The Minnesota Children's Museum
Go Figure! Summative Evaluation

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EXECUTIVE SUMMARY

This report presents findings from a summative evaluation of *Go Figure!* conducted by Randi Korn & Associates, Inc. (RK&A) for the Minnesota Children's Museum (MCM). *Go Figure!* is a traveling exhibition that is visiting both libraries and children's museums across the country. The exhibition was developed by the Minnesota Children's Museum in collaboration with the American Library Association through a grant from the Institute of Museum and Library Services and is intended to engage children two through seven years and their parents in exploring math through hands-on, book-based math activities.

The evaluation was undertaken to document the impact and effectiveness of *Go Figure!*. For comparison sake, families' experiences in *Go Figure!* were examined against those of families in another MCM exhibition, *Earth World*. To achieve the specific objectives of the evaluation, three data collection strategies were employed: observations, standardized questionnaires, and interviews.

Only selected highlights of the study are included in this summary. Readers are urged to read the body of the report for a more detailed account of the findings.

I. PRINCIPAL FINDINGS: *GO FIGURE!* OBSERVATIONS

Visitor Demographics

- Of the 100 children observed in *Go Figure!,* 58 percent were female and 42 percent were male. The average age of the children was five years.
- Of the 118 adults who were accompanying the children, 63 percent were female and 37 percent were male. Seventy-seven percent of the adults were between 25 and 44 years of age.

Overall Visitation Patterns

- Families stopped at between 1 and 19 different components of the 31 available. The median number of components stopped at was eight.
- At least half of the families stopped in each of the five books featured in the exhibition. *Goldilocks and the Three Bears*—situated at the entrance of the gallery—attracted the most visitors (89 percent of families stopped in this book).
- In terms of individual components, Measure Up and the *Goldilocks and the Three Bears* entrance attracted the most families (each 73 percent), followed by the Three Bears' Chairs, and the Button Board (61 percent and 57 percent, respectively).
- The Introduction Panels and *The Doorbell Rang* Book Station attracted the fewest families (each 4 percent).

Visitation of Component Types

- Overall, hands-on exhibits were the most plentiful and popular type of exhibit. Families stopped at a median of five hands-on components.
- Of the entrance exhibits, *Goldilocks and the Three Bears* attracted the most visitors—73 percent.

- *Arthur's Pet Business* had the most popular book station, attracting 29 percent of families.
- The Touch Screen Quilt was the most popular computer interactive with 29 percent of families stopping at this component.

Overall Behavioral Patterns

- Take-home brochures were available in each of the five books. Eighteen percent of families took a brochure.
- Staff were present in the gallery during the evaluation. A few families interacted with staff at seven components (less than 5 percent at each).
- Nearly all of the exhibits were used as intended by at least half of the families.

Adult-child Interactions

- At least half of the families interacted at 12 of the 24 components that were designed to foster adult-child interaction.
- Overall, adults and children used a median of four components together as a family.
- Adult-child interactions were most frequent at Measure Up—84 percent of the families who stopped at this exhibit interacted—followed by the Touch Screen Quilt (66 percent) and the Mixing Station (62 percent).
- Adult-child interactions occurred least frequently at book stations—less than one-third of families interacted at each.
- In terms of specific types of adult-child interactions, adults assisted their child at a median of three components and played with him or her at a median of two. Adults asked their child a question or observed their child at a median of one component each. Less than half of the adults read aloud to their child, making the median for that behavior zero.
- Adults assisted their child most frequently at Measure Up (85 percent), followed by the Sorting Tree (57 percent), and Arthur's Computer (56 percent).
- Adults played with their child most frequently at the Sorting Tree (57 percent) and the Touch Screen Quilt (52 percent).
- Adults asked their child a question most frequently at the Button Jacket (40 percent), followed by the Garden Patch (38 percent); Pets, People, and Places (36 percent); and the Pet Food Scale (35 percent).
- Adults observed their child most frequently at the Mixing Station (38 percent), the Pet Food Scale (33 percent), and the Miniature House (33 percent).
- Adults read aloud to their child most frequently at *The Doorbell Rang* Book Station—two of the four families who stopped read to their child. The Sorting Tree (29 percent), the Button Jacket (25 percent), and *Arthur's Pet Business* Book Station (24 percent) also had frequent reading.

II. PRINCIPAL FINDINGS: EARTHWORLD OBSERVATIONS

Visitor Demographics

- Of the 100 children observed in *Earth World,* 52 percent were female and 48 percent were male. The average age of the children was six years.

- Of the 147 adults who accompanying the children, 60 percent were female and 40 percent were male. Seventy-five percent of the adults were between 25 and 44 years of age.

Comparison of Go Figure! *and* Earth World *Observations*

- Nearly all of the adults in *Go Figure!* (94 percent), and nearly all of those in *Earth World* (96 percent) interacted with their child at one or more exhibits. There was no statistically significant difference between the frequencies of adult-child interactions between the two exhibitions.
- There were, however, statistically significant differences between how parents in *Go Figure!* interacted with their child and how those in *Earth World* did. More parents in *Go Figure!* read aloud to their child, asked their child questions, assisted their child with using the exhibits, and played with their child than did parents in *Earth World*.

III. PRINCIPAL FINDNIGS: *GO FIGURE!* AND *EARTH WORLD* QUESTIONNAIRES

Visitor Demographics

- Of the 150 adults surveyed each in *Go Figure!* and in *Earth World*, 75 percent of the respondents in *Go Figure!,* and 65 percent in Earth World were female. The average age of respondents in *Go Figure!* was 37 years and in *Earth World*, 36 years.
- Two-hundred, seventy-eight children accompanied respondents in *Go Figure!* and 262 children accompanied those in *Earth World*. The average age of the children in each exhibition was four years.

Opinions about the Exhibitions

- There were three statistically significant differences between respondents' ratings of their child's experiences in *Go Figure!* and *Earth World*. Respondents in *Earth World* gave higher average ratings for the exhibition being interesting, age appropriate, and understandable to their child than did those in *Go Figure!*
- In terms of parents' own experiences in each exhibition, there was one statistically significant difference: respondents in *Go Figure!* rated the exhibition higher for being educational for parents than did those in *Earth World*.
- Parents were asked whether the exhibition they visited encouraged certain adult-child interactions. One statistically significant difference was found. Respondents in *Go Figure!* rated the exhibition higher for encouraging them to ask questions to their child than did those in *Earth World*.

Behavior Patterns in the Exhibitions

- Eighty-three percent of respondents in *Go Figure!* and 60 percent in *Earth World* reported asking their child questions.
- Sixty-eight percent in *Go Figure!* and 65 percent in *Earth World* reported using the exhibits with their child.
- Sixty-one percent in *Go Figure!* and 75 percent in *Earth World* thought that the components in each exhibition were easy enough for their child to use alone.
- There was one statistically significant difference between the two exhibitions. More respondents in *Go Figure!* (83 percent) reported asking their child questions than did those in *Earth World* (61 percent).

IV. PRINCIPAL FINDINGS: *GO FIGURE!* INTERVIEWS

Visitor Demographics

- Of the 40 adults interviewed, 65 percent were female and 35 percent were male. The average age of the adults was 36 years.
- Fifty-six children accompanied the adults. Fifty-four percent of the children were female, and 46 percent were male. The average age of the children was four years.

Overall Reaction to Go Figure!

All of the parents appreciated the interactive quality of the exhibits. Some were also pleased with the books featured in the exhibition, and several complimented its overall design and appearance. The exhibition's interdisciplinary approach to math was attractive to a few parents, while others liked that information for parents was included. Despite enjoying the exhibition, some were uncertain who was the target audience for *Go Figure!*, stating that their child was either too young or too old for the books or math activities included in the exhibition.

Differences Between Go Figure! *and Other Exhibitions at the MCM*

Half of the parents remarked that *Go Figure!* was unique as a book-based exhibition. Several others said it had a more overtly educational message than other exhibitions at the MCM because of the math activities. Six parents did not think *Go Figure!* was different from other exhibitions at the Museum.

Use of and Reaction to Text for Parents

Half of the parents said they had read and used the labels in *Go Figure!* Some of these interviewees particularly appreciated the information geared to parents. About one-quarter of parents glanced at the labels, but did not use them, citing their child's age or short attention span as barriers. Another one-quarter did not read the labels, and while they liked the idea of having text for parents, they expressed doubt that it could work in a children's museum where children lead the experience.

Main Idea of Go Figure!

Nearly half of parents identified the main idea of *Go Figure!* as having to do with math. One-third thought the exhibition was about reading or books. Several did not attribute a content message to the exhibition, but simply said it was an environment for playing and exploring. A few could not identify any unifying theme for the exhibition.

Math Processes in Go Figure!

When parents were asked to describe any math activities that their children used in the exhibition, counting was most frequently mentioned followed by measuring/weighing, matching/sorting, and pattern making. A few parents could not identify any math activities in the exhibition.

Appropriateness of Math Content in Go Figure!

About half of the parents thought *Go Figure!* was appropriate for their child. More than one-quarter criticized the math content for being either too easy or too difficult for their child. Another one-quarter had mixed feelings, saying that in some respects the math exhibits were appropriate and in others they were not.

DISCUSSION AND RECOMMENDATIONS

Mathematics exhibitions in museums are rare, and those specifically designed for pre-school aged children are virtually non-existent (Anderson and Sutterfield, 2001). With young children being increasingly focused upon in the mathematics education literature, the importance of developing children's pre-math skills is coming to the forefront (Ginsburg and Baron, 1993). By developing *Go Figure!*, a traveling exhibition designed to engage adults and their two- to seven-year olds in math activities, the Minnesota Children's Museum has begun to address the math education needs of this audience and also fill a void in the museum field. The premise of the exhibition is to foster interaction between adults and children as they use math activities developed from popular children's books. Learning is focused on both parents and children, as the exhibition is designed to engage children's pre-math skills and help parents understand that aspects of children's play (e.g., sorting, pattern making, matching) are vital to understanding of math. As such, *Go Figure!* includes educational text specifically written for parents.

