

Exploring Measurement – Stretchability

Formative Evaluation Report

By Sarah Cohn, Scott Van Cleave, and Al Onkka

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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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Sarah Cohn
Science Museum of Minnesota
120 West Kellogg Boulevard
St. Paul, MN 55102
scohn[at]smm[dot]org
(651) 265-5972



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Background

The Science Museum of Minnesota conducted the *StretchAbility* program on January 25th, and February 1st, 2010, and the Children's Museum of Houston conducted the program on November 10th, 14th, and 25th, 2009. The program's learning goal is, "Things come in different sizes - and size is important!" The program's big ideas are listed below.

- Things come in different sizes - and size is important!
- A nanometer is a billionth of a meter.

A total of 20 paired adult and child groups provided feedback through a survey designed to measure their engagement with and comprehension of the activity. After the activity, evaluators targeted participating children 8 or younger who were verbal for the interview, and gave a survey to the child's parent to complete. 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 "n" value given for tables is reflective of the number of visitors who responded to the question. Additional visitor demographic information is available at the end of the report.

Results

Program Topic

Both parents and children were asked to describe the activity. Children were asked to tell about the game as if they were describing it to a friend, while parents were asked directly what the activity was trying to show. About one third of children (30%) were able to articulate answers about size or scale, and just under two thirds of adults (65%) were able to identify size or scale as a component of the activity (see Table 1). Nearly half of children (45%) described the activity by its rules such as "put your feet on colors" or "it's just like Twister" as did a small number of parents (15%). A complete list of child and adult responses follows the table below. Child responses are followed by the child's age in brackets.

Table 1: Parent and Child Explanation of Activity (n=20)

	Child Responses	Parent Responses
Nano-related connection	30%	65%
Game-related description	45%	15%
Don't know/No response	25%	20%

Children Explain Program (n=20)

30% (6) Size and scale

- About small things and big things that you can see and not see. [8]

- It's about stuff you can see and cannot see. [8]
- It's about what you can see and what you cannot see, and it's a little bit about nature. [7]
- It was about you put your right hand on the green circle and if you win they talk to you about really small stuff you can't even see with a microscope. [7]
- I would probably tell them that it was about...I don't know how to explain. It's about things you can and can't see. [7]
- It's about size and stretching. I don't know what they were trying to show about size. [5]

45% (9) Mechanics of game

- It's like twister. You spin a wheel and call it out and if you win you put your hand on green. [9]
- Stretching. [8]
- It's just like twister, but it's like a science game or something. [7]
- Put feet on colors. [5]
- Tried to put legs and arms on where the person tells us to. [5]
- Tell them I think I already know because I have it at home. I would say "would you play with me." [5]
- Just putting it, my foot, on the ones that close to me. [4]
- We have this game at home. I stretched. [4]
- It's about learning the names of these things in a game. Orange is... [no further response]. [8]

25% (5) No response or gave off-topic response

- Interesting. Funny. Science. [10]
- About animals because... actually I don't know. [8]
- It was fun. [7]
- [Could not give a response.] [4]
- No. [4]

Parents Explain Program (n=20)

65% (13) Size and scale

- Working on size comparisons.
- I think it is trying to show things you can see with your eyes, or not see.
- Use of microscopes and sizes
- Difference between size and what you can see with your eyes versus a microscope.
- It was trying to show the different size of things.
- Different things to scale.
- That matter comes in many sizes.
- Different microscope views.
- Difference in sizes - macro, micro, nano.
- Trying to show the different sizes.
- Teach measurements to children.
- The difference between actual size/micro/nano.
- Learning about different sizes of things.

45% (3) Mechanics of game

- That playing the game is fun. To look at what they are touching.

- Flexibility and game interaction.
- Coordination, strength, balance, colors, exposure to science/research terms.

20% (4) No response or gave off-topic response

- The fun of learning, making learning fun. That stuff (organisms, microscopes) is not so fun for kids but putting it in this form is.
- Trying to show different elements on there. The elements I guess you would say.
- Kids 2 and 4 too young.
- I mainly spent my time watching my one year old - so I have to say I wasn't paying attention.

Connection to Nano

To further assess the activity's ability to teach about nano, children were asked if they remembered hearing the word "nano," and if so, what had they learned about nano. Parents were asked how the activity was related to nano.

Fourteen children recalled hearing the word nano, and over half of this group (54%) reported on topic messages about nano: a third (39%) reported what they learned about nano in terms of size or scale (learning goal one), while the remainder (15%) made reference to nano examples presented in the game such as "lizards use hairs to stick, carbon nanotubes are very strong" and "atoms, Lego's, building blocks of the world" (see Table 2). Of the remaining children, one child (7%) made reference to the game rules (i.e. the color on the game mat that corresponded to nano examples), and about two fifths (39%) were unable to report something learned about nano.

A greater number of parents, over half (53%) could not articulate a connection between the activity and nano. Over two fifths (41%) of parents gave answers talking about size or scale. Although a smaller number of children articulated answers about size and scale than did adults, adults talked about size in more general terms while children articulated more specific things about nano such as "nano is tiny, the tiniest scale" or "nano means you can't see things" coming closer than did the adults to the second big idea that "a nanometer is a billionth of a meter." See all child and adult responses that follow the table below.

