement, the Institute for Learning Innovation expresses its support for peaceful assembly and protest and stands in solidarity with communities of color voicing their deep anguish, outrage, and grief toward social systems that continue to oppress and devalue their lives.

- One of the systems that contributes to oppression and marginalization worldwide is the education system, writ large. Educational institutions such as schools, museums, and some libraries and community organizations, primarily focus on a subset of learners, meeting a subset of learning needs. Thus, many of these institutions and organizations fail to achieve the most basic educational goal – the creation of unbiased, empowered people. The entire educational enterprise has currently mainly reinforced, rather than broken generational cycles of poverty, not only economic poverty, but poverty of social/cultural access and mobility, and poverty of learning opportunities.

- Research shows that access to, and ongoing support for learning, is the best way to end generational cycles of poverty. Our organization's vision is to create a global society in which all people have equitable and unlimited access, ability, and support for the learning they want and need.

- To create a healthier, sustainable, and just world, all of us must work diligently and faithfully to move forward from this moment. We need to listen, to try to understand, to respond with respect and humility, and most of all, to learn from the moment so that we do not repeat the mistakes of the past.

Kafuko, E. 1987. Community participation in development projects: The World Bank experience. Discussion Paper. Washington, DC: The World Bank.

- The definition of " community participation"(CP) is a matter on which there is considerable debate among community development scholars and practitioners. Some use the term to refer to equitable sharing of the benefits of projects. Others view participation as a tool to enhance the efficiency and effectiveness of efforts. And it also is used to describe the co-production of services (in the field of museums, this is often referred to as co-creation). Finally for some groups, participation means that people in the community have significant control over decisions made by the institution/ organization with whom they are partnering. Furthermore, some regard participation as an end in itself, whereas others see it, as a means, to achieve specific goals.

- These diverse perspectives reflect differences in the objectives for which participation might be advocated by different groups. For the purposes of this discussion paper, the author proposed defining community participation as an active process by which institutions/organizations engage community groups in influencing the direction and

implementation of a project, with a view to enhancing these groups' well-being, in terms of personal growth, self-reliance or other values they cherish, as well as in some cases, their incomes.

- The joint or collaborative involvement of partner groups is a hallmark of CP. In the context of a community development project, partner groups represented by individuals can participate in many ways. However, CP can be said to occur only when people act in concert to advise, decide, or act on issues which can best be solved through such joint action.

- In the context of development, CP may be viewed as a process that serves one or more of the following objectives, from the high-level empowerment to lower-level efficiency:

  » An instrument of empowerment. In this view, CP leads to an equitable sharing of power and to a higher level of people's, in particular the weaker groups' awareness and strengths. Thus, any project activity is a means of empowering people so that they can initiate actions on their own and, in so doing, influence the processes and outcomes of the activity.

  » A mechanism for building the capacity of partners in relationship to a project. In this case, partners might share in the planning or management tasks of the project by taking on some responsibility for a segment of it themselves, for example, they might play an active role in monitoring. Developing the capacity of partners can contribute to the sustainability of an effort due to the enhanced level of partner interest and competence.

  » Increased project effectiveness, the degree to which a given objective is achieved. CP tends to enhance project effectiveness when the involvement of partners contributes to better project design and implementation and leads to better match of project "services" with partner needs. CP can provide inputs for project design or redesign so that appropriate activities are created and facilitated. Viewed in this way, CP entails the "co-production" of activities by partners jointly with the project authority; the focus is on the achievement of project objectives.

  » CP may improve project efficiency in the areas of planning and implementation with timely input by partners. CP can promote agreement, cooperation, and interaction among and between partners, so that delays are reduced, a smoother flow of project outcomes is achieved, and, if managed well, overall costs can be minimized. Objectives often overlap in real life project situations, which is a project may pursue several objectives simultaneously.

- While CP can be used to achieve any, or all, of these objectives, those leading the effort may vary the intensity with which CP is sought in a particular project or at a particular stage of the project. The nature of the project and the characteristics of partners will determine, to a large extent, how actively and completely CP can be practiced. Where complex technologies and their adaptation dominate the design, there may be less opportunity for the active participation of partners in design, for example, than in a case where the technology is less complex and easier for community members who are not savvy about technology to participate. Even so, it is crucial to assess likely partners' responses to the introduction of complex technologies. It is equally important to share information on design with partners in such cases, though decisions on design may be made, or at least dominated, by other actors. Information sharing on design is clearly a less intense form of CP than decision making on design.