Because of the exhibition's goals of the exhibition, Randi Korn & Associates, Inc., developed an extensive summative evaluation to determine which aspects of *Go Figure!* most effectively engage visitors and convey math concepts. For comparison-sake, RK&A observed families and administered identical questionnaires to parents in *Go Figure!* and *Earth World*, a permanent exhibition at MCM. To understand what meaning visitors made from their experiences, RK&A also interviewed parents in *Go Figure!*

Overall Visitor Experience

Parents praised *Go Figure!* for its interactive nature and thoughtful design. Interviewees said the hands-on exhibits worked well for their children, noting that the diversity of activities made the exhibition enjoyable for children of all ages. In particular, parents of young children thought the physical activities (e.g., the entry exhibit for each book) were especially appropriate, while those of older children said the use of popular storybooks was an immediate hook. Both children and adults found the exhibits intuitive to use. In fact, observers noted that the majority of visitors used most of the components as designers intended.

The exhibition environment also played an important role in visitors' experiences. Survey respondents rated *Go Figure!* as welcoming both to their children and to themselves. During the observations, it became clear that families were attracted to the environmental features. Of the top five most visited exhibits, three included such elements. Furthermore, more than three times as many families stopped at the book station in *Arthur's Pet Business,* which incorporated a life-sized prop, than did at each of the other book stations. These observational data demonstrate the power of the exhibition's design, a finding further substantiated by the interviews. Without being specifically asked about design, interviewees complimented the book environments for being both attractive and compelling. They felt as if they were transported into the books because of the large-scale props and settings. This was of particular note to the evaluators, as visitors rarely talk about design issues.

The least successful components in *Go Figure!*—those that attracted the fewest visitors and were misused and not discussed by visitors—were the least interactive exhibits. The introduction

panels, despite being at the entrance of the exhibition, were stopped at by few visitors. Numerous studies RK&A and others have conducted have shown that stand-alone panels are not well attended to by visitors. The Book Nook and three of the book stations—*Goldilocks and the Three Bears*, *The Quilt*, and *Toad and Frog Are Friends: A Lost Button*—also attracted few visitors. This may be because they were perceived as primarily text-based experiences. The fact that these book stations were also frequently used in unintended ways may be evidence that children were attempting to make them interactive. It may also be that the Book Nook and these book stations lacked an impressive environmental feature to grab visitors' attention, unlike the successful book station in *Arthur's Pet Business*. Or it may also be the case that few visitors stopped at the Book Nook and these book stations because these components held some visitors for significant amounts of time which prevented others from using them.

Readers of the body of the report will also note that an additional exhibit, the Button Jacket, attracted few visitors. In contrast with the other low-attraction exhibits, the few visitors who did stop at the Button Jacket spoke highly of it. Therefore, the low attraction power is likely due to its location—on the backside of another component, facing the gallery's back wall—rather than a feature of the exhibit itself.

Fostering Adult-child Interactions

At the core of *Go Figure!* is the understanding that children's learning can be augmented by interaction with a parent or caregiver. To determine whether *Go Figure!* fostered adult-child interactions, the behaviors and perceptions of families in that exhibition were compared with those of parents in *Earth World*. While both exhibitions intended for adults and children to use the exhibits together, *Go Figure!* more explicitly encouraged adult-child interactions by posing questions, suggesting activities, and providing background information for parents to help them foster learning. *Earth World*'s approach was subtler—there were a few informational text panels for parents, but they did not suggest specific learning outcomes. Both exhibitions had a family-friendly design: interactive exhibits, physical activities, child- and adult-sized components, etc.

In terms of families' behaviors, the observations showed that parents in *Go Figure!* were more actively involved with their children's experiences than were parents in *Earth World*. While both exhibitions fostered adult-child interactions, *how* parents interacted with their child varied between the two exhibitions. More parents in *Go Figure!* played with their child, assisted their child with using the exhibits, asked their child questions, and read aloud to their child than did parents in *Earth World*. These relationships were highly statistically significant, meaning that a real difference in visitors' behaviors exists between the two exhibitions that cannot be attributed to chance.

Findings from the questionnaire also showed statistically significant differences in parents' opinions about the two exhibitions. Parents who rated *Go Figure!* gave it a higher average rating for encouraging them to ask their child questions as compared to parents who rated *Earth World*. Similarly, more respondents in *Go Figure!* reported asking their child questions than did those in *Earth World*.

From these data, RK&A concludes that the types of activities and text provided in *Go Figure!* were more successful than the components in *Earth World* in promoting quality adult-child interactions. In particular, *Go Figure!* had greater success fostering adults' reading and asking questions to their children—two behaviors Borun, et. al. (1996) have correlated with learning. While the sample sizes for the observations were too small to use statistical analysis to determine exactly which aspects of *Go Figure!* promoted reading and question asking, the simple frequencies show that families at four components frequently exhibited both reading and question asking. These exhibits were the Button Jacket; the Garden Patch; Pets, People, and Places; and Arthur's Calendar. As the table below shows, each was within the top six exhibits for both of these behaviors.

Top Six Exhibits At Which:	
Adult's Asked Child Questions	**Adults' Read Aloud to Child***
Button Jacket	Sorting Tree
Garden Patch	Button Jacket
Pets, People, and Places	Arthur's Calendar
Pet Food Scale	Pets, People, and Places
Measure Up	Giant Cookie Sheet
Arthur's Calendar	Garden Patch

*Non-Book Station Exhibits Only
For the complete data set, see Tables I.14 and I.16 in the body of the report.

Educational Value

Overall, parents thought *Go Figure!* was an educational exhibition. During the interviews, several commented that the exhibition was different from others at MCM in that it was explicitly trying to promote learning in both parents and children. When asked specifically about the text for parents in *Go Figure!*, half said they had used the labels, and many found them helpful. In particular, some liked the tips for parents, appreciating the suggestions for making their child's experiences more educational. There was also a statistically significant difference in questionnaire respondents' ratings of *Go Figure!* and in *Earth World*: parents who rated *Go Figure!* gave it a higher average rating for being educational for adults than did parents who rated *Earth World*.

Survey respondents were also asked to rate their child's experiences in *Go Figure!* and *Earth World*. They deemed both exhibitions moderately educational, and there was no statistically significant difference between these ratings. With the explicit educational activities in Go Figure!, it is interesting that parents did not perceive *Go Figure!* to be different from *Earth World* in terms of children's experiences. The interviews provide some insight into why this may be.

In part, some parents do not immediately associate learning with their children's experiences at MCM. Their perception of any exhibition regardless of its explicit educational message—like *Go Figure!*—or its implicit one—like *Earth World*—may account for their similar ratings. For these parents, a children's museum is a place where a child can direct his or her own experience and the parents play a relatively passive role. For example, some interviewees said that their children's behaviors had prevented them from using the text in *Go Figure!* Namely, their children moved quickly from exhibit to exhibit, either preventing the parents from reading the labels or not listening when parents tired to read the information to them. A few others felt that the MCM was a safe space where their children could simply explore, which these parents did not necessarily equate with learning. While how parents interact with their child is partially parenting style, these interviewees' comments also suggest that some parents may have misconceptions about what role they should play in their child's museum visit.

Parents' responses should also be considered in light of the observational data. Observations showed that parents were interacting with their children in more meaningful ways in *Go Figure!* than in *Earth World*. This suggests that while many parents in *Go Figure!* are using the exhibits with their children in thoughtful ways, they may not be conscious of their instructive role or they may not perceive their actions as educational.

Conveyance of and Response to Mathematics Content

Reading the exhibit text and brochure were critical to parents' perceiving the math theme. About half of the interviewees, all of whom reported reading text, identified the theme as mathematics, either explicitly stating that the exhibition focused on "math" or describing the math processes (e.g., counting, comparing) their children had used while in the exhibition. In contrast, those who did not read any text thought the exhibition was about reading readiness or popular storybooks, or simply described the exhibition as an environment for their child to play in and explore.

The exhibit text also impacted which math processes parents were able to identify. While most parents were able to name at least one math activity that their child had used in *Go Figure!*, those who had read exhibit text were able to name more activities than those who had not. In addition, parents who read text also mentioned less well-known processes such as pattern-making and matching.

Regardless of whether they had initially identified the math theme or had read text, some parents thought the math content was not appropriate for their two- to seven-year old children. One-quarter of the interviewees thought that the math activities were either too easy or difficult for their child. Another one-quarter had mixed feeling, saying that while the exhibition offered something for their child, he or she would have gotten more about of the experience if he or she were older. These opinions were echoed by statistically significant differences in questionnaire respondents' ratings of *Go Figure!* and *Earth World*. Parents who rated *Go Figure!* gave it lower average ratings for being age appropriate, understandable, and interesting to their child than did parents who rated *Earth World*. All of this data suggest that parents' preconceived notions about math and their child's ability to do math were not fully addressed in the exhibition. It again points to parents' misunderstanding about their role in the museum—that their children

should have been able to understand the exhibits' content and purpose without parental guidance. While changing how parents understand math and fostering educational interactions between adults and children are worthwhile goals for a children's museum, it is unfair to judge a single exhibition's ability to accomplish this. Such changes likely result from cumulative experiences. As such, *Go Figure!* is one important piece.

Recommendations

In thinking about parents' responses to *Go Figure!*, it becomes clear that parents needed additional assistance in knowing how to use the exhibition and to understand the teaching philosophy underlying the exhibition. A more compelling introduction area might have provided parents with the right frame-of-mind and conceptual tools to use and understand *Go Figure!* in a richer manner. For example, let parents know that there is text for them and that it should be used to guide their child's experience. Furthermore, make the case that parents can be teachers to their children. Moreover, explain up-front that the exhibition is a math exhibition for young children, define "math," and clarify that pre-schoolers do math (e.g., include a phrase such as "Two-year olds can do math!" throughout the exhibition).

Readers will noted that visitors did not use the existing introduction panels. However, this is not to say that they would not use an introduction if it included aspects that they found attractive, such as environmental features and interactive components. The introduction area should be modeled after successful exhibit components and not simply be stand alone panels that only give title and donor information. Numerous studies by RK&A, Serrell (1999), and others have shown that a thoughtfully developed introduction area can reinforce the main message and provide visitors an analytic framework in which to place their exhibition experiences.

