

# Hands-on Trolleys: Facilitating Learning Through Play

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## ABSTRACT

Museums offer children unique opportunities for meaningful learning, and over time, have evolved from being adult oriented to child-friendly places. Today, museum vision statements often include a commitment to lifelong learning and young visitors are viewed as an important museum-going audience. Consequently, museums are looking for ways to design exhibitions and programs that accommodate children's learning needs. In this context, the Queensland Museum developed a set of resource trolleys to introduce young visitors to museums and their collections. This paper reports findings from a study that evaluated the impact child-centered discovery trolleys have on 4-8 year old children's museum experiences. Findings from this study add to the body of knowledge on this topic and may have important implications for designing museum experiences that stimulate children's interest in museums and increase learning outcomes.

## INTRODUCTION

The Queensland Museum<sup>1</sup> (QM), with funding from the Australia Council for the Arts, developed a set of mobile resource units or trolleys to introduce young visitors to museums and their collections. The What's Inside? (WI) project was designed to encourage child-centered practices within the museum and engage children in hands-on learning. Current understandings about cognitive development and early childhood education were incorporated into the design of the trolleys, providing children with opportunities for choice, play, and social interaction.

Current learning theories support the view that every child is a unique individual with personal interests and learning preferences. Howard Gardner's multiple intelligences theory claims that individuals possess different kinds of intelligences including: linguistic, spatial, logical-mathematical, musical, bodily-kinesthetic, naturalistic, interpersonal, and intrapersonal

(Gardner, 2000). One implication of this theory is that learning experiences should be designed to encourage development of all intelligences. In the museum setting this means creating an environment where children can choose to explore topics in a variety of ways.

In addition to multiple intelligences, children also have individual learning styles—strengths and differences in the ways each child prefers to process new information (Dunn, Dunn & Perrin, 1994). Included in children's individual learning styles are perception preferences. For example, some children may prefer to learn by looking, others may prefer to learn by listening, others by touching, and some may prefer to learn by doing. In order to maximize opportunities for learning, museum experiences should be designed to provide a variety of modes of learning such as visual, auditory, tactile, and kinesthetic. Providing children with opportunities for choice and control have been shown to stimulate children's learning during

museum visits (Csikszentmihalyi & Hermanson, 1995; Falk & Dierking, 2000; Paris, 1997; Perry, 1994; Piscitelli, Weier & Everett, 2003). When children decide what they want to do and how long they want to do it, they gain a sense of empowerment and ownership of the learning process (Falk & Dierking, 2000).

Play is widely accepted as a precursor of formal learning. Both Piaget (1951) and Vygotsky (1978) incorporated theories of play into their broader theories of cognitive development. In recent years there has been increased research in the area of children's play and its influence on learning. Engaging in play helps children to:

understand their own capabilities and identity, the physical world around them, and social relationships and social settings (Nicolopoulou, 1993); gain a sense of power and control that comes from mastering new experiences, ideas, and concerns;

learn new concepts, explore new attitudes, and develop new skills; transform their experiences into creations that are uniquely their own; and build meaningful connections between their experiences at home, at school, and in the community (Levin, 2000).

An important factor contributing to learning outcomes that result from play experiences is the nature of adult/child interactions that take place during play. Levin (2000) states that supported by adults, play can provide an effective vehicle for working on a variety of concepts and skills that are important for young children to learn (p. 56).

The value of play experiences is supported in the museum literature. The play-based approach to learning adopted by many children's museums has been found to enhance learning by providing children with hands-on, interactive environments that stimulate their motivation and interest (Speaker, 2001). Play experiences in museum settings have also been found to be a platform for memorable learning for young children (Anderson, Piscitelli, Weier, Everett & Tayler, 2002).

The role social interactions play in influencing children's learning is not to be underestimated. Social constructivists such as Vygotsky focus on the social influences on learning. Vygotsky's social development theory is based on the view that learning does not take place apart from the social world. Vygotsky (1978) argued that cognition develops through interaction with others; the learner socially constructs meaning.