- There are four levels of intensity in CP, though different levels of CP may coexist in the same project.

  » Information sharing. Project designers and managers may share information with partners to facilitate collective or individual action. Though it reflects a low level of intensity, it can have a positive impact on project outcomes to the extent it allows partners to understand the effort.

  » Consultation. When beneficiaries are not only informed, but also consulted, on key issues at some or all stages in a project cycle, the level of intensity of CP rises. There is an opportunity for partners to interact and provide feedback which leaders can accommodate in the design and implementation stages of an effort. If partners are consulted on intended practices and arrangements, project outcomes are likely to be better than if they were merely informed.

  » Decision-making. A still higher level of intensity occurs when partners have a decision-making role in matters of project design and implementation. Decisions may be made exclusively by partners or jointly with others on specific issues or aspects of a project. Decision-making implies a much greater degree of control or influence on projects by partners.

  » Initiating action. When partners are given agency to take the initiative in terms of actions/decisions pertaining to a project, the intensity of CP may be said to have reached its peak. Initiative implies a proactive capacity and confidence and trust on the part of leaders. When partner groups engaged in a project identify a new need and decide to respond to it on their own, they are taking the initiative for their development. This is qualitatively different from their capacity to act or decide on issues or tasks proposed or assigned to them.

  » Projects also vary in their intensity for CP in different stages of the cycle. At the design stage, a project may rely on information sharing and consultation, whereas during implementation, partners may be given decision-making or other more intense roles.

Koke, J. and Ryan, K. From consultation to collaboration: Mechanisms for integrating community voices into exhibition development, Chapter 4 in Villeneuve, P., & Love, A. R. (Eds.). (2017). Visitor-centered exhibitions and edu-curation in art museums. Rowman & Littlefield Publishers.

- This chapter discusses how to effectively integrate community voices into exhibition development. The authors' main thesis is that groups of people who have historically not visited or used museums to meet their free-choice-learning needs, are unlikely to change their behaviour in significant numbers, if the collections and temporary exhibitions are presented in ways that do not connect to the ideas and issues important to them, nor to their leisure needs.

- They argue that museums, having developed largely in a positivist era, continue to act as though they know what visitors want to see (or even what visitors should see) and how they would choose to experience it. Gathering public input is often perceived as catering to the lowest common denominator. Yet what other industry develops a product without consulting its target market to inform both the final use and the shape of that product and how it is positioned for maximum appeal?

- Engaging active and potential audience members in conversations about concepts, exhibitions, and programs does not dilute the expertise—it enhances it. Audiences are the experts in their own interests, their preferences, and their values. Better aligning the themes and ideas that museums prioritize with what potentials value can only increase our long-term financial stability and public value.

- In developing different kinds of partnerships with audiences, museums are arrayed along a continuum of shared authority. On one end are institutions, or staff members, who hold on to traditional approaches in which they are certain that what visitors' needs are (or should be). At the other end of the continuum is the position in which the institution gives up its role (or shares it) in framing the experience and provides a platform for the community to speak. Most museums are working to find the right location for their institutions or exhibitions along this continuum knowing that to be relevant means there will need to be some degree of authority-sharing.

- Authors lay out different methods to help organizations, or staff, locate themselves on this continuum, recommending that the strategy chosen, respond to the level and desired input, and how comfortable they are in sharing authority with their audiences.

- Whichever form is chosen, the degree of decision-making power offered—from consultation to collaboration—should be clearly articulated at the outset, or participants on both sides of the partnership may be disappointed. They suggest that the most important element in doing this work is a true desire and respect for community wisdom.

Montgomery, J.D. 1983. When local participation helps. *Journal of Policy Analysis and Management*, 3(1): 90-105.

- This paper discusses the issue that activities offering goods and services for the public (the mission of many museums) are often more effective if the public participates in the planning and execution of such efforts.

- The author argues that the common-sense ideas and cultural knowledge of local peoples, what he calls the social capital of a community, is a resource that many institutions/organizations either ignore or do not fully acknowledge or value.

- Activities whose effectiveness most benefits from such participation are those in which local preferences vary; the activities call for frequent decisions, the lead time is likely to be short, and the impact on individual families may be substantial. The author suggests that education is an arena in which local participation is considered positively.