Parents' misconceptions about their young child's ability to do math are pervasive. They came to light during the front-end and formative evaluations and remained regardless of the well-written and conceived brochure and exhibit text. An additional medium may be necessary to help change parents' beliefs: a video that addresses developmental stages and defines math. This video could also model adult-child behaviors so visitors will know how to interact with their child in *Go Figure!* MCM does something similar in Habitot, which includes a video explaining to parents their child's developmental needs.

While *Go Figure!* is succeeding in changing how families behave in a children's museum, it would be even more powerful if it could help alter how parents think about their role and their child's potential experiences in such a place.

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INTRODUCTION

This report presents findings from a summative evaluation of *Go Figure!* conducted by Randi Korn & Associates, Inc. (RK&A) for the Minnesota Children's Museum (MCM). *Go Figure!* is a traveling exhibition that is visiting both libraries and children's museums across the country. The exhibition was developed by the Minnesota Children's Museum in collaboration with the American Library Association through a grant from the Institute of Museum and Library Services and is intended to engage children two through seven years and their parents in exploring math through hands-on, book-based math activities.

The evaluation was undertaken to document the impact and effectiveness of *Go Figure!.* Because *Go Figure!* was designed to foster adult-child interactions, the summative evaluation examined the experiences families in *Go Figure!* against those of families in another MCM exhibition, *Earth World.* The specific objectives of the study were to determine:

- families' use of *Go Figure!* (e.g., total number of stops made);
- parents' and children's behaviors at *Go Figure!* exhibits;
- parents' interactions with their children in *Go Figure!*;
- parents' interpretation of their children's behaviors in *Go Figure!*;
- parents' feeling about the text in *Go Figure!*;
- parents' understanding of and opinions about the exhibition's math focus;
- differences between families' behaviors in *Go Figure!* and *Earth World*;
- differences between parents' opinions of *Go Figure!* and *Earth World*.

METHODOLOGY

Data were collected in the summer and fall of 2000 and the winter of 2001 by RK&A and MCM staff trained by RK&A. Four data collection strategies were employed to accomplish the objectives stated above:

- observations of families in *Go Figure!*,
- observations of families in *Earth World*,
- parent questionnaires (same questionnaire administered in *Go Figure!* and *Earth World*),
- parent interviews in *Go Figure!*.

Observations

Observations provide an objective and quantitative account of how visitors behave and react to exhibition components. Observational data suggest the range of visitor behaviors occurring in an exhibition and indicate which components attract, as well as hold, visitors' attention. Two types of observations were conducted: observations of families in *Go Figure!* and observations of families in three areas of *Earth World*.

Go Figure! Observations

Families (groups with at least one adult and one child) with at least one child two years of age or older—the target audience of *Go Figure!*—were unobtrusively observed in the exhibition. Families were selected using a continuous random sampling method. In accordance with this method, a trained observer was stationed at the entrance of the exhibition. The first eligible family to enter the exhibition was selected for the study. The data collector then conducted an observation. Once the family exited the exhibition and the tracking was completed, the observer returned to the entrance to await the next eligible family to enter the exhibition.

To ensure the quality of the observations and the feasibility of data collection, one child from each family was the focus of the observation. Once a family was selected, the first child two years of age or older to stop at an exhibit was observed, with the data collector noting where the child stopped as well as behaviors exhibited by the child and interactions the child had with adults in his or her group (see Appendix A for the tracking form).

Earth World Observations

The same audience and protocol for the *Go Figure!* observations were followed for those conducted in *Earth World*. To expedite the data collection, a trained observer was stationed at either the pond, the ant hill, or the canopy and noted families' behaviors at components within that designated section (see Appendix B for the tracking form). A total of 100 families were observed in *Earth World* (35 in the pond, 30 in the ant hill, and 35 in the canopy).

Questionnaires

Standardized questionnaires are an efficient method for gathering quantitative information and for analyzing statistically significant differences between groups. The same questionnaire was administered to eligible adults (16 years of age and older visiting with at least one child 2 years of age or older) as they exited *Go Figure!* and *Earth World* (see Appendix C and D for the questionnaires). Again, respondents were selected using a continuous random sampling method. A total of 300 parents completed surveys (150 in *Go Figure!* and 150 in *Earth World*).

Interviews

Interviews are a useful tool for understanding the successes and shortcomings of exhibitions from the visitors' point-of-view. The purpose of conducting open-ended interviews is to encourage and motivate interviewees to describe their experiences, express their opinions and feelings, and share with the interviewer the meaning they constructed from an experience. Open-ended interviews produce data rich in information because interviewees talk about their experiences from a very personal perspective. In particular, exit interviews were conducted to understand visitors' overall experiences in and opinions about *Go Figure!*.

After visiting each gallery, eligible adults (16 years of age and older visiting with at least one child 2 years of age or older) were selected following a continuous random sampling method. Interviewees were asked to answer several questions about their experiences (see Appendix E for the interview guide). The interview guide was intentionally open-ended to allow interviewees

the freedom to discuss what they felt was meaningful. All interviews were tape-recorded with participants' awareness and transcribed to facilitate analysis.

DATA ANALYSIS

The questionnaire and observational data were quantitative. As such, these data were entered into a computer and analyzed statistically. Percents and summary statistics, including the median (point at which half the responses fall above and half fall below), mean (average), and standard deviation (spread of scores: ±) were calculated for interval and ratio variables. To compare the relationship between two categorical variables (e.g., visiting *Go Figure!* and adults' interacting with their child), cross tabulation tables were computed to show the joint frequency distribution of the two variables, and the chi-square statistic (X^2) was used to test the significance of the relationship.[1]

For the most part, medians rather than means are reported in this document because, as is typical, the number of components used and the time spent by visitors were distributed unevenly across the range. For example, whereas most visitors stop at relatively few exhibition components, a few visitors stopped at many. When a distribution of scores is extremely asymmetrical (i.e., "lopsided"), the *mean* is strongly affected by the extreme scores and, consequently, falls farther away from the distribution's central area. In such cases, the *median* is the preferred measurement because it is not sensitive to the values of scores above and below it—only to the number of such scores.

The interviews were qualitative, meaning that results are descriptive. In analyzing qualitative data, the evaluator studies the responses for meaningful patterns. As patterns and trends emerge, similar responses are grouped together and these groupings are reported.

METHOD OF REPORTING

The data presented in this report are both quantitative and qualitative in nature. Following the qualitative tradition of data reporting, trends and themes within the interview data are presented from most frequently to least frequently occurring. Verbatim quotations from the interviews (edited for clarity) are provided in this report to illustrate respondents' thoughts and ideas as fully as possible. The quotations are intended to give the reader the flavor of visitors' experiences. Within quotations, the interviewer's questions appear in parentheses.

For the quantitative data, tables and figures are regularly used to display the information in an easily accessible manner. Percentages within tables may not always equal 100 due to rounding. The findings within each topic are presented in descending order, starting with the most frequently occurring.

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[1] A level of significance of p<0.01 was used in this study. This means that when a statistical test, such as a test of a relationship, is significant at a probability level of p<0.01, the magnitude of the relationship being tested would occur purely by chance fewer than 1 in 100 times. Because the odds are so low that the relationship would occur purely by chance, there is sufficient reason to be confident that the relationship really exists. Within the body of the report, only statistically significant results are discussed.

Findings from the study are presented in four main sections as follows:

I.   *Go Figure!* Observations
II.   *Earth World* Observations
III.   *Go Figure!* and *Earth World* Questionnaires
IV.   *Go Figure!* Interviews

I. PRINCIPAL FINDINGS: *GO FIGURE!* OBSERVATIONS

Visitor Demographics

A total of 100 children were observed in *Go Figure!* As Table I.1 shows, more than half of the children observed in *Go Figure!* were female and less than half were male (58 percent and 42 percent, respectively). One-third of the children were between two and three years of age (34 percent). One-quarter were between the ages of six and seven, and another quarter were between four and five (25 percent and 24 percent, respectively). The average age was five years.

Table I.1.
Demographic Characteristics of Observed Children in Percent (*n* = 100)

Characteristics	*Go Figure!* %
Gender of Observed Child	
Female	58.0
Male	42.0
Age[1]	
2 - 3	34.0
4 - 5	24.0
6 - 7	25.0
8+	17.0

[1]Data collectors estimated the ages of the visitors being observed.

The observed children were accompanied by adults and, in some cases, other children as well. The families totaled 118 adults in *Go Figure!* As Table I.2 presents, three-fifths of the adults were female and two-fifths were male (63 percent and 37 percent, respectively). Three-quarters of the adults in *Go Figure!* were between 25 and 44 years of age (77 percent). Half of the families in *Go Figure!* had two adults present (50 percent). Almost half of the families included two children (44 percent).

Table I.2.
Demographic Characteristics of Families in Percent

Characteristics	*Go Figure!* %
Gender of Adults (*n* = 188)	
Female	62.8
Male	37.2
Age[1]	
16 - 18	2.1
19 - 24	8.5
25 - 44	76.6
45 - 64	11.2
65 +	1.6
Family Composition (*n* = 100)	
Number of adults in each family	
1	34.0
2	50.0
3+	16.0
Number of children in each family	
1	33.0
2	44.0
3+	23.0

[1]Data collectors estimated the ages of the visitors being observed.

Overall Visitation Patterns

Following the protocol described in the methodology section of this report, selected families were tracked during their entire experience in *Go Figure!* One set of data that was recorded was where adults and children stopped. **For the purposes of this study, a "stop" was defined as a visitor standing for three seconds or longer in front of a given component. If a visitor returned to a component at which she or he had previously stopped, this return was not counted as an additional stop.**

Total Number of Stops

Families stopped at between 1 and 19 different components of the 31 available. The median number of components stopped at was eight (i.e., 26 percent of the exhibition). This means that half of visitors stopped at eight or fewer components, and half stopped at eight or more.