Research in the area of learning in museums supports the view that social interactions play an important role in learning outcomes (Borun,

Chambers, & Cleghorn, 1996; Crowley & Callanan, 1998; Falk & Dierking, 2000; Hein, 1998; Piscitelli & Weier, 2002; Wolins, Jensen, & Ulzheimer, 1992). Falk and Dierking (2000) argue that meaningful learning experiences in museum settings are derived from shared experiences conversation with and observation of others. They suggest that although learning is both an individual and group process, learning, particularly in museums, is a fundamentally social experience (p. 38). Because children visit museums in social groups, social interactions that occur during the visit play an integral part in the learning process.

Based on our understandings of play, choice, and social cognition, the purpose of the What's Inside? study was to investigate the impact child-centered discovery trolleys have on young children's museum experiences, and in particular on their perceptions of museums, enjoyment, and learning. Such information may have important implications for designing museum experiences that stimulate children's interest in museums and increase learning outcomes.

## METHODS

Eight WI trolleys were constructed for the project four self-guided units (Life in the Outback, Marine Reptiles, Dinosaurs, and Discover Queensland) and four guided units (Taxonomy, Material Culture, Mammals, and Welcome & Orientation). Self-guided trolleys were designed to be used as unstructured, free-choice experiences facilitated by QM volunteers. Guided trolley experiences included a 15 minute introduction provided by a member of the education staff, followed by 15 minutes of free-exploration. Themes for the trolleys were selected to complement the permanent exhibitions.

The trolleys were designed to be mobile so that they could be wheeled on and off the floor and moved to a variety of locations. All trolleys contain a variety of hands-on resources including artifacts and specimens (originals and replicas), dress-ups, puppets, puzzles, books, and materials for drawing (see Figure 1).

## Participants

Four classes from two schools were invited to participate in the study. Although ninety children participated in the museum visit program, due to child absences and a low return rate of consent forms by parents from one class, 66 children (ages 4–8) took part in the research (see Tables 1 and 2 below for children's grade level and gender). Four teachers also participated in the study.



Figure 1. What's Inside? Mammals trolley

*Photo by David Fittell*

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Table 1. Grade levels

Grade	Frequency	Percent
Pre-school	18	27.3
1st	41	62.1
1st & 2nd	7	10.6
Total	66	100.0

Table 2. Gender

Gender	Frequency	Percent
Girl	34	51.5
Boy	32	48.5
Total	66	100.0

## Procedure

Pre- and post-visit questionnaires, observations, and photographs were the primary data generation methods used to evaluate the impact the hands-on trolleys had on young children's museum experiences (see Table 3 for data collection strategies used). Questionnaires were developed by the museum researcher in consultation with QM staff and participating teachers (see Appendix for a sample of questions from pre- and post-visit child questionnaires). Data were collected by the QM researcher, QM education staff, and museum volunteers.

Approximately two weeks before the visit, the researcher and a member of the museum education staff visited the four classrooms to administer the pre-visit questionnaire. Child questionnaires were orally administered on an individual basis. Pre-visit questionnaires probed children's past visiting history and perceptions of museums. Questionnaires consisted of both closed response and open-

ended questions. One week prior to the museum visit, the researcher made a second visit to each of the four classes and provided the children with a 30 minute overview of the museum visit. During the classroom session children were shown pictures of the trolleys they would be using during the visit.

Informal meetings were held with teachers to discuss the content and structure of the museum visit. The selection of WI trolleys used during the visit was influenced by the school curriculum. For example, students from School 1 used the Dinosaurs trolley during their museum visit because they were learning about dinosaurs at school. Each class used three different trolleys during their visit: one

guided and two self-guided experiences (see Table 4 for trolleys used).

