



## **Alice in Nanoland Formative Evaluation By Sarah Cohn August 25, 2010**

The Science Museum of Minnesota's Theater Department developed the book and storytelling play "Alice in Nanoland" for younger museum audiences. The age range for the story were 4-7 year olds, as the actors stated, "This program is best suited for 7 year olds and younger." Through the spring and summer of 2010, the actors have performed the show on the museum's floor for formative evaluation testing. Eighteen pairs of parent and child surveys and interviews were collected to assess how well the program was conveying information about nanoscience and nanotechnology to the younger visitors and their parents.

Paired surveys were used due to the lower verbal nature of the younger audience; by also collecting data from the children's parents, the evaluators were able to better assess the young visitors' possible connection to the story. While the questions were written differently for the parents and the children, all connected or similar questions are discussed in tandem in the following report.

The "Alice in Nanoland" play covers the following learning goals for museum audiences:

- Big goal: To explain the basics of nanoscale science by using an example accessible to early elementary students.
- 1. Nanoscale effects occur in many places. Some are natural, everyday occurrences; others are the result of cutting-edge research.
- 2. Many materials exhibit startling properties at the nanoscale.
- 3. Nanotechnology means working at small size scales, manipulating materials to exhibit new properties.

### **Program Topic**

Children were asked how they would describe the program to their friends. While over a third of the children (39%) could not verbalize or did not remember what the story was about, the rest of the children were able to verbalize something that happened in the story (see Table 1). A third of the children identified aspects of the story relating to Alice shrinking to the nanoscale, or about nanoscience, in their response. The children's responses show that a third of the children watching the show grasped some part of the learning goals for "Alice in Nanoland," which is the big goal for the program.

Parent responses to a similar question, "What would you say this activity was trying to show?" showed a more nuanced understanding of the theme and information conveyed through the play. Nearly all of the parents (89%) explained the story in terms of nanoscience or nanotechnology. A fifth of parents (17%) discussed basic pieces or the general theme of the story in their responses. Parent responses reflected a greater grasp of a number of the learning goals for the show. Responses reflected each of the three learning goals. Full responses, from both parents and children, are located in the Appendix, but examples of each response type are shared below.

**Table 1: Visitor Explanation of What the Show is About (n=18)**

	Child Responses	Parent Responses
<b>Nano-related connection</b>	33%	89%
<b>Story elements</b>	50%	17%
<b>Don't know/No response</b>	39%	0%

**Child Responses****33% (6) Nano-related connections**

- About nanoscience.
- Alice drank a bottle and she shrunk and then she drank it again and was normal.
- Shrinking.
- It was about nanoscience and stuff like that.
- The story was about the big girl, she fell in the rabbit hole, she drinks milk, turns into a little girl.
- A girl named Alice getting stuck in a rabbit hole and going to nanoland. She shrunk.

**50% (9) Story pieces**

- Alice in Wonderland.
- It was about stories and Alice in Wonderland. I was wondering why the queen wanted to go after Alice? She was following the bunny to see what he was after and then the queen came after her.
- Alice and the rabbit. Alice went down the rabbit hole. Then she fell. Then she went to a tea party. They wanted her to stay, but she wanted to go. The rabbit chased her. And then she saw the queen. The queen wanted to cut off her head.
- Alice drank a bottle and she shrunk and then she drank it again and was normal. She chased an animal.
- About a girl that went into a different land and that's all.
- Shrinking, the queen.
- Rugs on the ground. The story was about the big girl, she fell in the rabbit hole, she drinks milk, turns into a little girl.
- She fell down a rabbit hole.
- A girl named Alice getting stuck in a rabbit hole and going to nanoland. She shrunk and she had to find the rabbit. She met a work and had a tea party with Mad Hatter and the hare. She got chased by an evil queen.

**39% (7) Don't know/No response.**

- Nothing. (2)
- No, I don't remember.
- I don't know. (4)

**Parent Responses****89% (16) Nano-related connections**

- Nanoscience, small things are important too!
- The value and impact of nanotechnology.
- Just because you can't see it doesn't mean it's not there.
- The importance of small nanoparticles.
- Relating nanotechnology to real life problems.
- Explanation of atoms and molecules in simple terms for kids.
- Very small things are important. Nanoscience.