As Figure I.1 shows, more than one-quarter of the families stopped at between seven and nine components and more than one-quarter stopped at between four and six components (29 percent and 28 percent, respectively). Another one-quarter stopped at between 10 and 12 exhibits (24 percent). Few visitors (7 percent) stopped at more than half of the components (15 or more components).

Figure I.1.
Total Number of Components Stopped At by Percent of Families
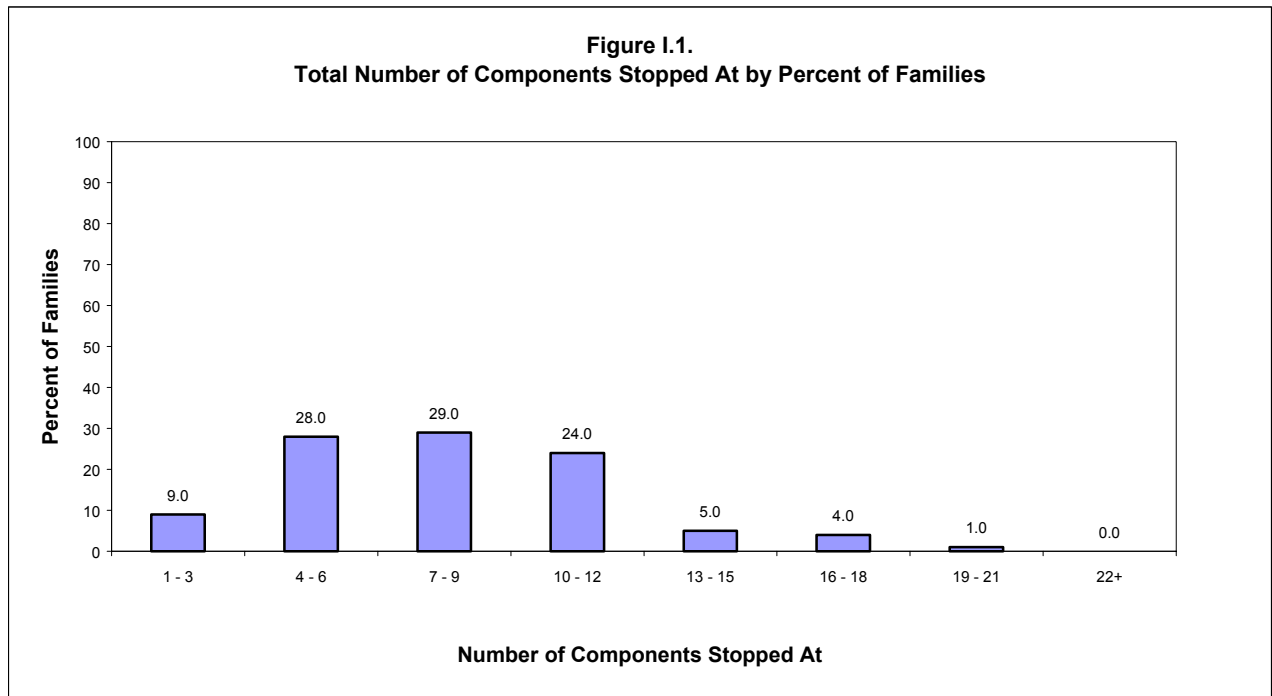
Visitation of Each Book

As Table I.3 shows, *Goldilocks and the Three Bears* attracted the most visitors, followed by *Toad and Frog Are Friends, The Doorbell Rang*, and *Arthur's Pet Business* (89 percent, 75 percent, 73 percent, and 71 percent, respectively). *The Quilt* attracted the fewest visitors (58 percent). While visiting each book, families made a median of two stops.

Table I.3.
Median Number of Stops Made in Each Book ($n = 100$)

Book	Percent of Families that Stopped	Median Number of Stops
Goldilocks and the Three Bears	89.0	2
Toad and Frog Are Friends	75.0	2
The Doorbell Rang	73.0	2
Arthur's Pet Business	71.0	2
The Quilt	58.0	2

Visitation of Individual Components

Exhibitions are free-choice environments. Most visitors do not follow a linear path through an exhibition but are drawn from one component to another according to what attracts or interests them. **Tallying where visitors stop gives exhibition teams a sense of the varied attraction power of individual components.** As the data presented in the previous section indicate, most families to *Go Figure!* stopped at relatively few components. Hence, the stops they did make had a large impact on their experience in the exhibition.

As presented in Table I.4, Measure Up and the *Goldilocks and the Three Bears* Entrance attracted the most families (73 percent each). The Three Bears' Chairs and the Button Board were also frequently visited (61 percent and 57 percent, respectively). Nearly one-half of families stopped at the *Toad and Frog Are Friends: A Lost Button* Entrance and Goldilocks' Miniature House (each 46 percent).

It should be noted that Measure Up and the *Goldilocks and the Three Bears* Entrance were located at the entrance of the exhibition and that attraction power is a function of location; therefore, it is not surprising that they attracted the most visitors.

The exhibits that attracted the fewest visitors were the Introduction Panels and *The Doorbell Rang* Book Station (each 4 percent).

Table I.4.
Visitation of *Go Figure!* Components in Percent (*n* = 100)

Component	Percent of Families that Stopped
Measure Up (*G*)	73.0
Goldilocks and the Three Bears Entrance (*G*)	73.0
Three Bears' Chairs (*G*)	61.0
Button Board (*T*)	57.0
Toad and Frog Are Friends: A Lost Button Entrance	46.0
Miniature House (*G*)	46.0
Pet Food Scale (*A*)	43.0
Kitchen Table (*D*)	41.0
Pets, People, and Places (*A*)	39.0
The Doorbell Rang Entrance	38.0
Mixing Station (*D*)	37.0
Foot Prints (*G*)	34.0
Arthur's Pet Business Book Station	29.0
Touch Screen Quilt (*Q*)	29.0
Giant Cookie Sheet (*D*)	26.0
Arthur's Calendar (*A*)	23.0
How Many Cookies? (*D*)	23.0
Town Patch (*Q*)	22.0
Where's Sally? (*Q*)	22.0
Arthur's Pet Business Entrance	20.0
The Quilt Entrance	17.0
Arthur's Computer (*A*)	16.0
Garden Patch (*Q*)	16.0
Sorting Tree (*T*)	14.0
The Quilt Book Station	8.0
Goldilocks and the Three Bears Book Station	8.0
Toad and Frog Are Friends: A Lost Button Book Station	6.0
Book Nook	5.0
Button Jacket (*T*)	5.0
Introduction Panels	4.0
The Doorbell Rang Book Station	4.0

A = Arthur's Pet Business   *D = The Doorbell Rang*
G = Goldilocks and the Three Bears   *T = Toad and Frog Are Friends: A Lost Button*
Q = The Quilt

Visitation of Component Types

Seventeen of the components were hands-on exhibits, 6 were book stations, and 2 were computer interactives. In addition, there were six entrance exhibits—each book had an entry piece that was intended to provide children with a physical activity (e.g., a doorbell to ring, a slide, a window to climb through).

Overall, hands-on exhibits were the most popular components—families stopped at a median of 5 hands-on components (see Table I.5). Entrance exhibits also attracted families. They stopped at median of one entrance exhibit. Less than half of the families stopped at book stations or computer interactives each; thus, the median number of stops for both of these is 0.

Table I.5.
Number of Stops Made at Each Component Type (n = 100)

Type of Component	Number Available	Percent of Families that Stopped At			Median Number of Stops
		0	1-2	3+	
Hands-on Exhibit	17	1.0	10.0	89.0	5
Entrance Exhibit	6	27.0	62.0	11.0	1
Book Station	6	58.0	40.0	2.0	0
Computer Interactive	2	63.0	37.0	-----	0

Of the hands-on exhibits, Measure Up, the Three Bear's Chairs, and the Button Board attracted the most visitors (73 percent, 61 percent, and 57 percent, respectively) (see Table I.6). The entrance to *Goldilocks and the Three Bears* attracted the most visitors, with nearly three-quarters stopping and using it (73 percent). *Toad and Frog Are Friends: A Lost Button* attracted nearly half of the families (46 percent). The Touch Screen Quilt was the most popular computer interactive, attracting 29 percent of families. The book station for *Arthur's Pet Business* attracted the most families—29 percent—more than three times as many as the other books.

Table I.6.
Visitation to Each Component Type in Percent (*n* = 100)

Hands-on Exhibits	Percent of Families that Stopped	Book Entrance Exhibit	Percent of Families that Stopped	Computer Interactives	Percent of Families that Stopped
Measure Up (*G*)	73.0	*Goldilocks and the Three Bears*	73.0	Touch Screen Quilt (*Q*)	29.0
Three Bears' Chairs (*G*)	61.0	*Toad and Frog Are Friends*	46.0	Arthur's Computer (*A*)	16.0
Button Board (*T*)	57.0	*The Doorbell Rang*	38.0		
Miniature House (*G*)	46.0	*Arthur's Pet Business*	20.0		
Pet Food Scale (*A*)	43.0	*The Quilt*	17.0		
Kitchen Table (*D*)	41.0	Introduction Panels	4.0		
Pets, People, and Places (*A*)	39.0				
Mixing Station (*D*)	37.0		**Percent of Families that Stopped**		
Foot Prints (*G*)	34.0				
Touch Screen Quilt (*Q*)	29.0	**Book Stations**			
Giant Cookie Sheet (*D*)	26.0	*Arthur's Pet Business*	29.0		
Arthur's Calendar (*A*)	23.0	*The Quilt*	8.0		
How Many Cookies? (*D*)	23.0	*Goldilocks and the Three Bears*	8.0		
Town Patch (*Q*)	22.0	*Toad and Frog Are Friends*	6.0		
Where's Sally? (*Q*)	22.0	Book Nook	5.0		
Garden Patch (*Q*)	16.0	*The Doorbell Rang*	4.0		
Sorting Tree (*T*)	14.0				
Button Jacket (*T*)	5.0				

Overall Behavioral Patterns

Take-home Activity Brochure

Families could pick up the take-home activity brochure in each of the five sections of the exhibition. As Table I.7 shows, four-fifths of the families did not pick up a brochure (82 percent). Most of the families who picked up a brochure did so in the *Goldilocks and the Three Bears* section (7 percent).