The two participating schools visited the museum on separate days. During the on-site visit children toured the museum in groups that consisted of 9-13 students, 1-2 adult chaperones (teacher and/or parents), a museum volunteer guide, and a researcher (to record observations). While at the self-guided trolleys, children were free to engage in activities of their choosing. Facilitators (museum volunteers) offered assistance and interpretation. The guided trolley experiences consisted of a 15 minute introduction provided by a member of the education staff, followed by 15 minutes of

Table 3. Data collection strategies

Data Collection Period	Methods	Participants
Pre-visit	Child orally administered questionnaire	66 Children
Visit	Observations Photographs	
Post-visit	Child orally administered questionnaire Teacher questionnaire	55 Children 4 Teachers

Table 4. Trolleys used during museum visit

School	Grade level	Trolleys
School 1	1st	Welcome & Orientation guided Dinosaurs self-guided Marine Reptiles self-guided
School 2	Pre-school	Mammals guided Life in the Outback self-guided Marine Reptiles self-guided
	1st & 2nd (combined)	Taxonomy guided Life in the Outback self-guided Marine Reptiles self-guided

free-exploration. Observations and photographs were used to record children's interactions with the trolleys. Observations focused on describing children's physical, cognitive, emotional, and social engagement.

A week after the museum visit, the researcher and museum education staff member re-visited the four classrooms to administer the post-visit questionnaire. Questionnaires were orally administered on an individual basis. During this session, children were asked the same questions concerning their perceptions of museums and additional questions pertaining to the impact of the trolleys, specifically in regards to enjoyment and learning.

In addition to the child questionnaires, teachers were asked to complete a post-visit questionnaire to gain their perspective on the impact the trolleys had on students' enjoyment and learning.

## RESULTS

Responses to open-ended questionnaire questions and observational data were coded, and statistics were generated from closed response questions. Results will be discussed in the following areas: perceptions of museums, enjoyment, and learning.

### Perceptions of museums

Overall, children in this study held positive perceptions of museums.

The data suggest that participants' perceptions of museums changed as a result of the WI interactive experience. Before the visit, children's perceptions of museums focused on dinosaurs and dinosaur-related items such as bones and skeletons. After the visit, although children's perceptions continued to be dinosaur-focused, they perceived the museum to be a place where you see animals, olden day objects, and items for children such as toys, dress-ups, and puppets—all features of the WI trolleys.

Children viewed museums as fun places with lots of things for kids to do before and after the WI visit. Children's perceptions of how much they would talk with friends, play, touch things, and look at things increased considerably after the visit.

Table 5. How often do / would you do the following things during a visit to a museum?

	Pre-visit			Post-visit		
	Never	A little	A lot	Never	A little	A lot
Touch things	34%	40%	22%	7%	55%	35%
Play	35%	31%	31%	5%	44%	51%
Look at things	0%	18%	79%	0%	9%	91%
Learn	4%	20%	73%	2%	22%	76%
Talk with friends	20%	36%	40%	4%	31%	65%

Table 6. A sample of responses to the question "Why do you think we have museums?"

Pre-visit	Post-visit
No response.	Cause people like museums. It's fun.
To show dinosaur bones.	To collect things and display them.
They tell you all about dinosaurs.	To show you all about the dinosaurs and things about a long time ago.
Study about dinosaur bones.	For people to learn about the olden days and dinosaurs.
No response.	So people can look. So people can play sometimes.
To see things.	We look for things. They have dress-ups and bats and possums.
No response.	Because you can look at things, touch things, and see things.

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(see Table 5). Children's perceptions about what they would learn about in museums changed over the duration of the project. After the WI museum visit, a higher percentage of children indicated that they would learn about animals, olden day things, rocks/fossils, dinosaurs, and oceans—all topics featured in the WI Trolleys.

Data from child questionnaires indicate that child-centered resources and trolley activities facilitate children's understanding of museums, their collections, and exhibitions. Table 6 reports a sample of children's pre- and post-visit responses to the question "Why do you think we have museums?". These suggest that the children gained a greater understanding about the museum and were more likely to view museums as child-friendly places as a result of their interactions with the WI trolleys.