- Size isn't important.
- Nanoscience.
- It was trying to teach you that "nano" is about very small things.
- Through the story of Alice, show the world of molecules and nanosize.
- Importance of nanoparticles, atoms.
- World of nano, and the importance with the future of technology.
- The importance role of very small things in the world.
- It was talking about small things, small molecules.
- How scientific properties work - in a relatable way.

#### *17% (3) Story pieces*

- The science part of the story.
- The girl that read from the book was very good and interesting. She put a lot of feelings into it.
- Through the story of Alice, show the world of molecules and nanosize.

### **Connection to Nano**

Parents were also asked how they saw the program relating to nano. One parent did not respond to this question and another parent was "not sure" how the program related to nano (it should be noted here that the person who was "not sure" thought the show was about "World of nano, and the importance with the future of technology." They knew that it was about nano, but they did not relate the topic of the show to teaching audiences about nanoscale science). The remaining parents related the show to nano as showing examples of how nanotechnology is used (29%), educating visitors about nano using a story format (29%), and that Alice simply became small (29%). Only a third of visitors (29%) identified the show as pertaining to nano in a way reflected in the learning goals; visitors' who identified the uses of nanoscience in modern technology related the show to its nano-based learning goals.

### **Parents Relate Program to Nano (n=17)**

#### *29% (5) Use of examples*

- The clothes that beaded up when the liquids went on them.
- Relates the concept of water repelling objects.
- Talks about cabbage's bumps... interesting.
- Tells you how it is used everyday.
- Discussed how it is used in products to help people.

#### *29% (5) Teaching through story format*

- In a story format, shows what nanoscience is.
- Education perhaps more adult value.
- It helped to explain it to kids.
- Explanation through storytelling is a good way to engage children.
- Alice becomes small to learn about the value of nanoscience.

#### *29% (5) Sending character to nanoscale*

- It took Alice and her adventure into "small," talking about how everything is small.
- The size of Alice and how different things can be so small you don't see.
- Alice became nanosized (small!).
- By telling the story in which Alice shrinks and learns how things are conformed, see miniature world.
- Nanoland, Alice shrinking, needs more interactive stuff!!

**6% (1) Other**

- Small size of nanos.

**6% (1) Not sure**

- Not sure.

Children were asked if they remembered hearing the word “nano” during the show. Most of the children (83%) recalled hearing the word “nano.” The children were then asked to explain what they remembered learning about “nano” or what the actor said about “nano.” A third of children (33%) could not remember or describe what the word meant. Just over a quarter shared a different connection with the word. Those that recalled a property of nano (40%) related it to being very very small, showing that they captured a portion of the third learning goal intended for the play.

**Children Recall Definition of Nano (n=15)**

**33% (5) Cannot define**

- Nothing.
- [No response.]
- No.
- Don't remember.
- No. can't remember.

**40% (6) Scale**

- She said nano a lot. What is nanoworld? Why is nano so small? Why is everything so small?
- Small!
- That it's small.
- It's teeny.
- Tiny.
- Nanos make blocks and legos and air to breath. They're tiny.

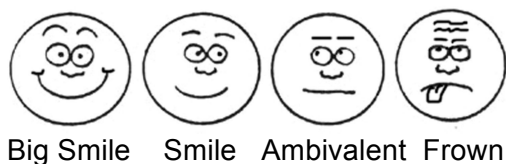
**27% (4) Other**

- Alice in Nanoland. Alice drank bottle and then she grew smaller.
- She said, "Stop talking about science" to her sister.
- Nanos are really important.
- About nanos, the queen.

**Visitor Engagement**

The child and parent pairs were asked about their enjoyment of the play. The children were asked how “fun” the activity was using a four-point smiley face scale (see below). The parents were asked about their interest and enjoyment in the play as well as their perception of their child’s interest in the show.

**Figure 1: Child “Fun” Scale**



Overall, the children found the play very fun, with over three quarters of the children (82%) pointing to the face with the biggest smile (see Table 2). One tenth (12%) of the

children pointed to the smaller smile face and a single child pointed to the frowning face (a final child did not share a response).

