

*1, 2, 3 Ready? Set. Go!*

**Front-End Evaluation: Summary of Museum Interviews**

**Prepared for the Minnesota Children's Museum**

**by Randi Korn & Associates, Inc.**

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## INTRODUCTION

This report presents the findings from a front-end evaluation of *1, 2, 3 Ready? Set. Go!*, conducted by Randi Korn & Associates (RK&A) for the Minnesota Children's Museum. *1, 2, 3 Ready? Set. Go!* is a traveling exhibition that will visit both libraries and children's museums across the country. The exhibition is being developed by the Minnesota Children's Museum in collaboration with the American Library Association to engage children 2 through 7 years and their parents in exploring math through hands-on, book-based math activities.

In general, front-end evaluation is conducted to provide exhibit planners with information about their audience during the planning stages of an exhibition. RK&A designed this evaluation to determine:

- Parents' ability to recognize math processes that their young children engage in when problem solving;
- Parents' verbal and physical behaviors when their child is engaged in a math problem/activity;
- Whether parents recognize the natural math lessons in the world around them, and whether they use them with their children;
- What kinds of interactives parents would feel comfortable using in a children's museum setting;
- How parents prefer to receive information in a children's museum (e.g., video, print, computer);
- What would motivate parents to interact with their children in a children's museum.

## METHODOLOGY

The observations and interviews were conducted at the Boston Children's Museum and the Minnesota Children's Museum in October 1998. Parent-child pairs with children ages 3 to 7 years were intercepted and asked to participate in the study. The children were asked to try an activity (for the 3 to 5 year-olds, the activity was based on *The Teddy Bears' Picnic* and for the 6 to 7 year-olds, *The Doorbell Rang*) and parents were given instructions to interact with their child as they normally would. As the parent-child pairs used the activity, observations of their behaviors and interactions were recorded. After the children finished the activity, the parents were interviewed (see the Appendix for a description of the activities and the interview guide).

## DATA ANALYSIS AND METHOD OF REPORTING

The data presented in this report are qualitative, meaning they are description rather than numerical. In analyzing qualitative data, the evaluator studies the responses for meaningful patterns. As patterns and trends emerge, similar responses are grouped together. Specifically, observations recorded behaviors and, when analyzed, natural grouping emerged (i.e., the

observations are ethnographic in nature). In terms of the interviews, they were structured by an interview guide, yet conversational in tone, encouraging the interviewees to talk about their experiences from a personal perspective. As such, verbatim quotations (edited for clarity and conciseness) are provided in this report to illustrate interviewees' thoughts and ideas as fully as possible. All findings from the observations and interviews are presented in descending order, starting with the most frequently occurring. Idiosyncratic responses are reported only when they offer noteworthy perspectives on a topic.

Findings are reported in four main sections as follows:

- I. Demographics
- II. Results from Observations
- III. Results from Interviews
- IV. Recommendations

## SUMMARY OF MUSEUM OBSERVATIONS AND INTERVIEWS

The observations and interviews were conducted at the Boston Children’s Museum and the Minnesota Children’s Museum in October 1998. Parent-child pairs with children ages three to seven years were intercepted and asked to participate in the study. The children were asked to try an activity (for the three to five year-olds, the activity was based on *The Teddy Bears’ Picnic* and for the six to seven year-olds, *The Doorbell Rang*). Parents were instructed to interact with their children as they do normally. The interviewer observed and recorded the interactions and behaviors. Next, the parents were interviewed (see the Appendix for the interview guide).

A total of twenty-six child and parent pairs were observed and twenty-six parents were interviewed (fourteen at Boston and twelve at Minnesota). Of the thirty-eight English-speaking parents who were approached, twelve declined to participate. Thus, the refusal rate was 31 %, a relatively high rate for museum visitor surveys. It should be noted that most of the refusals took place at the Boston Children’s Museum, and nearly all of these were from families with timed-tickets to the popular *Arthur* program.