### Enjoyment

Children provided overwhelmingly positive comments about their experiences with the WI trolleys. The majority of children stated that they liked using the trolleys a lot. Few

children provided responses to the question asking them if there was anything about the trolleys that they did not like. Features of the trolleys children liked best included: dress-ups, puppets, toy/games, and touching the specimens and artifacts.

Overall, observational data shows children demonstrated high levels of interest and involvement at each of the WI trolleys. High levels of engagement and enjoyment were observed during both guided and self-guided trolley experiences. Laughter, excitement, and amazement were emotions commonly expressed by children. Children actively participated in play activity using puppets, dress-ups, making puzzles, and playing with olden day toys. The range of resources available in the WI trolleys provided children with an opportunity to engage in activities of their choosing. Some children engaged in highly active play while others preferred to sit quietly and draw or make puzzles—choosing to work by themselves or in the company of others (see Figure 2). Topics were explored in many ways. For example, at the Dinosaurs trolley children looked at

and touched fossils and other dinosaur-related specimens, read books, made puzzles and drawings of dinosaurs, played with dinosaur models and puppets, dressed-up as dinosaurs, and ran on the dinosaur footprint mat.

Teachers perceived the WI experiences to be highly enjoyable and fun for their students. One teacher commented, "It was very positive. Children thoroughly enjoyed the experience. The wide range of hands-on activities touching specimens and artifacts, using puppets and dress-ups" was identified as the primary way through which the children's experience was enhanced.

### Learning

In response to the question asking them about their learning, the majority of children stated that they thought they had learned something new while using the trolleys. Children indicated that they learned in many different ways—by looking, touching, doing, and listening. Specific WI resources such as puppets, models, dinosaur footprint mats, fossils, and artifacts/specimens were referred to in children's learning statements, for example:



Figure 2. Children engage in a range of activities—playing with puppets, dress-ups, and touching specimens

*Photos by David Fittell*

- *What dinosaur footprints look like*
- *Fossils are very, very heavy*
- *Seagulls like to eat turtles*
- *About how the sea snake gets fish to follow him*
- *Skeletons inside the bird*
- *To be careful with echidnas – they have sharp spikes*
- *What possums feel like when they're dead*
- *The story of the (washing) peps*

The trolleys' resources and activities encouraged children to engage in many forms of social interaction – peer to peer, adult to child, and child to adult. Children reported learning from both adult interpretation and through self-discovery. Children's learning statements suggest that learning resulted from both guided and self-guided experiences. The interpretation provided by facilitators was identified as playing a significant role in guiding children's learning and shaping learning outcomes. Training sessions for facilitators focusing on techniques for interacting with young children were built into the design of the project.



Figure 3. Facilitators guide children's learning

*Photo by David Fittell*

Facilitators guided children's learning by explaining, asking questions, and providing links between the resources and the exhibition (see Figure 3). Although children gravitated to the puppets and dress-ups, they demonstrated high levels of interest in learning about specimens and artifacts when facilitators used strategies such as story telling and guessing games.

Teachers viewed students' interactions with the WI trolley as a valuable learning experience. Features of the trolleys identified as impacting learning outcomes included: hands-on, active learning, and facilitators providing a nurturing environment for learning.

The location and physical space devoted to the trolleys were two additional features of the trolleys that may have increased opportunities for learning. Locating the trolleys in close proximity to the exhibition served to both introduce the topic and reinforce learning. For example, after a child finished making a sea snake puzzle at the Marine Reptiles WI trolley, a facilitator led the child to the Marine Reptiles exhibition to watch the video of a sea snake swimming in the ocean. Having adequate space for both quiet activities such as reading and drawing, as well as large open spaces for active play (such as dress-up) was another feature of the trolleys' design that assisted in accommodating children's individual learning preferences.