**Table 2: Child Ranking of Fun (n=17)**

	Percent of Child Responses
<b>Big Smile</b>	82%
<b>Smile</b>	12%
<b>Ambivalent</b>	0
<b>Frown</b>	6%

Parents were less interested in the show than their children were (see Table 3). Less than half of the parents (44%) thought the show was “very interesting,” and just over a quarter thought that the show was either “interesting” (28%) or “somewhat interesting” (28%). The parents also thought that their children enjoyed “Alice in Nanoland” less than the parents did. Half of the parents rated their children’s interest at “interesting” and a fifth (22%) rated their child’s interest as “very interesting.”

**Table 3: Interest by Parents (n=18)**

	Parent Interest	Parent Perception of Child Interest
<b>Very Interesting</b>	44%	22%
<b>Interesting</b>	28%	50%
<b>Somewhat Interesting</b>	28%	28%
<b>Not Interesting</b>	0	0

Parents were also asked about their enjoyment of the program. Half of parents ranked their enjoyment of the program as “enjoyable” (see Table 4). A fifth (22%) thought the program was “very enjoyable” and another fifth thought it was only “somewhat enjoyable.”

**Table 4: Parent Enjoyment (n=18)**

	Percent of Parents
<b>Very Enjoyable</b>	22%
<b>Enjoyable</b>	56%
<b>Somewhat Enjoyable</b>	22%
<b>Not Enjoyable</b>	0

Children were asked if they found anything hard to follow or to understand in the program. None of the children identified anything they saw as being hard or difficult. Additionally, some parents shared their thoughts about the program beyond the questions asked through the survey. Their comments are shared below:

- The language is too harsh. All of the name calling is bothersome to me. In our house, "hate" is a bad word. That kind of language should be changed in the show.
- Atoms and molecules bit was just thrown in. There was not enough information about what they are, why they are important to the story. It's not being absorbed by the

children. More illustrations and examples from the medical field would be better. Nano means very very small - at least the kids get that.

## Conclusions

“Alice in Nanoland” is still undergoing modifications. The actors found the length of the story to be too long for holding visitors’ attention on the museum floor, and they are now working to shorten the length of the piece. The Theater Department has also decided to create additional images for book, as the story does not yet seem to be supported through the five pictures already in use.

These changes will help further engage young audiences, and may help them take the bigger steps of imagining both the nanoscale and the story. These changes may also facilitate child visitors retaining more information about nanoscale science and technology.

## Demographics

Most of the children were between 5 and 7 years old (see Table 5). The adult figures ranged in age from 29 to 67 (see Table 6).

**Table 5: Child Ages (n=18)**

Percent of Children	
2	6%
3	11%
4	22%
5	17%
6	28%
7	11%

**Table 6: Parent Ages (n=17)**

Percent of Adults	
22-29	6%
30-39	68%
40-49	12%
50-59	0
60-69	12%
70 and older	0

Less than a third of the adults and children spoken to were male (29%). Of the children, just under half were male (41%), while the majority of adults were female (83%).

All but one group was visiting the museum in smaller family or friend groups consisting of adults and children. One group visited with a larger tour group.

Parents were asked to rate their own and their child’s interest in science on a scale from 1 to 10, where 1 is “I have no interest in science” and 10 is “I am very interested in science.” As seen in Table 7, three quarters of the parents shared a high level of interest

in science. They rated their children's interest in science as being slightly less than their own, with two thirds of the children having a rating of 7 or higher.

**Table 7: Interest in Science**

	Percent of Adults (n=16)	Parent Perception of Child Interest (n=18)
<b>1-6</b>	25%	33%
<b>7-10</b>	75%	67%

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### THIS IS A FORMATIVE EVALUATION REPORT

Formative evaluation studies like this one often:

- **are conducted quickly**, which may mean
  - small sample sizes
  - expedited analyses
  - brief reports
- **look at an earlier version** of the exhibit/program, which may mean
  - a focus on problems and solutions, rather than successes
  - a change in form or title of the final exhibit/program

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