Table I.7.
Use of the Take-home Brochures in Percent (*n* = 100)

Status	Percent of Families that Picked Up Brochure
Did not pick up a brochure	82.0
Picked up the brochure in *Goldilocks and the Three Bears*	7.0
Picked up the brochure in *Toad and Frog Are Friends*	3.0
Picked up the brochure in *Arthur's Pet Business*	3.0
Picked up the brochure in *The Doorbell Rang*	3.0
Picked up the brochure in *The Quilt*	2.0

Staff Interaction

Museum staff were present in the *Go Figure!* exhibition during the evaluation. As Table I.8 shows, a few families interacted with staff at seven components (less than 5 percent at each).

Table I.8.
Interactions with Staff at *Go Figure!* Components in Percent (*n* = 100)

Component	Percent of Families that Stopped	Percent that Interacted with Staff
Arthur's Calendar (*A*)	23.0	4.3
Miniature House (*G*)	46.0	4.3
How Many Cookies? (*D*)	23.0	4.3
Touch Screen Quilt (*Q*)	30.0	3.3
Kitchen Table (*D*)	41.0	2.4
Three Bear's Chairs (*G*)	61.0	1.6
Measure Up (*G*)	73.0	1.4

<u>Using the Exhibits as Intended</u>

As families used each exhibit, the data collector noted if they used it as the developers' intended (e.g., operated the computer activity properly, used the props in a productive manner, etc.)[2]. As presented in Table I.9, nearly all of the exhibits were used as intended by at least half of the families. The exhibits that were used as intended by the most families were a mixture of different component types. Although only five families used the Button Jacket, all of them used it as intended. Nearly all of the families who used *The Doorbell Rang* Entrance, Measure Up, the *Goldilocks and the Three Bears* Entrance, the *Toad and Frog Are Friends* Entrance, and the Touch Screen Quilt used these components as intended (each 90 percent or more). In contrast, the three components that were used in unintended ways by the most families were all book stations.

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[2] During the training workshop for data collectors, the developer of *Go Figure!* described what intended use should look like.

Table I.9.
Use of *Go Figure!* Components as Intended in Percent (*n* = 100)

Component	Percent of Families that Stopped	Percent that Used Exhibits as Intended
Button Jacket (*T*)	5.0	100.0
The Doorbell Rang Entrance	38.0	94.7
Measure Up (*G*)	73.0	94.5
Goldilocks and the Three Bears Entrance (*G*)	73.0	94.5
Toad and Frog Are Friends: A Lost Button Entrance	46.0	93.5
Touch Screen Quilt (*Q*)	29.0	89.7
Foot Prints (*G*)	34.0	82.4
Where's Sally? (*Q*)	22.0	77.3
Arthur's Pet Business entrance	20.0	75.0
Arthur's Computer (*A*)	16.0	75.0
The Doorbell Rang Book Station	4.0	75.0
Button Board (*T*)	57.0	73.7
Giant Cookie Sheet (*D*)	26.0	73.1
Pet Food Scale (*A*)	43.0	72.1
Three Bears' Chairs (*G*)	61.0	70.5
Miniature House (*G*)	46.0	69.6
Pets, People, and Places (*A*)	39.0	69.2
Arthur's Calendar (*A*)	23.0	65.2
How Many Cookies? (*D*)	23.0	65.2
Sorting Tree (*T*)	14.0	64.3
Mixing Station (*D*)	37.0	62.2
Town Patch (*Q*)	22.0	59.1
The Quilt Entrance	17.0	52.9
Kitchen Table (*D*)	41.0	51.2
Arthur's Pet Business Book Station	29.0	44.8
Garden Patch (*Q*)	16.0	43.8
Goldilocks and the Three Bears Book Station	8.0	37.5
Toad and Frog Are Friends: A Lost Button Book Station	6.0	33.3
The Quilt Book Station	8.0	25.0

Adult-child Interactions

Twenty-four of the exhibits were designed for adults and children to use together. As Figure I.2 shows, two-fifths of families used one to three components together (39 percent) while another two-fifths used four to six (37 percent). Overall, adults and children used a median of four components together as a family.

Figure I.2.
Total Number of Components Adults and Children Used Together by Percent of Families
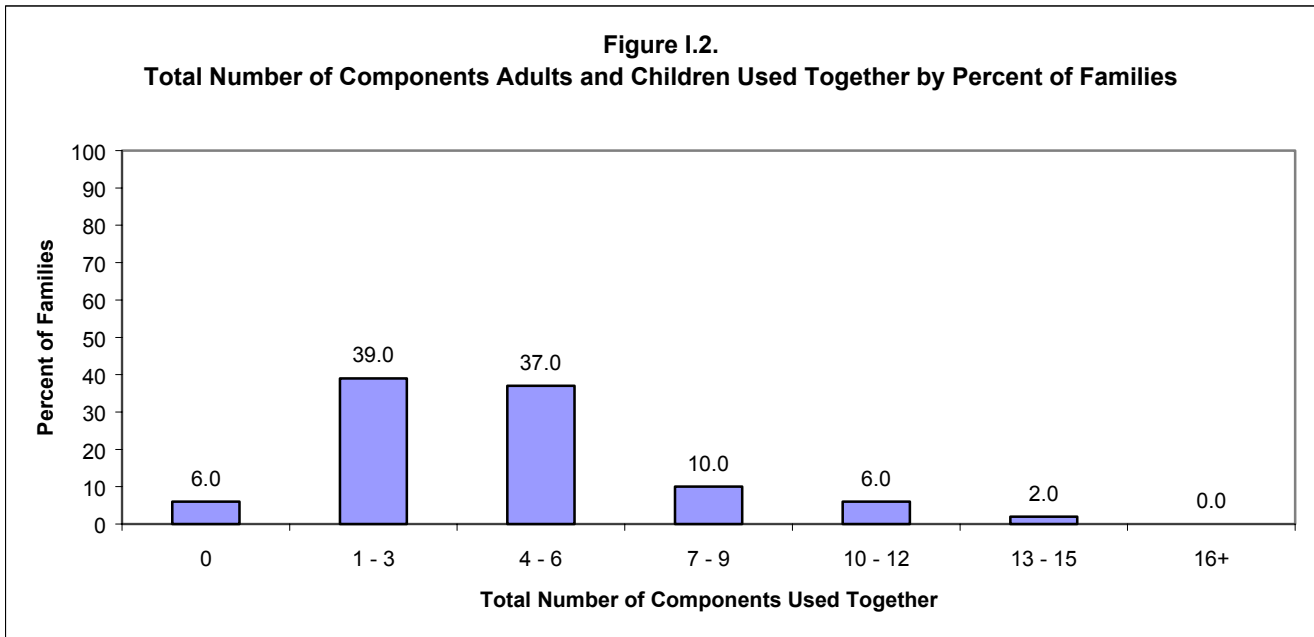
In terms of specific components, adult-child interactions occurred in at least half of the families at 12 of the components (see Table I.10). The components at which adult-child interactions were most frequent were Measure Up, the Touch Screen Quilt, and the Mixing Station (84 percent, 66 percent, and 62 percent, respectively). Such interactions occurred least frequently at book stations: in less than one-third of the families for each.

Table I.10.
Adult-child Interactions at *Go Figure!* Components in Percent (*n* = 100)

Component	Percent of Families that Stopped	Percent that Used Exhibits Together
Measure Up (*G*)	73.0	83.6
Touch Screen Quilt (*Q*)	29.0	65.5
Mixing Station (*D*)	37.0	62.2
Button Jacket (*T*)	5.0	60.0
Foot Prints (*G*)	34.0	58.8
Sorting Tree (*T*)	14.0	57.1
How Many Cookies? (*D*)	23.0	56.5
Giant Cookie Sheet (*D*)	26.0	53.8
Three Bears' Chairs (*G*)	61.0	52.5
Arthur's Computer (*A*)	16.0	50.0
Garden Patch (*Q*)	16.0	50.0
The Doorbell Rang Book Station	4.0	50.0
Pet Food Scale (*A*)	43.0	48.8
Kitchen Table (*D*)	41.0	48.8
Arthur's Calendar (*A*)	23.0	47.8
Button Board (*T*)	57.0	47.4
Pets, People, and Places (*A*)	39.0	46.2
Town Patch (*Q*)	22.0	45.5
Where's Sally? (*Q*)	22.0	45.5
Miniature House (*G*)	46.0	32.6
Arthur's Pet Business Book Station	29.0	31.0
The Quilt Book Station	8.0	25.0
Toad and Frog Are Friends: A Lost Button Book Station	6.0	16.7
Goldilocks and the Three Bears Book Station	8.0	12.5

Because *Go Figure!* was designed to foster adult-child interactions, data collectors noted several predetermined behaviors: adults' playing with, observing, reading aloud to, or assisting their child. As Table I.11 shows, adults assisted their child at a median of three components and played with him or her at a median of two. Adults asked their child a question and observed their child at a median of one component each. Less than half of the adults read aloud to their child, making the median for that behavior zero.

Table I.11.
Median Number of Each Type of Adult-child Interaction (*n* = 100)

Behavior	Median Number of Stops at Which Behavior Occurred
Adult assists child	3
Adult plays with child	2
Adult asks child question	1
Adult observes child	1
Adult reads aloud to child	0

Adults' Assisting Children

Data collectors noted when adults helped their child use hands-on and computer interactives (see Table I.12). Adult assistance occurred most frequently at Measure Up, followed by the Sorting Tree, and Arthur's Computer (85 percent, 57 percent, and 56 percent, respectively). Adult assistance occurred least frequently at the Miniature House (15 percent).