Zakus, J.D.L. and Lysack, C.L. 1998. Revisiting community participation, *Health Policy and Planning*, **13 (1):1–12, https://doi.org/10.1093/heapol/13.1.1**

- This paper reviews the value of community participation, specifically in the health arena. However, it provides a detailed examination of the benefits and challenges of implementing and sustaining community participation efforts, with applications for community participation and museums and other cultural institutions/organizations.

- Particularly, the authors stress the importance of defining 'community participation' at the outset, since the organization/institution initiating the process, in this case, a museum or other cultural institution/organization may have a different view of the term from community members. If views are different (suggesting the need for a process to determine community members' views), then the museum can decide whether to adjust their definition, or ensure they are extremely clear about how they are defining it (e.g., members of an advisory groups, rather than co-creators/decisionmakers).

- Most important after defining community participation, is a need for long-term commitment, understanding, competencies and resources.

- They also discuss that successful community participation requires capacity building and support/training for the effort, in the case of this article, for health administrators/ workers on the ground, as well as community members (think administrators/workers on the ground at a museum).

- Factors that facilitated successful community participation included community-level trust, strong existing external linkages between the community and health entity (think museum), the intrinsic motivation of individuals involved, and supportive institutional processes that were flexible and responsive to community.

- Factors that challenged successful community participation included lack of training, interest in the goal, along with weak financial sustainability for ALL partners and the community engagement effort itself.

Appendix B:
An Indigenous Perspective

Note: this section was authored by Marcel Robitaille, a proud member of the Caldwell nation and a University of Toronto Museum Studies Graduate Student. It informed much of the discussion of Foundational Principle Two: Honouring Reconciliation and is presented here in its entirety.

I recognize and accept my position of being a person of Indigenous and European descent. As a youth, I was taken from my Indigenous family through the Crown Ward foster care system and placed within an Anglo-European family. As such, I recognize that the lens through which I've been accustomed to perceiving research, culture and society has habitually been through a Western perspective. I have striven to learn more about my roots, culture, Indigeneity and what it means to be a displaced person within Canada's systemic institutionalized racial policies. That said, I'm a treaty 2 Anishinaabe and a proud Caldwell of Southwestern Ontario.

Honouring reconciliation and Indigenous ways of knowing, being and doing, have never been acts performed alone and fettered away behind closed doors. It is an act of community, of support and uplifting from all peoples across Canada. Honouring reconciliation represents truths, it is the wounds of history suffered by Indigenous peoples and a further guide on how to create a balm to heal and nourish a people. It is not an easy task, nor is it performed in half measures. It is a commitment to acknowledging the truths of a people and it's a commitment to repairing a bridge of friendship that has been systematically neglected. Between 2008 and 2015, the Truth and Reconciliation Commission (TRC) created a series of calls to action for government agencies, institutions, and communities to follow, in order to begin that healing process. It began with honouring survivors of the residential school system, the last of which closed in 1996. That commission grew to represent ninety-four separate calls to action. Many of these calls to action have been emplaced within cultural institutions, like museums, over the succeeding years. The TRC gave a voice to lost generations, it's our duty as Indigenous and non-Indigenous individuals, to make sure that the voices of the generations yet to be born are heard, acknowledged and supported. Further, the TRC has been used as a model for governments the world over to create Indigenous reconciliation commissions of their own. It will take generations to heal learned trauma, but our Elders, our communities, our land – these are the supports in which we base our truth.

A fundamental aspect of the Two Row Wampum Covenant-Chain is that Indigenous and non-Indigenous people operate as equals, fording the river of the human experience on separate vessels. Each perspective is valued, those operating the vessels on either side of the river can offer a distinct worldview – neither are assimilated into the other. These two vessels are separate, never veering into the other lane. However, there is a tradition that has arisen within recent years that honours reconciliation within research and cultural institutions. Etuaptmumk – a Mi'kmaw word for two-eyed seeing. It is, as