### DEMOGRAPHICS

More than two-thirds of the parents interviewed were female and about one-third were male. About three-quarters of interviewees were between the ages of thirty-five and forty-four years and nearly all were Caucasian (see Table 1). Approximately three-fifths were female and two-fifths were male. Children ranged in age from three to seven years, with the majority falling at either end of the range (one-third were three years old and one-third were seven years old). Again, nearly all of the children were Caucasian.

**Table 1.**  
**Demographic Characteristics of Parents**

<b>Gender</b>	<b><i>n</i></b>
Female	18
Male	8
<b>Age</b>	<b><i>n</i></b>
18 - 24	0
25 - 34	5
35 - 44	19
45 - 54	2
<b>Ethnicity</b>	<b><i>n</i></b>
Caucasian	21
Asian	4
Hispanic	1
African American	0

**Table 2.**  
**Demographic Characteristics of Children**

<b>Gender</b>	<b><i>n</i></b>
Female	15
Male	11
<b>Age</b>	<b><i>n</i></b>
3	9
4 – 5	4
6	3
7	10
<b>Ethnicity</b>	<b><i>n</i></b>
Caucasian	20
Asian	4
Hispanic	1
African American	1

## RESULTS FROM OBSERVATIONS

### *The Teddy Bears' Picnic Activity*

Preschoolers (three to five) were told the basic storyline of the book, *The Teddy Bears' Picnic*, and were presented with small plastic bears (in three sizes and four colors) and a mat with three circles each representative of a distinct habitat (cave, lake, forest). The children were then asked to decide where the bears should picnic.

### Observations of Children

Many of the preschoolers sought parental assurance for the novel situation of meeting a stranger with whom they were allowed to speak (the interviewer) and being asked to do an activity. All but two of the children interacted with their parents during the activity. In some cases the parents led the activity, in others, the children took the lead. Overall, children used the activity for longer and incorporated more math processes (sorting, sequencing, etc.) when their parents actively participated.

There was substantial variation in the ways in which the children played with the bears. Many children sorted the bears by color and/or size. For example, several children placed all the red bears in one circle, all the blue in another, and all the green in the third. When two parents asked their children to explain how they decided to sort the bears, the children explained that they had matched the color of the bears with the color of the habitat (e.g., blue bears in the blue lake). The fact that there were four colors seemed to cause some of the children to re-think their sorting plans. Several simply left the bears of the fourth color in a pile next to the mat, while a few others placed bears of two colors in a single circle (e.g., half green and half yellow) or used one-to-one correspondence to evenly distribute the additional bears in the three circles. Several children also sorted the bears by size. Most of these children identified the largest bear as “the daddy,” the medium-sized as “the mommy,” and the smallest as “the baby” and then created family groupings or placed all the bears of one size into one circle.

Instead of sorting, some of the children arranged bears of mixed sizes and colors into rows and circles. There did not appear to be any repeated patterns of color or size within these rows or circles, although the children were careful about selecting and lining up the bears. Other children focused more on the number of bears; some used one-to-one correspondence to divide the bears equally into the three circles while others seemed preoccupied with the sheer quantity of bears. (These children scooped up as many bears as they could hold and packed them into one circle. The bears had neither a consistent orientation, nor were they individually selected.) Yet another child counted the bears when prompted by her mother.

Several children played with the bears as if they were action figures or dolls. They devised and acted out stories with their parents. Others simply moved the animals around the mat, pretending that the bears were walking in the cave, climbing trees, and swimming in the lake.

## Observations of Parents

Most of the parents actively engaged their children by facilitating the use of the activity and/or engaging in dramatic play. For example, many parents helped by pointing out the three habitats and reiterating the purpose of the activity. Others posed questions to their children and made suggestions about where to place the bears. Some parents pointed out the bears' differing sizes and colors. One parent even instructed her child to count the bears. Dramatic play took the form of using the bears as action figures and making up stories. The parents and children often took turns creating scenarios for the bears.