Table 2: Parent and Child Connecting Activity and Nano

	Child Responses (n=13)	Parent Responses (n=17)
Size or scale reference	39%	41%
Other nano reference	15%	0
Activity/game reference only	8%	6%
Don't know	39%	35%

Children Recall Definition of Nano (n=13)

39% (5) Size or scale reference

- Nano means you can't see the things. [7]
- Tiny. Nano is tiny. The tiniest scale. [10]
- Really small scale. You can't see. [8]

- That nanos are things you can see with a microscope. [7]
- Something you can't see on something else. [8]

15% (2) Other nano reference

- Lizards use hairs to stick, carbon nanotubes are very strong, didn't know that. [8]
- Atoms, Lego's, building blocks of the world. [8]

8% (1) Activity/game reference only

- Nano is orange. [7]

39% (5) Don't know

- Not sure. [4]
- Nothing yet. [9]
- No. [5]
- I forgot. [5]
- [Couldn't remember anything] [8]

Parents Relate Program to Nano (n=17)

41% (7) Size or scale reference

- Comparison to actual size.
- I don't know that they (kids) could understand nano. It probably gives them an idea of what they could see, (using a microscope for example) at the nano level.
- One of the measurements.
- Show the really small nano things are and that we are surrounded for a lot of this.
- Teaches children about things they cannot see.
- Teaches that nano is smaller than minuscule.
- That it is very small.

53% (1) Activity/game reference only

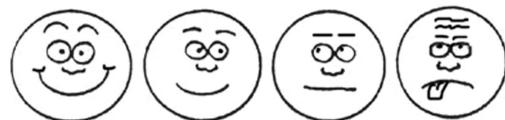
- Exposure to nano with movement and visual recognition.

53% (9) Don't know

- ?
- I am not familiar with nano.
- I don't know.
- I don't know.
- I don't know. I don't know what nano is.
- Never heard of it.
- Not sure what you mean by nano.
- Wasn't clear.
- What is that? Wasn't aware of that.

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 Figure 1 below). The parents were asked about their enjoyment of the program.

Figure 1: Child “Fun” Scale

Big Smile Smile Ambivalent Frown

Children engaged in the activity showed a much higher enjoyment rating than the supervising parents. Overall, the children enjoyed the program. Four fifths (80%) of the children interviewed gave the program the highest rating. The remaining fifth (20%) gave it the second highest rating. Parents were less connected to the program (see Table 3). Only one fifth (20%) of adults rated the activity as very enjoyable. Over half (55%) rated it “enjoyable.” One quarter of parents reported the activity as only “somewhat enjoyable.”

Table 3: Parent Enjoyment of Activity (n=20)

Percent of Parents	
Very enjoyable	20%
Enjoyable	55%
Somewhat enjoyable	25%
Not enjoyable	0

Parents were asked to rate their own and their child’s interest in the activity. Half or more of adults rated their own and their child’s interest in the second highest category, and adults were more likely to rate their child’s interest higher than their own (see Table 4).

Table 4: Yours and Your Child’s Interest in Activity (n=20)

	Parent Interest	Parent Perception of Child Interest
Very Interesting	10%	35%
Interesting	65%	50%
Somewhat Interesting	25%	15%
Not Interesting	0	0

Children were asked if they found anything hard to follow or to understand in the program. Sixteen of the twenty children said that they had found something difficult to do during the activity. Most of the children (81%) said that stretching and twisting in relation to placing their hands and feet on different circles on the mat was difficult. A few (19%) of the children shared that the various scales used within the game were hard to remember or identify during the game.

Children Express Program Difficulties (n=16)

81% (13) Twisting/Stretching

- It was hard to stretch sometimes.

- Twisting.
- Stretching. (2)
- Why I got twisted.
- Twisting my body a lot.
- No, when I got a little twisted.
- It was hard to stretch.
- When you put your hand and behind the other one. That was hard.
- A little hard, putting legs and arms on places was hard.
- Crossing over something else.
- Kind of hard to put my left foot on a green and my right hand on a... I fell down.
- It was just hard like finding a space to put your hand and your feet.

19% (3) Scale Difficulty

- Micro - hard to tell nano from micro.
- Remember which scale.
- The hard part is to know what, which one is a microbe.

6% (1) Other Responses

- Yes.

Conclusions

Stretchability is an offshoot of the popular game “Twister” that physically and mentally engages young children in thinking about and seeing the nanoscale. The pictures on the mat and the use of “nano” as a color begins to familiarize children with a scale that is too small for them to see or imagine.

Children and their parents were not able to consistently explain and identify the game’s connection to nano or the nanoscale. This lack of clarity on the program’s connection to the nanoscale is most likely due to volunteers not incorporating discussion of the different sizes into the program. The activity can support further incorporation of the discussion of the nanoscale by adding to or supplementing the directions and information available for the program.

Demographics

Most of the children (65%) and nearly all of the parents (85%) who participated in the evaluation were female. Nearly all of the groups participating in the study were family groups (89%) rather than tour or daycare groups.

Half of the children interviewed were 7 or 8 years old (see Table 5). The children ranged in age from 4 to 10 and nearly all of the adults were between 30 and 49 years of age (see Table 6).

Table 5: Age of Children (n=20)

Percent of Children	
4	20%
5	20%
6	0
7	25%
8	25%
9	5%
10	5%

Table 6: Age of Adults (n=17)

Percent of adults	
30-39	65%
40-49	29%
50-59	0%
60-69	6%

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, most of the parents shared a high level of interest in science, surpassed only by their perception of their child's interest in the subject.

Table 7: Interest in Science

Percent of Adults (n=17)		Parent Perception of Child Interest (n=18)
1-6	29%	6%
7-10	71%	94%