Mi'kmaw Elder Albert Marshall says, "learning to see from one eye with the best in the Indigenous ways of knowing and from the other eye with the best in the mainstream ways of knowing, and most importantly, learning to see with both eyes closed." It is within the Western disciplinary framework that all things are knowable, especially when it comes to science and nature. Further, by understanding the blank slates of human knowledge can we learn to understand ourselves and the world around us? In contrast, Indigenous knowledge is positional – knowledge and the natural world are tied to place, the body and spirit. Knowledge and learning become one and the same, knowledge is relational to place and people, knowledge is moral and ethical, knowledge is ways of knowing passed from one generation to the next as a distinct equity. Two eyed seeing on the other hand, creates structures in which western knowledge can create the infrastructure through which Indigenous knowledge can interact with the community. This allows institutions to create research and education roles for Indigenous peoples in line with the mandates proposed by the TRC. Two eyed seeing becomes an interdisciplinary action that creates collaboration between different viewpoints, rather than operating as a separate entity for separate goals. Further, it creates space for Elders and communities within the institution – allowing them a key role within the ceremony of research, conversation, and connection.

For institutions to create educational spaces for honouring reconciliation within the public sphere, education must represent Indigenous historical and contemporary contributions to Canada – whether it is through science, culture, technology, medicine, or other avenues. It must approach on par with western knowledge, one is not more important or relevant than the other. Ways of knowing encompasses family learning – an area of knowledge that has been sadly subverted over the centuries. When approaching family learning within the museum, heavy focus should be given to the role that the mother plays within the hierarchy of the family structure. Traditionally, western society has subverted the power that women held within matriarchal societies of Indigenous nations – placing women within the bottom of the social power structure rather than their traditional space as the heads of families. This subversion of family roles hastened assimilation policies of Europeans – women were traditionally seen as the caregivers of both children and family. Although providing opportunities for all should be important, special attention should be given to Indigenous women in educational opportunities within the space – they are traditionally the caregivers and educators of the people. The Indian Act, residential schools and colonial policies were direct malicious attempts at subverting the family structure and stripping rights away from women and their roles within the family. However, although women play an important role within families, the mother's partner and community has a direct role to play as well.

Parenting is a shared act between both parents, the community, Elders, and kinships. The child is always under a watchful eye, family is an important element of Indigenous life

to make sure the child always feels as they though belong to someone and a community. This itself is an important aspect of early childhood, one that family spaces in institutions can build off of – being is belonging, it's a fundamental human need to be wanted, to belong to someone or a community. The concept of family, likewise, is not entirely the same as western notions. Family can represent kinships, they can represent people sharing the same household, they could be distant cousins. Family does not always mean a shared ancestor – family is a mindset of shared familial support. Families, at times, can share the task of raising children. Indigenous children can always find support within family relationships, even if the mother or father's attention is drawn elsewhere. Further, many Indigenous cultures observe childhood learning and support it through non-verbal learning styles rather than directly intervening – children are free to explore their environment as they wish. Family learning encompasses all aspects of family within the Indigenous context, it must incorporate the family structure and allow the roles of caregivers to participate. One such mandate by the TRC is to provide parents the full opportunity to be part of their child's education. Organizations must work closely with parents, Elders and communities to provide an educational model that is culturally safe and equitable. Cree scholar and educator, Michael Hart, states that "it can be said that Indigenous knowledge is holistic, personal, social and highly dependent upon the local ecosystem." He further adds: "it is also generational, incorporates the spiritual and physical, and heavily reliant on Elders to guide its development and transmission".

To support Indigenous ways of knowing, being and doing in play-based learning, the experiences must connect to history, land, language, and ancestral knowledge. Play is impacted by intergenerational trauma and socio-economic status. Within some Indigenous families, many of whom due to Canadian generational policies, are at-risk, low socio-economic households– play is often focused on supporting survival skills, rather than leisure (this is the case for many low-income families as pointed out in the previous play-based learning section). In many cases, meaningful play opportunities are lacking. Institutions need to offer opportunities for families of all backgrounds and incomes to play together. Further, such family play needs to be supported and training provided to parents and extended kin, about the important role of play in learning, not just content, but how to interact with their children in ways that build their creativity, resourcefulness and agency. As said before, it is inherent in children to want to belong, regardless of whether they are Indigenous or not. Belonging to the land, the community and family needs to be an integral part of any institution's commitment to understanding and supporting Indigenous pedagogies of play. Likewise, the TRC mandates that resource allocation should be given to provide for opportunities in which Indigenous knowledge can be showcased. Honouring reconciliation is understanding how to best provide a platform in which Indigenous Knowledge can be disseminated – however a large portion

of Indigenous knowledge and early play is situated within nature. Whereas Western Knowledge limits the time spent in nature, nature itself is an educator - the birds, trees, wind and mud are as much of an educator as anyone else. Humans are not distinct from nature; we create a symbiotic relationship with it – not in discord of it. There is an emphasis that early play must be based within this truth – an understanding and respect of the environment should encompass early learnings. Creating land-based experiences and opportunities are an important facet of Indigenous knowledge and pedagogies. Play within nature is important to Indigenous knowing. Likewise, storytelling also offers education through strong Indigenous practices.