### *The Doorbell Rang Activity*

The elementary school-age children (six to seven years) were told the general outline of *The Doorbell Rang*. Next, they were given a set of six plates, a stack of paper napkins, and a jar containing thirteen plastic cookies. They were then asked to set the table and share the cookies with their parents and the interviewer.

## Observations of Children

In general, these children were more comfortable with the interviewer and less dependent on their parents than were the preschoolers. They were able to follow verbal instructions to successfully complete the activity. Those who were not prompted (by a parent or the interviewer) finished the activity quickly and used few math processes. Fewer than half of the children interacted with their parents while using this activity.

All of the children used one-to-one correspondence to distribute the appropriate number of plates and napkins and/or to share the cookies. When asked to set the table for their parents, interviewer, and themselves, all but three of the children did so using the correct number of plates and napkins. Those who did not match the number of people with the number of plates, set out all six plates and distributed the cookies evenly. Regardless of how they set the table, all of the children used one-to-one correspondence to evenly distribute the cookies. About half of the children placed only one cookie on each plate, leaving the remaining cookies in the jar. When asked to explain why, some replied that they were saving cookies for other guests, while a few said they were saving the cookies for themselves. The other half of the children placed one cookie on each plate until only one remained in the jar. Many of these children offered no explanation as to what to do with the extra cookie. Others placed the remaining cookie on either their own plate or that of their parents or the interviewer. A few suggested that the cookie could be broken in order to share it equally.

Several children were prompted by either a parent or the interviewer to sort the cookies in multiple ways (e.g., to add plates and share the cookies with additional guests) and to estimate the number of cookies in the jar. The observer noted that these children were quite flexible in adapting to the different scenarios that were presented. In addition, one child (prompted by her parent) counted the number of chocolate chips in each cookie and then sorted the cookies into piles accordingly.

A few of the children engaged in dramatic play by acting out the story of *The Doorbell Rang* or pretending to eat the cookies.

### Observations of Parents

Fewer than half of the parents interacted with their children. Instead, they sat and watched their children and/or interacted with the interviewer. Those who participated with their children did so to varying degrees. Some asked questions and made suggestions about how to share the cookies. Others engaged in pretend play. A few asked their children to perform math processes such as counting and adding. Two parents reiterated the story and purpose of the activity and one read the book aloud.

## RESULTS FROM PARENT INTERVIEWS

### *The Teddy Bears' Picnic Activity*

#### Parents' Insights

When parents were asked to describe the processes their children used in this activity, all but one gave accurate accounts. In other words, the parents' descriptions matched the interviewer's observations. Some parents were able to list, step-by-step, what their children did. This suggests that the parents were astute observers of their children. The lone exception was a parent who exaggerated his child's actions. He said his child first sorted the bears by color and size and then arranging them. The interviewer did not observe this sequence.

Some of the parents were analytical about the behaviors they had observed.. Although none of the parents specifically stated that their children were using pre-math processes, seven recognized that their children were "sorting," "arranging," and/or "matching." In addition, some offered explanations of their children's choices. For example, one explained that her child had selected two large bears and two small ones to create a grouping that resembled her family. A second stated that her child likes rainbows and therefore sorted and arranged the bears into rows. A third pointed out that her child had matched the dominant color in each habitat with the color of the bears (i.e., all the blue bears were placed in the blue lake), while another suggested that her daughter began sorting the bears by color but gave up when confronted with the fact that there were four colors and only three circles.

Other parents analyzed the stories and situations that their children created for the bears. For example, one parent said her child treated the small bears as children and the large ones as mothers because that is how the child normally plays. Another explained that his son likes Winnie the Pooh and was pretending that the bears were in the forest "looking for honey." A third said her daughter had recently learned to swim which is why she placed all the bears in the lake.