## CONCLUSION

The results of this study suggest that child-centered resources make a positive impact on children's museum experiences. The child-centered features incorporated into

the design of the trolleys – providing children with opportunities for choice, play, and social interaction – played an instrumental role in creating a successful learning environment for young children. The content of the trolleys, having a range of hands-on resources and activities, provided children with an opportunity to engage in activities of their choosing. They could follow their own interests and participate in activities that matched their individual learning styles. The play-based design of the trolleys facilitated active learning and heightened children's enthusiasm and creativity. The activities and resources also encouraged children to interact socially with their classmates and adults. Interpretation provided by museum facilitators played an important role in guiding children's learning.

Findings from this study also suggest that children's perceptions of museums changed as a result of the WI museum experience. Children's perceptions moved from a narrow dinosaurs focus to an expanded view about what could be seen and done in museums. After the visit, children's descriptions of museums included child-friendly terms such as play, touch, and fun. Innovations such as hands-on trolleys provide children with opportunities for a highly enjoyable learning experience and provide museums with opportunities to stimulate children's interest in museums and better serve the learning needs of young visitors.

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### NOTE

1. The Queensland Museum is a social and natural history museum located in Brisbane, Australia.

### ABOUT THE AUTHORS

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Photos by David Fittell

## Appendix: Sample of Questions from Pre- & Post-Visit Child Questionnaires

### [Pre-Visit Questionnaire]

Have you ever visited the Queensland Museum? (How many times? With whom?)

### [Pre- & Post-Visit Questionnaires]

#### *Perceptions of museums*

- 1) Tell me what you think a museum is.
- 2) Why do you think we have museums?
- 3) Who do you think visits museums? [ Tick all that apply]  
 Kids    Adults    Families    Teachers
- 4) What sorts of things do/would you **see** at museums?
- 5) What sorts of things do/would you **do** at museums?
- 6) What sorts of things do/would you learn about at museums? [ Tick all that apply]  
 Animals                       Computers                       Plants  
 Art                                       Olden day things                       Rocks / Fossils  
 Dinosaurs                       Trains                                       Oceans  
 Other \_\_\_\_\_
- 7) What sorts of things do you think people who work in museums do?
- 8) Do you think visiting a museum would be/is...  
 fun                       just ok                       boring
- 9) How much stuff do you think there is for kids to do at museums?  
 nothing                       a little                       a lot
- 10) How often do/would you do these things during a visit to a museum?  
Touch things                       never                       a little                       a lot  
Play                                       never                       a little                       a lot  
Look at things                       never                       a little                       a lot  
Learn                                       never                       a little                       a lot  
Talk with friends                       never                       a little                       a lot

### [Post-Visit Questionnaire]

#### *Impact of the What's Inside? trolleys*

- 11) What did you like best about your museum visit?
- 12) Was there anything that you didn't like about your museum visit?  
[Show children images of the *What's Inside* units used during their visit. Ask children if they remember using these units.]
- 13) Which trolley did you like the best? [Rank order 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup>]  
Orientation \_\_\_\_\_ Mammals \_\_\_\_\_ Taxonomy \_\_\_\_\_  
Marine Reptiles \_\_\_\_\_ Dinosaurs \_\_\_\_\_ Life in the Outback \_\_\_\_\_  
[Go through each trolley used, one at a time (in order of preference), asking children the same series of questions] [Circle Unit]  
Orientation   Mammals   Taxonomy   Marine Reptiles   Dinosaurs   Outback
- 14) How much did you like using this *What's Inside* unit?  
 not at all                       a little bit                       a lot
- 15) What did you like best about it?
- 16) Was there anything that you didn't like about it?
- 17) Did you learn (find out) anything new (get any new ideas) about... [museums, animals, marine reptiles, life in the olden days, etc.] while you were using it?  
 Yes (If yes, what? How?)                       No                       Not sure