Good story work practices are an essential part in facilitating play through "silence, storytelling and teasing". Regardless of background, children are able to recognize the lessons and morals shared within stories. There is an inclusivity in story work that expands beyond the confines of culture – even then, Indigenous story work provides children of non-Indigenous background an insight into Indigenous education methods. Honouring reconciliation within the institution is allowing elders and educators to provide access to good story work. Through story work, even art, children are able to access their own creativity. This becomes a means to understanding the self, an important aspect of Indigenous holism. Stories are built on seven fundamentals, respect, responsibility, reciprocity, reverence, holism, interrelatedness and synergy. That said, holistic understandings of storytelling strengthen our ability to emphasize with others, builds on our understanding of who we individually and promotes a connection to our wider family, community and society. Even then, storytelling is an act of resistance against colonialism. They are stories provided to us by the ancestors, stories which were suppressed by Anglo-European powers. Stories are passed down by the people who had the courage to remember them, to teach them and facilitate their dissemination. Stories are integral to understanding the self, the land and community, they operate outside the confines of time – they become the past, present and future. Learning not only explores our identity but it is a sacred act given with permission, honouring our ancestors, land and ways of knowing. In many cases this learning involves generational roles[i].

Honouring Reconciliation is a collaborative process, one that involves direct action with Elders, communities, Indigenous peoples and allies. It is not a river travelled alone, is not about overtaking the other or veering into another's lane. It is not performed because you expect a return, reward or even recognition. Honouring Reconciliation is not an easy path, but it is the right path, the just path. Murray Sinclair, the chair of the Truth and Reconciliation Commission of Canada and Indigenous Senator (2016-2021), stated that "reconciliation will be about ensuring that everything we do today is aimed at that high standard of restoring that balance to that relationship (between Indigenous and non-Indigenous".

Appendix C:
Key Informants

Based on discussion, the preceding analyses, literature summaries, and availability, a list of key informants was developed with ROM staff. An abbreviated copy of this report, emphasizing the foundational principles was shared with those informants for discussion and input, which was then incorporated into each section. These 12 one-hour interviews were conducted digitally and recorded for future use by ROM staff.

1. Jill Carter (https://www.cdtps.utoronto.ca/people/directories/all-faculty/jill-carter)

A researcher and theatre-worker Jill Carter (Anishinaabe/Ashkenazi) works in Toronto with many indigenous artists to support the development of new works and to disseminate artistic objectives, process, and outcomes through community-driven research projects. Dr. Carter's scholarly research, creative projects, and activism are built upon ongoing relationships with Indigenous Elders, artists and activists positioning her as witness to, participant in, and disseminator of oral histories that speak to the application of Indigenous aesthetic principles and traditional knowledge systems to contemporary performance.

2. Lynn D. Dierking (https://www.instituteforlearninginnovation.org/person/lynn-dierking-ph-d/)

A Principal Researcher at the Institute of Learning innovation, and Professor Emeritus at Oregon State University, Dr. Dierking is internationally recognized for her research in lifelong learning, particularly free-choice, out-of-school time learning, focusing on youth and families historically under-represented in museums. A key team member on this project, a recorded interview with Dierking will serve as an important resource for future ROM staff.

3. Laura Mingus Huerta (https://www.linkedin.com/in/laurahuertamigus/)

Executive Director of the Association of Children's Museums, and currently the Deputy Director of the IMLS (Institute for Museum and Library Services) Office of Museum Services Museum, Ms. Huerta also brings 6 years of experience as director of professional learning and Inclusion Initiatives at ASTC (American Association of Science and Technology Centers). Throughout her career she has been committed to equity and inclusion, informal learning environments, and community change efforts.