### Parents' Ability to Identify Math Processes

After parents described their observations, they were asked to choose from a list those math processes that their children had used. In contrast with their accurate descriptions of actions, the parents' identification of processes often did not match the observations of the interviewer (see Table 3). In fact, parents often exaggerated the number and type of processes used by their children. For example, more parents said their children had "arranged" and "compared" than were observed, and a few parents said their children had "estimated" and "graphed" although no children were seen doing so. In addition to this tendency to exaggerate, a few parents did not recognize instances where their children actually did employ some of the math processes. For example, more children "explored" the habitats than was identified by parents. Because all but one of the parents had given accurate descriptions of their children's actions, this suggests that the terms used to describe the math processes were unfamiliar.

**Table 3.**  
**Bear Activity**  
**Math Processes Identified by Parents vs. Observed by Interviewer ( $n = 13$ )**

<b>Processes Identified by Parents</b>	<b><i>n</i></b>	<b>Processes Observed</b>	<b><i>n</i></b>
Arranging	11	Exploring	9
Sorting	9	Sorting	8
Comparing	8	Arranging	7
Describing	5	Describing	4
Exploring	5	Matching	3
Matching	5	Comparing	2
Counting	3	Counting	2
Problem solving	3	Investigating	2
Estimating	2	Problem solving	2
Investigating	2	Drawing	0
Graphing	1	Estimating	0
Drawing	0	Graphing	0

After identifying which processes they thought their children had used in the bears activity, parents were asked whether the processes had anything in common. About two-thirds of the parents said the processes were all related to "learning" or "thinking" while one-third identified the processes as "mathematical." One parent could not determine any relationships among the processes.

Parents provided a number of different explanations for how the processes relate to math. About one-third focused on how the processes form the foundation of mathematics. As one parent stated, "[The processes] have to do with organization and that's what math is--organization of numbers and quantities." One-quarter of parents simply agreed that the processes are related to math and did not offer any further explanation. Another quarter did not think that drawing,



arranging, exploring, investigating, and describing are math processes. A few other parents thought the processes involved the “concept of numbers.”

### *The Doorbell Rang Activity*

#### Parents’ Insights

When parents were asked to describe the processes their children employed in the cookie activity, all gave accurate accounts and some provided detailed descriptions. This suggests that, overall, the parents were accurate observers even though few participated actively in the activity. In addition, some parents recognized that their children were using one-to-one correspondence to distribute the cookies (see the first quotation below). As the second quotation demonstrates, some parents attributed altruistic motives to their children. In addition, three parents offered explanations for why only one cookie was placed on each plate (see second quotation).

[My son] made sure that everybody had an even number of cookies. He didn’t take the whole jar and divide them up but [rather] passed the cookies out one at a time, like dealing cards, until everybody had the same number of cookies and there was only one left.

My daughter has a brother and a sister so she’s really used to sharing. I think she was really concerned with being fair and making sure everybody got the same amount of cookies . . . She’s a really considerate kid.

[My son] handed out the cookies, but stopped at only one apiece probably because that’s what we would do at home. You wouldn’t empty the cookie jar; you would just have one.

#### Parents’ Ability to Identify Math Processes

After parents described their observations, they were asked to choose from a list those math processes that their children had used. As with the previous activity, the descriptions and observations did not always correspond (see Table 4). In fact, parents exaggerated the type and number of processes used. For example, four parents said their children had “estimated” when only two children had done so. Several parents recognized that their children used one-to-one correspondence. These parents used the terms “arranged,” “sorted,” and “counted.” Because all of the parents had given accurate descriptions of their children’s actions, this suggests that the terms used to describe the math processes were unfamiliar to the parents.

**Table 4.**  
**Cookie Activity**  
**Math Processes Identified by Parents vs. Observed by Interviewer ( $n = 13$ )**

<b>Processes Identified by Parents</b>	<b><math>n</math></b>	<b>Processes Observed</b>	<b><math>n</math></b>
Arranging	9	<i>One-to-one correspondence*</i>	13
Problem solving	9	Problem solving	8
Sorting	9	Estimating	2
Counting	9	Counting	1
Comparing	5	Sorting	1
Estimating	4	Arranging	0
Exploring	2	Comparing	0
Investigating	2	Describing	0
Matching	1	Drawing	0
Describing	0	Exploring	0
Drawing	0	Graphing	0
Graphing	0	Investigating	0
		Matching	0

\*This was not included on the list of math processes.