Table I.12.
Adults' Assisting Child with *Go Figure!* Components in Percent (*n* = 100)

Component	Percent of Families that Stopped	Percent that Assisted Children
Measure Up (*G*)	73.0	84.9
Sorting Tree (*T*)	14.0	57.1
Arthur's Computer (*A*)	16.0	56.3
Touch Screen Quilt (*Q*)	29.0	55.2
Arthur's Calendar (*A*)	23.0	52.2
How Many Cookies? (*D*)	23.0	52.2
Pet Food Scale (*A*)	43.0	50.0
Foot Prints (*G*)	34.0	50.0
Giant Cookie Sheet (*D*)	26.0	50.0
Button Board (*T*)	57.0	47.4
Mixing Station (*D*)	37.0	43.2
Pets, People, and Places (*A*)	39.0	41.0
Where's Sally? (*Q*)	22.0	40.9
Button Jacket (*T*)	5.0	40.0
Kitchen Table (*D*)	41.0	39.0
Town Patch (*Q*)	22.0	36.4
Garden Patch (*Q*)	16.0	31.3
Three Bears' Chairs (*G*)	61.0	29.5
Miniature House (*G*)	46.0	15.2

Adults' Playing with Child

As Table I.13 shows, the Sorting Tree and the Touch Screen Quilt promoted adults' playing with their child in the most families (57 percent and 52 percent, respectively). The components at which the fewest number of families engaged in adult-child play were book stations.

Table I.13.
Adults' Playing with Child at *Go Figure!* Components in Percent (*n* = 100)

Component	Percent of Families that Stopped	Percent that Played
Sorting Tree (*T*)	14.0	57.1
Touch Screen Quilt (*Q*)	29.0	51.7
Measure Up (*G*)	73.0	43.9
Arthur's Computer (*A*)	16.0	43.8
How Many Cookies? (*D*)	23.0	43.4
Mixing Station (*D*)	37.0	43.2
Giant Cookie Sheet (*D*)	26.0	42.3
Button Jacket (*T*)	5.0	40.0
Three Bears' Chairs (*G*)	61.0	39.3
Pets, People, and Places (*A*)	39.0	38.5
Pet Food Scale (*A*)	43.0	37.2
Button Board (*T*)	57.0	36.8
Foot Prints (*G*)	34.0	35.3
Town Patch (*Q*)	22.0	31.8
Kitchen Table (*D*)	41.0	31.7
Where's Sally? (*Q*)	22.0	27.3
Arthur's Calendar (*A*)	23.0	26.1
The Quilt Book Station	8.0	25.0
Miniature House (*G*)	46.0	17.4
Goldilocks and the Three Bears Book Station	8.0	12.5
Arthur's Pet Business Book Station	29.0	10.3
Garden Patch (*Q*)	16.0	6.3
Toad and Frog Are Friends: A Lost Button Book Station	6.0	1.7
The Doorbell Rang Book Station	4.0	0.0

Adults' Asking Child Questions

Twenty-four components provided questions to help adults facilitate math play with their child. Data collectors noted if adults asked these questions to their child. Overall, question asking occurred most frequently at the Button Jacket and the Garden Patch (see Table I.14). None of the families asked questions at either the *Goldilocks and the Three Bears* book station or the *Toad and Frog Are Friends* book station.

Table I.14.
Adults' Asking Questions to Child at *Go Figure!* Components in Percent (*n* = 100)

Component	Percent of Families that Stopped	Percent that Asked Questions
Button Jacket (*T*)	5.0	40.0
Garden Patch (*Q*)	16.0	37.5
Pets, People, and Places (*A*)	39.0	35.9
Pet Food Scale (*A*)	43.0	34.9
Measure Up (*G*)	73.0	32.9
Arthur's Calendar (*A*)	23.0	30.4
How Many Cookies? (*D*)	23.0	30.4
Mixing Station (*D*)	37.0	29.7
Sorting Tree (*T*)	14.0	28.6
Touch Screen Quilt (*Q*)	29.0	27.6
Kitchen Table (*D*)	41.0	26.8
Foot Prints (*G*)	34.0	26.5
The Doorbell Rang Book Station	4.0	25.0
Where's Sally? (*Q*)	22.0	22.7
Three Bears' Chairs (*G*)	61.0	21.3
Miniature House (*G*)	46.0	17.4
Button Board (*T*)	57.0	15.8
Giant Cookie Sheet (*D*)	26.0	15.4
Town Patch (*Q*)	22.0	13.6
Arthur's Computer (*A*)	16.0	12.5
The Quilt Book Station	8.0	12.5
Arthur's Pet Business Book Station	29.0	6.9
Goldilocks and the Three Bears Book Station	8.0	0.0
Toad and Frog Are Friends: A Lost Button Book Station	6.0	0.0

Adults' Observing Children

As Table I.15 presents, the Mixing Station, the Pet Food Scale, and the Miniature House had the highest frequency of adults' making observations (38 percent, 33 percent, and 33 percent, respectively). Measure Up and *The Doorbell Rang* Book Station had the lowest frequency of observations (5 percent and 0 percent, respectively).

Table I.15.
Adults' Observing Child at *Go Figure!* Components in Percent (*n* = 100)

Component	Percent of Families that Stopped	Percent that Observed Children
Mixing Station (*D*)	37.0	37.8
Pet Food Scale (*A*)	43.0	32.6
Miniature House (*G*)	46.0	32.6
The Quilt Book Station	8.0	25.0
Goldilocks and the Three Bears Book Station	8.0	25.0
Where's Sally? (*Q*)	22.0	22.7
Arthur's Calendar (*A*)	23.0	21.7
Touch Screen Quilt (*Q*)	29.0	20.7
Pets, People, and Places (*A*)	39.0	20.5
Button Jacket (*T*)	5.0	20.0
Button Board (*T*)	57.0	19.3
Arthur's Computer (*A*)	16.0	18.8
Toad and Frog Are Friends: A Lost Button Book Station	6.0	16.7
Kitchen Table (*D*)	41.0	14.6
Sorting Tree (*T*)	14.0	14.3
Town Patch (*Q*)	22.0	13.6
How Many Cookies? (*D*)	23.0	13.0
Garden Patch (*Q*)	16.0	12.5
Giant Cookie Sheet (*D*)	26.0	11.5
Three Bears' Chairs (*G*)	61.0	11.5
Foot Prints (*G*)	34.0	8.8
Arthur's Pet Business Book Station	29.0	6.9
Measure Up (*G*)	73.0	5.5
The Doorbell Rang Book Station	4.0	0.0

Adults' Reading Aloud to Child

Twenty of the exhibits included text panels and four were book stations at which visitors could read the featured book in its entirety. Data collectors noted if adults read any of the text aloud to their child. As Table I.16 shows, reading aloud occurred most frequently at *The Doorbell Rang* book station, the Sorting Tree, and the Button Jacket (50 percent, 29 percent, and 25 percent, respectively). Conversely, none of the families read aloud at the Touch Screen Quilt and *The Quilt Book* Station.

Table I.16.
Adults' Reading Aloud to Child at *Go Figure!* Components in Percent (*n* = 100)

Component	Percent of Families that Stopped	Percent that Read Aloud
The Doorbell Rang Book Station	4.0	50.0
Sorting Tree (*T*)	14.0	28.6
Button Jacket (*T*)	5.0	25.0
Arthur's Pet Business Book Station	29.0	24.1
Arthur's Calendar (*A*)	23.0	21.7
Pets, People, and Places (*A*)	39.0	20.5
Toad and Frog Are Friends: A Lost Button Book Station	6.0	16.7
Giant Cookie Sheet (*D*)	26.0	15.4
Garden Patch (*Q*)	16.0	14.3
How Many Cookies? (*D*)	23.0	13.0
Goldilocks and the Three Bears Book Station	8.0	12.5
Button Board (*T*)	57.0	12.3
Town Patch (*Q*)	22.0	9.1
Where's Sally? (*Q*)	22.0	9.1
Foot Prints (*G*)	34.0	8.8
Kitchen Table (*D*)	41.0	7.3
Measure Up (*G*)	73.0	6.8
Arthur's Computer (*A*)	16.0	6.3
Mixing Station (*D*)	37.0	5.4
Pet Food Scale (*A*)	43.0	4.7
Three Bears' Chairs (*G*)	61.0	3.3
Miniature House (*G*)	46.0	2.2
Touch Screen Quilt (*Q*)	29.0	0.0
The Quilt Book Station	8.0	0.0

II. PRINCIPAL FINDINGS: *EARTHWORLD* OBSERVATIONS

Visitor Demographics

A total of 100 children were observed in *Earth World*. As Table I.1 shows, more than half of the children observed in *Earth World* were female and less than half were male (52 percent and 48 percent, respectively). More than one-third of the children were between six and seven years of age (39 percent), while more than one-quarter were between four and five (27 percent). The average age was six years.

Table II.1.
Demographic Characteristics of Observed Children in Percent (*n* = 100)

Characteristics	*Earth World* %
Gender of Observed Child	
Female	52.0
Male	48.0
Age*	
2 - 3	19.2
4 - 5	27.3
6 - 7	39.4
8+	14.1

*Data collectors estimated the ages of the visitors being observed.

The observed children were accompanied by adults and, in some cases, other children as well. The families included 147 adults in *Earth World.* Two-thirds of the adults were female and one-third were male (see Table II.2). Three-quarters of the adults in *Earth World* were between 25 and 44 years of age (75 percent). Two-thirds of the families in *Earth World* had one adult present (61 percent). More than half of the families included only one child (52 percent).

Table II.2.
Demographic Characteristics of Families in Percent

Characteristics	Earth World %
Gender of Adults (*n* = 147)	
Female	60.5
Male	39.5
Age[1] (n = 141)	
16 - 18	1.4
19 - 24	3.5
25 - 44	75.2
45 - 64	16.3
65 +	3.5
Family Composition (*n* = 100)	
Number of adults in each family	
1	61.0
2	33.0
3+	6.0
Number of children in each family	
1	52.0
2	27.0
3+	21.0

[1]Data collectors estimated the ages of the visitors being observed.