4. Robert Kiihne (https://www.linkedin.com/in/robert-kiihne-1a17a626/)

Director of Exhibitions at the USS Constitution Museum for over 25 years, Mr. Kiihne has led a number of NEH (National Endowment for the Humanities) and IMLS (Institute for

Museum & Library Services) funded exhibition and program development projects. His work focuses on actively engaging families in history through the personal narratives of "the less usual suspects," including people of color, women and working-class sailors. These efforts have led to conversations with museum professionals across the US about the importance of prototyping and social learning in exhibition design.

5. Marissa Largo (https://marissalargo.com/new/about/)

A researcher, artist, curator, and educator, Dr. Largo's work focuses on the intersections of race, gender, settler colonialism, and Asian diasporic cultural production. Largo is co-editor of *Diasporic Intimacies: Queer Filipinos and Canadian Imaginaries* (Northwestern University Press). Her projects have been presented in venues and events across Canada and she also collaborates with organizations that connect social activist art practices with community engagement.

6. Ange Loft (http://www.jumbliestheatre.org/jumblies/about/staff/ange-loft)

Associate Artistic Director of Jumblies Theatre, and an interdisciplinary performing artist from Kahnawa:keKanien'keha:ka Territory, Ms. Loft is a collaborator, consultant, and facilitator of Haudenosaunee history. She specializes in, and facilitates interdisciplinary creation, arts-based research, oral history, outdoor performance, community art design, wearable sculpture and project planning. Loft also is a Juno and Polaris nominated vocalist with YAMANTAKA//SONIC TITAN.

7. Jenni Martin (https://www.cdm.org/staff/education-strategic-initiatives/)

Director of Education and Strategic Initiatives with more than 25 years of experience in the museum field, Dr. Martin manages a team of 19 responsible for creating and facilitating educational experiences grounded in experiential, inquiry-based, and service-learning methods. She has participated in numerous, significant research projects related to family learning in museums.

8. Kelly McKinley (https://www.linkedin.com/in/kelly-mckinley-4286a721/)

Director of the Bay Area Discovery Museum, an institution which recently completed a significant construction and redevelopment project to engage families, Ms. McKinley is a seasoned museum leader who has practiced in Toronto and developed the "Off the Wall" hands-on center at the Art Gallery of Ontario.

9. Margaret Middleton (https://www.margaretmiddleton.com)

Independent exhibit designer and museum consultant currently based in Belfast, Northern Ireland. Middleton has over 15 years of experience in the museum field, working at the intersection of design and social justice. They developed the popular Family Inclusive Language Chart and consult with museums on implementing inclusive practice with special focus on children, gender minorities, and queer people.

10. Jennifer Pace Robinson (https://ceo.childrensmuseum.org/)

CEO of Indianapolis Children's Museum, Ms. Pace Robinson was previously the Vice-President of experience development and family learning at the museum. She has spent the past 2 decades working to fulfill the museum's family-learning mission through exhibition development, family and school programs, and collections. Dr. Dierking worked closely with her on the Family Learning Initiative and the development of the Dinosphere exhibition.

11. Imara Ajani Rolston (https://www.linkedin.com/in/imara-ajani-rolston-113b3391/?originalSubdomain=ca)

Dr. Rolston is currently leading the development of the University of Toronto Dalla Lana School of Public Health Community Climate Resilience Lab (CCRL). This lab focuses on advancing a racial justice-oriented climate resilience agenda through action research, community partnership, and policy engagement.

12. Carol Tang (https://www.linkedin.com/in/carol-tang-76895b9/)

Executive Director at San Francisco's Children's Creativity Museum, Dr. Tang leads an institution that offers hands-on, multimedia arts experiences that nurture collaboration, creativity and confidence in children and families. Their educational approach encourages visitors to imagine and create by moving from conventional approaches of play to one of invention. Located in a culturally diverse and creative city, they encourage children and families from all backgrounds, communities, and income levels to collaborate in a dynamic and creative learning environment.

13. Lisa Van Deman (https://www.linkedin.com/in/lisa-van-deman-8322396/)

Ms. Van Deman has over twenty years of experience in management, administration, organizational development, program development and implementation, fundraising, grant writing, and staff development in child-centered arenas, including science centers, children's museums, and arts organizations. She is a former professional actress, an adjunct professor of theatre and has written extensively on the use of theatre as an interpretive strategy for learning. She also has extensive experience in creating and expanding museums of all sizes.