Next, the parents were asked whether the processes they had described had anything in common. Half of the parents replied that the processes were all related to “math” while one-third identified the processes as “thinking skills.” Two parents could not determine any relationships among the processes.

When asked to explain how the processes relate to mathematics, nearly all of the parents simply reiterated the relationship and did not provide any explanations. As one parent stated, “You do graphing, estimating, and counting in math, so it makes sense that all these words have to do with math.” Two other parents observed that all the processes used “analytical” skills, which to them is the basis of math.

#### *Math Activities Children do at Home*

The parents were asked what kinds of math activities their children do at home. Parents in both groups reported that they include math activities in their children’s daily routines and play times by incorporating counting, matching, and/or sorting into tasks such as getting dressed, setting the table, and putting away toys. Some parents also let their children help with cooking in order to reinforce counting and measuring concepts. About one-third of parents regularly use educational products with their children (workbooks, computer software, instructional videos, etc.). In fact, several of the parents with elementary school-age children use these products to help their children learn “addition and subtraction tables.” Other parents reported that board and card games are enjoyable ways for children to practice counting, matching, and sorting. A few think

playing with blocks encourages problem solving, while one parent uses beadwork to exercise her daughter's counting and patterning abilities.

### *Ways Parents Like to Interact with Their Children in Museums*

All of the interviewees recognized that children's museums are safe places in which children can direct their own experiences. As the following quotations demonstrate, these parents prefer to follow after their children. They play with, and provide explanations to, their children as needed. In addition, some parents learn about their children's interests and abilities by watching them at play. A few parents like to see their children play with others because the peer interaction is important in and of itself (and gives the parents a chance to talk with other parents or to have a moment to themselves).

I think I pretty much let him go and explore and then I try to explain. I think he has enough of a mommy/son relationship wherever else we go, that when I'm in an environment like [the children's museum] I just let him go and choose what he wants to get interested in. And then I'm always there to follow up and talk to him about the exhibits. It's basically his opportunity to explore on his own level.

I let my child initiate and try not to put ideas into her head. I try to see where her imagination will take her and then kind of join in with whatever ideas she's started.

We give her a choice so she can go anywhere she wants. Sometimes she needs a little help getting started, like understanding how to do an activity, but then if she wants to play by herself or with some kids she meets, I sit and read a book. But if she wants me to play with her then I'm down on my hands and knees, crawling around and doing everything she's doing . . . I'm also there if she has any questions and so I try to teach her, too. But a lot of times it depends on her mood. Sometimes she'll try to listen and if she ask me questions, then I go little farther. But, if she's restless and doesn't want to listen to me, then I let it go.

### *Activities that Promote Parent-Child Interaction*

Parents were told that the exhibition under development will encourage parental participation. They were asked to name exhibits that they had enjoyed as a family during their current visit and to describe the kinds of activities that exhibitions should include for families. Many parents thought that dramatic play areas with "props and set" (such as a grocery store or the castle at the Minnesota Children's Museum) encourage involvement by both parents and children (see the first and second quotations below). Some thought the activities should have a certain level of difficulty to encourage parents and children to work together to solve a problem (third quotation).

The castle is really great because kids and parents can act out a story . . . It's important to have props and [a set] because sometimes parents don't have the best imaginations and it helps to have stuff to react to or use to make up a story.

I like to use the *mercado* [grocery story] with my daughter. We can talk about what we should buy or cook for supper. She likes to pretend she's the mom. It gives us plenty of things to talk about because it's something I already know.