Data Collection Conditions

Trackings in *Earth World* were undertaken as comparison data for *Go Figure!* To expedite the data collection in *Earth World*, trained observers were stations in one of three areas: the Pond/swamp, the Anthill, and the Forest Canopy. They noted where adults and children stopped and whether select behaviors were exhibited within their designated section. As with the *Go Figure*! data, a "stop" was defined as a visitor standing for three seconds or longer in front of a given component. If a visitor returned to a component at which she or he had previously stopped, this return was not counted as an additional stop.

As Table II.3 shows, about an equal number of trackings were completed in each of the three sections.

Table II.3.
Tracking Location ($n = 100$)

Section	Number of Trackings
Pond/swamp	35
Anthill	30
Forest Canopy	35

Comparison of Go Figure! *and* Earth World *Observations*

As Table II.4 shows, nearly all of the adults in *Go Figure!* (94 percent), and nearly all of those in *Earth World* (96 percent) interacted with their child at one or more exhibits. In fact, there was no statistically significant difference between the frequencies of adult-child interactions in *Go Figure!* and *Earth World*.

Table II.4.
Comparison of Adult-Child Interactions in *Go Figure!* and *Earth World*

Number of Components at which Adults Interacted with Child	Percent of *Go Figure!* Families[1]	Percent of *Earth World* Families[2]
One or more	94.0	96.0
None	6.0	4.0

[1]*Go Figure!* ($n = 100$)
[2]*Earth World* ($n = 100$ combined)

However, there were statistically significant differences between **how** parents in *Go Figure!* interacted with their child and how those in *Earth World* did. More parents in *Go Figure!* assisted their child with using the exhibits, played with their child, asked their child questions, and read aloud to their child than did parents in *Earth World* (see Tables II.5). In contrast, there was no statistically significant difference between the frequencies of parents' observing their child in *Go Figure!* and *Earth World*.

Table II.5.
Parental Behaviors in *Go Figure!* and *Earth World*

Specific Behavior	Percent of *Go Figure!* Families[1]	Percent of *Earth World* Families[2]
Adults assisted child[3]	88.0	67.0
Adults played with child[3]	81.0	65.0
Adults asked questions to child[3]	62.0	25.0
Adults read aloud to child[3]	24.0	3.0
Adults observed child	53.0	56.0

[1]*Go Figure!* ($n = 100$)
[2]*Earth World* ($n = 100$ combined)
[3]$p = 0.00$

III. PRINCIPAL FINDINGS: *GO FIGURE!* AND *EARTH WORLD* QUESTIONNAIRES

Visitor Demographics

A total of 150 adults in *Go Figure!* and another 150 adults in *Earth World* completed identical standardized questionnaires. In *Go Figure!* of the 160 visitors who were intercepted, only 10 declined participation. Thus, the refusal rate was six percent, very low for museum surveys. In *Earth World* the refusal rate was higher—13 percent (i.e., 23 of the 173 visitors intercepted declined to participate); however, still low for museum surveys.

As Table III.1 shows, in each exhibition more respondents were female than male (75 percent in *Go Figure!* and 65 percent in *Earth World*). Similarly, the majority of respondents were between the ages of 35 and 44 years in each exhibition. The average age of respondents in *Go Figure!* was 37 years and in *Earth World*, 36 years. Each respondent was accompanied by one or more children. The majority of children in each exhibition were three years of age or younger (41 percent for *Go Figure!* and 43 percent in *Earth World*). The average age of children in *Go Figure!* and *Earth World* was each four years.

Table II.1.
Demographic Characteristics of Questionnaire Respondents in Percent

Characteristics	*Go Figure!* %	*Earth World* %
Gender of Adult	(*n* = 146)	(*n* = 146)
Female	74.7	65.1
Male	25.3	34.9
Age of Adult	(*n* = 139)	(*n* = 143)
16 – 24	3.6	4.2
25 – 34	38.8	42.0
35 – 44	42.4	46.9
45 – 54	11.5	2.8
55+	3.6	4.2
Age of Accompanying Child(ren)	(*n* = 278)	(*n* = 262)
≤ 3	41.0	42.7
4 - 5	34.2	34.4
6 - 7	16.9	15.6
8+	7.9	7.3

Opinions about the Exhibitions

As respondents exited either *Go Figure!* or *Earth World* they were asked to rate the exhibition they had visited on 11 different scales—5 about their child's experience and 6 about their experience. As Table II.2 presents, respondents in *Go Figure!* rated the exhibition highest for being welcoming to their child, followed by educational, interesting, age appropriate, and understandable. In *Earth World*, respondents rated the exhibition highest for being interesting to their child, followed by welcoming, age appropriate, educational, and understandable. There were three statistically significant differences between respondents' ratings of *Go Figure!* and *Earth World*. Respondents in *Earth World* gave higher average ratings for the exhibition being interesting, age appropriate, and understandable to their child than did those in *Go Figure!*

Parents' also rated their own experiences in each exhibition. Respondents in *Go Figure!* rated the exhibition highest for being understandable to them, followed by welcoming, interesting, and educational. In *Earth World*, respondents rated the exhibition highest for being understandable to them, followed by welcoming, interesting, and educational. There was one statistically significant different between the two exhibitions: respondents in *Go Figure!* rated the exhibition higher for being educational for parents than did those in *Earth World*.

Parents were asked whether the exhibition they visited encouraged their asking questions to their child and whether it helped them play with their child. Respondents in *Go Figure!* rated the exhibition higher for encouraging them to ask questions to their child than for helping them play with their child. The exact opposite rating was seen in *Earth World*. There was one statistically significant difference: respondents in *Go Figure!* rated the exhibition higher for encouraging them to ask questions to their child than did those in *Earth World*.

Table II.2.
Respondents' Opinions about *Go Figure!* and *Earth World*

Rating Scales	*Go Figure!*			*Earth World*		
	n	**Mean**	*±*	*n*	**Mean**	*±*
Off-putting to my child (1) / Welcoming to my child (7)	147	**6.01**	1.02	149	**6.22**	0.99
Not education for my child (1) / Educational for my child (7)	146	**5.62**	1.25	148	**5.82**	1.23
Boring for my child (1) / Interesting for my child (7)*	146	**5.62**	1.33	149	**6.23**	1.17
Not appropriate for my child's age level (1) / Appropriate (7)*	146	**5.51**	1.42	149	**5.95**	1.12
Confusing for my child (1) / Understandable to my child (7)*	146	**5.19**	1.40	147	**5.69**	1.29
Confusing to me (1) / Understandable to me (7)	147	**6.27**	1.23	149	**6.48**	1.01
Off-putting to me (1) / Welcoming to me (7)	145	**5.94**	1.21	148	**6.14**	1.07
Boring for me (1) / Interesting for me (7)	147	**5.68**	1.24	148	**5.44**	1.44
Not education for me (1) / Educational for me (7)*	144	**5.46**	1.51	149	**4.87**	1.78
Did not encourage me to ask my child questions (1) / Encouraged me to ask my child questions (7)*	145	**6.04**	1.21	146	**5.60**	1.41
Hindered my playing with my child (1) / Helped me play with my child (7)	147	**5.82**	1.12	146	**5.90**	1.26

* p ≤ 0.01

Behavior Patterns in the Exhibitions

As respondents exited either *Go Figure!* or *Earth World* they were asked to identify how they had used the exhibits in the exhibition they visited. As Table II.3 shows, more than half of the respondents in *Go Figure!* and *Earth World* asked their child questions and used the exhibits with their child. More than half also thought that the components in each exhibition were easy enough for their child to use alone. There was one statistically significant difference between the two exhibitions. More respondents in *Go Figure!* (83 percent) asked their child questions than did those in *Earth World* (61 percent).

Table II.3.
Behaviors in *Go Figure!* and *Earth World* in Percent

	Go Figure!		*Earth World*	
Behavior	***n***	**%**	***n***	**%**
Asked child questions*	118	83.1	83	60.6
Did not ask child questions*	24	16.8	54	39.4
Used exhibits with child	91	67.9	87	64.9
Let child use the exhibits alone	43	32.1	47	35.1
Child able to use exhibits alone	80	61.1	100	75.2
Child needed help to use exhibits	51	38.9	33	24.8

* $p \leq 0.01$

IV. PRINCIPAL FINDINGS: *GO FIGURE!* INTERVIEWS

Upon exiting *Go Figure!*, eligible adults (18 years of age and older, accompanied by at least one child age 2 to 7 years of age) were asked to participate in an interviews. Of the 46 adults intercepted, 6 declined to participate. Thus, the refusal rate was 13 percent—low for museum studies. A total of 40 adults were interviewed. These adults were accompanied by 56 children.

Visitor Demographics

As Table IV.1 shows, almost two-thirds of interviewees were female and one-third were male (65 percent and 35 percent, respectively). More than four-fifths of the interviewees were between 25 and 44 (85 percent), with the average age being 36 years. About two-thirds of interviewees were accompanied by one child (65 percent). More than half of the children were female and less than half were male (54 percent and 46 percent, respectively). Almost half were between 2 and 3 years of age (45 percent), with the median age being 4 years.

Table IV.1.
Demographic Characteristics of Interviewees in Percent

Characteristics	%
Gender of Interviewee (*n* = 40)	
Female	65.0
Male	35.0
Age of Interviewee	
18 - 24	2.5
25 - 44	85.0
45 - 64	12.5
Number of Accompanying Children (*n* = 40)	
1	65.0
2	30.0
3+	5.0
Gender of Accompanying Children (*n* = 56)	
Female	53.6
Male	46.4
Age of Accompanying Children (*n* = 56)	
2 - 3	44.6
4 - 5	39.3
6 - 7	14.2

Overall Reaction to Go Figure!

All of the parents appreciated the interactive quality of the exhibits. Some were also pleased with the books featured in the exhibition, and several complimented its overall design and appearance. The exhibition's interdisciplinary approach to math was attractive to a few parents, while others liked that information for parents was included. Despite enjoying the exhibition, some were uncertain who was the target audience for *Go Figure!*, stating that their child was either too young or too old for the books or math activities included in the exhibition.