[The activities] need to be something kids don't totally understand right away on their own, because otherwise they just go ahead and do it themselves and move on . . . You have to make something challenging enough [so] that the parent and child have to work together and for it to be interesting to the parent, too . . . Like [in] the waterworks area, my daughter did not know how to get some of the water wheels moving so I tinkered with them and we got it working.

Several parents made practical suggestions such as: make exhibits large enough so that there is space for adults; provide background information so that parents can explain things to their children; include an “educational framework” that explains age level appropriateness and learning objectives. Two parents indicated that parental interaction may simply depend on “parenting style” and not on the qualities of an exhibit.

#### *Parents' Preferred Information Source*

After being told that the planned exhibition will include background information, parents were asked to name the format in which they prefer to receive information. Three-quarters of the parents favored print, primarily as wall text panels or take-home brochures. A few of these parents suggested that the label lettering should be large and easy-to-read, that the text be composed of simple language in short sentences, and that there be multiple copies of the labels to prevent overcrowding. In addition, two parents thought there should be one set of labels for parents and another one for children (see below).

If the activity is for seven year-olds, then you could include really simple instructions or information that the kids can read themselves. I've noticed my kids, now that they are older, like to figure some things out for themselves. But you should [also] have some information that's at a higher level for parents like questions to ask your child, information to answer [your child's] questions—something that'll help parents teach their children and be interesting to [the parents].

Of the other one-quarter of interviewees, three prefer a staff person present in the exhibition to explain instructions and answer questions. Two other parents chose video and one parent favored computers. One interviewee thought the exhibits should be “self-explanatory” because his children like to use exhibits quickly and then move on, leaving him little time to read label text or to discuss the exhibits.

## RECOMMENDATIONS

The primary challenge for the exhibition will be to provide background information and guidance that promotes parent-child interaction with pre-math processes while still maintaining free-choice exploration and play that both children and parents value. This is especially the case for the parents of the 3 to 5 year-olds who primarily engaged their child with pretend play and the parents of the 6 to 7-year olds who did not interact with their child.

- In the exhibition, provide labels for parents that provide simple instructions, suggestions, and questions they can ask their child to engage them in pre-math processes.
- Using gentle yet persuasive language in introductory panels and throughout the exhibition, explain the vital role parents play in their child's learning from the pre-math activities. It will be especially important to reiterate this point in the activities for older children, as older children depend less on their parents for guidance and reassurance than preschoolers do.
- Another way to emphasize the parent's role would be to have two sets of labels: one that is for children which explains in pictures or simple text how to do the activity and one that is for parents which provides suggestions and gives background information.
- Many parents appeared comfortable engaging their child in pretend play. Encouraging parents to pretend play with their child may be one way to promote parent-child interaction. It may also make math more approachable for parents who dislike it. In the exhibition, provide opportunities for pretend play, especially scenarios in which such play incorporates exercising pre-math skills.

Another issue the exhibition will need to address is parents' ability to recognize pre-math processes and the terms for those processes.

- For the parents of younger children, they simply may need to know that the sorting, arranging, etc., that their child normally incorporates into his or her play are important pre-math skills.
- For the parents of older children, they may need an explanation that math skills are not necessarily number based and that tasks such as rote counting or memorizing addition and subtraction problems should not be emphasized until a child has mastered fundamental math concepts.
- Because some parents' focused on math functions rather than processes, the exhibition will need to set a non-competitive tone and an open-ended atmosphere. That is, parents need to be reminded that getting the "right" answer is not the purpose of the activities, rather, it is to have their child explore a variety of problem-solving strategies.
- Although parents were unfamiliar with the pre-math terms, they were able to identify some of the pre-math processes their children were using. Thus, the exhibition may not need to highlight such vocabulary, but instead incorporate common usage words for the processes (e.g., instead of "estimate" use "guess the amount"). This is especially important for parents who may have anxieties related to math and for whom the use of special terms might be an additional barrier. An appropriate venue for explaining the terms may be a take-home brochure in which clear explanations can be given and useful strategies for promoting pre-math processes at home can be included.

**APPENDIX**

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