Parents praised a number of different aspects of *Go Figure!* All thought the hands-on exhibits worked well for their children. In particular, several complimented the pretend kitchen in *The Doorbell Rang*, the Pet Food Scale in *Arthur's Pet Business*, the Button Board in *Toad and Frog Are Friends*, and the Touch Screen Quilt in *The Quilt*. Many also thought their young children enjoyed the physical components (e.g., the entry exhibit for each book). Several parents commented on the "attractiveness" of the exhibition. They liked the whole environment: the look and feel of the large props, especially Goldilock's chairs and Arthur's bed, and the way the exhibition made visitors "feel like they were walking into the books." Parents praised the exhibition for making the "books come alive." In terms of the books selected for the exhibition, some parents liked the choices, remarking that their children immediately connected with the familiar stories. Others thought the books were not appropriate for their two to three year-olds, stating that the reading level was too high or that the math content was too advanced. However, regardless of parents' opinion about the books, they thought there was something for their child in *Go Figure!*

Differences Between Go Figure! *and Other Exhibitions at the MCM*

Half of the parents remarked that *Go Figure!* was unique as a book-based exhibition. Several others said it had a more overtly educational message than other exhibitions at the MCM because of the math activities. Six parents did not think *Go Figure!* was different from other exhibitions at the Museum.

Many parents thought *Go Figure!* was different from other exhibitions at the MCM. For half of the parents its distinguishing feature was the focus on familiar children's literature books (see the first quotation below). For others, the math content seemed unique and more explicitly educational (see the second quotation). A few thought it was more interactive than other exhibitions, especially the other traveling exhibition—*Mr. Roger's Neighborhood*—present during the evaluation. Two parents said the exhibition seemed geared to older children who could read, but indicated that their two- and three-year-olds had fun anyway playing with the exhibitry.

> (In what ways, if any, was this exhibit different from others here in the Museum?) Yeah, definitely. I like the fact that it kind of brought the stories to life. . . . When she went into this house she said, "Oh, the Three Bears' chairs. I'm going to sit in daddy bear's chair. . . . I think it's cute to have the storybooks—to bring them to life. . . . That's something different that I haven't seen here [before].

It's educational. There's more meat to it maybe than some of the other ones. . . . (What do you think is the substance, the meat, behind the exhibit?) The measuring, the patterning, the counting.

In contrast, six parents did not think *Go Figure!* was different from other exhibitions at the MCM. They thought it was equally interactive and child-friendly as the others.

Use of and Reaction to Text for Parents

Half of the parents said they had read and used the labels in *Go Figure!* Some of these interviewees particularly appreciated the information geared to parents. About one-quarter of parents glanced at the labels, but did not use them, citing their child's age or short attention span as barriers. Another one-quarter did not read the labels, and while they liked the idea of having text for parents, they expressed doubt that it could work in a children's museum where children lead the experience.

Of the half of the parents that used the labels, many found them helpful. In particular, some liked the tips for parents, appreciating the suggestions for how to make their child's experiences more educational (see the two quotations below). Others made general positive remarks, and did not specify what about the labels worked well for them even upon further probing. A few thought the instructional labels were helpful for knowing how to use exhibits but did not have an opinion about the parenting information.

> (How do you feel as a parent, about having text, instructions, and information for you to read?) I think that's great. That's a great idea, because sometimes, as a parent, you're not sure what the connection is to what they're trying to show them or teach them. It's a good educational opportunity for kids.

> I think it's nice to have that. There's a purpose to play and a lot of times you're here to play and learn, not just play and touch the buttons. So yes, I liked the instructions.

One-quarter of parents briefly looked at the labels but did not use them, and another one-quarter did not pay any attention to them. Both groups gave similar reasons for not utilizing the labels. Many said their children move quickly from exhibit to exhibit, either preventing parents from reading the labels or not listening when parents try to read information to them (see the first and second quotations below). Others thought the labels did not apply to them, because their children were five years of age or younger (see the third and fourth quotations). Three parents assumed the labels were for the children to read themselves.

> When you're here with kids, they don't always give you a chance [to read] . . . because they want to see everything. So you're always stopping to try to read in a hurry. . . . I want to stop and read, but they go so fast saying, "Mommy, what's this?"

> He's not interested in spending much time having me read anything to him, so he just kind of goes from one place to the other. Even if I read something to him, he pretty much continues to do what he wants. It's sort of lost on him.

I think she's a little too young to want to do all that stuff that's on [the labels], but for a little older kid it would probably work out a lot better. She just kind of ignored them. (How old is she?) Five. (How do you feel about having text in children's museums that's meant for adults to read to their child?) I think that they can work, but not with young children.

My impression is that they'd probably get bored. He doesn't listen to me too much. (How old is he?) He's three and a half. I think the point is to just let him go around and explore. (Are there any circumstances in which you might read text in a museum for children?) I don't think so, not unless he were older. To me, the museum should be for them to explore and test things out. . . . I just watch him and see what he finds interesting. . . . The balance [Pet Food Scale] attracted him because he could do something with it. (What do you think he was learning at the balance?) I think he was just testing it to see how it was working. I'm not sure he's really learning at his age. . . . He's just testing it to see what it looks like and what's going on.

Main Idea of Go Figure!

Nearly half of parents identified the main idea of *Go Figure!* as having to do with math. One-third thought the exhibition was about reading or books. Several did not attribute a content message to the exhibition, but simply said it was an environment for playing and exploring. A few could not identify any unifying theme for the exhibition.

Of the half parents who recognized the math message of *Go Figure!*, some explicitly said the exhibition "stresses math," while others described the math processes that their children used while in the exhibition (see the first quotation below). One-third of parents perceived the exhibition's main message to be about reading readiness, literacy, or simply "storybooks" (see the second quotation).

> (What do you think this exhibit is trying to get across to families?) Counting, comparisons like all the size things, and asking questions [like], "Which is bigger?" and "Which is smaller?"

> (What do you think this exhibit is trying to get across to families?) That reading can be fun. It's part of everyday life. (Can you talk a little more about that?) Just getting your preschooler ready for Kindergarten, for reading and learning—that's what I think it's about. And to get parents to read to their kids.

Some parents did not think *Go Figure!* had an explicit educational message. Several thought the exhibition was a place for their children to have sensory experiences and use their imagination (see the quotation below). A few did not see any connections among the components or an overall theme.

> (What do you think this exhibit is trying to get across to families?) It's just a place for kids to play—have a lot of different experiences, pick up different things, physically interact with things, pretend to be inside a storybook.

Math Processes in Go Figure!

When parents were asked to describe any math activities that their children used in the exhibition, counting was most frequently mentioned followed by measuring/weighing, matching/sorting, and pattern making. A few parents could not identify any math activities in the exhibition.

All of the parents who had identified the math theme were able to name math activities in the exhibition that their children had used. Most of the parents who did not mention math as part of the main idea were able to identify math activities after being told that the exhibition contained math. Responses between the two groups were similar: counting was the most frequently mentioned math activity. Measuring and weighing activities were also frequently named by both groups. More parents who perceived the math theme mentioned pattern making than those who were unaware of the math theme. Two quotations are presented below to exemplify parents' responses.

> (Another idea that the exhibit developers wanted to get across is that you can find math in children's books. Did you use any math activities?) Yes, she was making a quilt and he was playing with the patterns. I think she was over there counting and stuff. So, yeah, they did. I didn't realize that. You just don't think about what your kids are doing, you're just kind of helping them out.

> (What were some of the math activities that your child used?) We did some sorting with the buttons. . . . We counted the chocolate chips and put them in the right place. We did some measurement over there with the thing that talked about bigger and smaller. (Goldilocks?) Yes, where you can measure your height and then talking about the different sized chairs.

Four parents were unable to identify any math activities even after being told about the exhibition's math theme.

Appropriateness of Math Content in Go Figure!

About half of the parents thought *Go Figure!* was appropriate for their child. More than one-quarter criticized the math content for being either too easy or too difficult for their child. Another one-quarter had mixed feelings, saying that in some respects the math exhibits were appropriate and in others they were not.

Parents were asked specifically whether *Go Figure!*'s math activities were appropriate for their child. For about half of the parents, both the math concepts and the activities fit their child's abilities (see the first quotation below). In contrast, more than one-quarter thought the exhibition inappropriate. As the second quotation shows, some with children two to seven years old thought the math content was too difficult for their child. A few others with children five to seven years old thought the math activities were too easy (see the third quotation). The remaining one-quarter had mixed feelings, saying that while the exhibition offered something for

their child, he or she would have gotten more out of the experience if he or she were older (see the fourth quotation).

> The kids played with the pattern stuff. I think they both liked it. It was fun for them. (Do you think it's appropriate to have math in an exhibit for kids their age?) Oh sure. Yeah. That got them interested in math, and it shows that math is not just numbers, abstract numbers. (So, it's showing them that?) Math is measuring and patterns and comparing.

> My daughter's four, so she just wanted to climb on everything. She didn't seem to have the ability to concentrate and work on some of the stuff. She just wants to run. . . . I said, "Let's do some patterns." Well, she didn't want to. She wanted to climb on the quilt exhibit as opposed to doing the patterns. . . . She likes the physical interaction—sitting in the tubes, playing with the cookies—but she didn't want to count the cookies. I tried to get her to count the cookies, but she didn't want to do that. She wanted to serve them to me. So, maybe that's age appropriate for her, but she didn't want to sit in any one place for long.

> (Did you use any of the math activities?) Not really, because most of them [were] simple counting and, in his case, he's working on adding and subtracting already. (So maybe it was a little bit lower level?) A little bit lower [than] his skill level. [It] didn't tax any of skill levels for him.

> I would say right now she's starting to get into the stage where this is stuff that's going to help her. I think that this stuff is more for the parents—to get across to the parents that you can start going this with your children. Obviously, it's well above most of the kids that I've seen in here. It's above her level, but she can do some things like the scale and then the parents learn to start doing math stuff with their kids. . . . She would have done more math and probably learned more math, [rather] than just playing in the kitchen if she were older, but I think that's fine. It's a start for her and it's good for parents, so in that way I think it's very appropriate, and I think it's a good idea.

APPENDICES

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