



# Exhibit & Program Summative Evaluation

Year 4 Progress Report

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## Table of Contents

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Background .....	4
Overall Results and Comparison .....	5
Main Messages .....	5
Nanotechnology Awareness .....	5
Relevance .....	9
Enjoyment & Interest .....	7
Demographics .....	9
Appendix 1: Main Message(s) and Learning Objectives .....	12
Appendix 2: Coding of Main Messages .....	13
Appendix 3: Instrument .....	15

## Background

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This is a progress report on the summative evaluation of NISE Net exhibits and programs. This study is driven by the question *What are the measureable impacts of NISE Net-produced deliverables on a public audience?* These deliverables have already undergone extensive revisions based on formative evaluation, professional development workshops, and review by museum educators, NSET researchers, and in some cases people with disabilities.

The instrument was designed to measure public impact in terms of (a) interest, (b) attitude, (c) understanding, and (d) awareness. Interest and attitude are measured using a self-assessment scale and open-ended follow-up question. Awareness and understanding are assessed with a combination of closed- and open-ended questions. Questions about awareness overlap with the study on Nanoawareness. Questions about understanding were analyzed in relation to the six main messages that guided the development of exhibits and programs.

Data was collected and analyzed for four nano programs conducted at the Science Museum of Minnesota and the Oregon Museum of Science and Industry in early 2009. Data collectors and program staff distributed the self-administered surveys to all museum visitors in the program audience. A self-administered survey is being used to allow the extensive sample size needed for the entire summative sample. But this method does have the limitation of not allowing probing questions, for example.

This report includes some comparisons among formative findings and the trends from this initial summative data. In a number of instances we make general comparisons across NISE Net programs and exhibits. In these instances, we cannot make a one-to-one formative-summative comparison because programs and exhibits were eliminated, added, combined, or otherwise transformed significantly after formative testing. As this study progresses, we will continue to make an effort to provide one-to-one comparisons when possible.

The theater shows, *Wheel of the Future* (hereafter *Wheel*) and *Nano Dreams and Nano Nightmares* (*Dreams*), and the cart demonstrations, *Inkjet Printer* and *Surface Area*, all used the same self-administered instrument. The “n” value given for tables is reflective of the number of visitors who responded to that question. Additional visitor demographic information is available at the end of the report.

In year 5 of NISE Net, additional data collection will continue to complete the sample of exhibits and programs. There will also be a baseline data collection (in the lobby of each of the five subawardee institutions). These additional data will allow us to make comparisons across different audiences.

## Overall Results and Comparison

### Main Messages

Each of the four programs has one broad objective, called the main message or big idea, and three learning goals (hereafter all are grouped and called “main messages”). Please see the appendix for the big idea and learning goals for each program. One question, designed to evaluate whether museum visitors were taking away any of the main messages, in other words whether they got the point, asked them to describe what the program they saw is trying to show. Of the 375 visitors who responded, over four fifths (84%) were able to articulate the main message of their program (see Table 1). Visitors’ responses are coded as understanding a main message if they mentioned or inferred any of the big ideas or learning goals, or if they mentioned anything related to nano including the word only.

Visitors’ use of the word “nano” in their description of the program varied significantly. Roughly two thirds to three quarters of theater program visitors who got a main message used the word “nano;” not one visitor to the Inkjet Printer program and only 5% of visitors to Surface Area used the word. The Inkjet Printer program’s main messages do not include the word “nano,” but the other three programs do. (For Table 1, every visitor who used the word “nano” was coded as articulating a main message.)

**Table 1: Visitors Who Articulated a Main Message**

	Articulated a main message	Used the word “nano”
<b>Overall (n=375)</b>	<b>84%</b>	<b>44%</b>
<b>Wheel (n=161)</b>	83%	53%
<b>Dreams (n=125)</b>	86%	62%
<b>Inkjet Printer (n=46)</b>	89%	0%
<b>Surface Area (n=43)</b>	77%	5%

In the formative evaluation, NISE Net program participants tended to comprehend fewer but broader main messages. Participants from the formative program testing more often expressed learning about a specific aspect of the nanoscale as well as how nano properties affect current technological advances. Visitors interviewed after participating in one of the formative NanoDays activities identified basic nano concepts two fifths (40%) of the time, identified aspects of each program’s main message three fifths (61%) of the time, and directly related the activity to nano two thirds (67%) of the time.

For each of the four programs studies in Year 4, the ‘main message’ responses have been coded to show the range responses (see Tables 2-5 below). See Appendix 2 for a coding key and a sample of responses.

**Table 2: Wheel's Main Messages (n=161\*)**

	Percent of visitors
Field of nanotechnology and applications	43%
Field of nanoscience and research	23%
Societal impacts	23%
Description of museum experience	15%
Nanoscale and things measured in it	4%
Behavior of particles or molecules	1%
Things behave differently when they are small	1%
Other	4%

\*Some visitors gave more than one response.

**Table 3: Dreams' Main Messages (n=125\*)**

	Percent of visitors
Nanoscale and things measured in it	48%
Field of nanoscience and research	25%
Behavior of particles or molecules	18%
Field of nanotechnology and applications	18%
Description of museum experience	6%
Societal impacts	4%
Other	5%

\*Some visitors gave more than one response.

**Table 4: Inkjet Printer Main Messages (n=46)**

	Percent of visitors
Technology of a printer	67%
Printers utilize properties of small molecules	24%
Field of nanotechnology and applications	4%
Other	4%

Table 5: Surface Area Main Messages (n=43\*)

	Percent of visitors
<b>Things behave differently when they are small</b>	37%
<b>Surface area</b>	14%
<b>General chemistry</b>	18%
<b>Usefulness of small molecules or particles</b>	12%
<b>Behavior of particles or molecules</b>	5%
<b>Field of nanotechnology and applications</b>	5%
<b>Description of museum experience</b>	5%
<b>Other</b>	7%

\*Some visitors gave more than one response.

## Nanotechnology Awareness

Visitors rated, on a scale of one to ten, how much they had heard about nanotechnology before coming to the museum. A rating of one represents having heard nothing at all about nanotechnology, and ten represents having heard a lot. Less than half of visitors rated the amount they had heard about nanotechnology in the six to ten range for all of the programs; overall two fifths (38%) of visitors rated the amount they had heard in the upper half of the scale (see Table 6).

Visitors also rated, on a similar scale, how much the NISE program they saw influenced their awareness of nanotechnology. A rating of one indicates that the program did not influence their awareness of nanotechnology and ten indicates that the program highly influenced their awareness. For each program, between half and four fifths of visitors rated the influence the program had on their awareness in the upper half of the scale; for all programs two thirds (66%) of visitors rated the influence in the upper half of the scale (see Table 6). We do not have comparisons to the formative findings because awareness was not part of that evaluation.

Wheel and Dreams have about the same percentage of visitors who rated the amount they had heard previously in the six to ten range. But one quarter more visitors rated the Wheel program as having a high influence on their awareness of nanotechnology.

**Table 6: Visitors' Nanotechnology Awareness**

	Pre-existing high awareness (6-10)	Program had a high influence (6-10)
<b>Overall (n=362, 359)</b>	<b>38%</b>	<b>66%</b>
<b>Wheel (n=137)</b>	34%	80%
<b>Dreams (n=131)</b>	38%	56%
<b>Inkjet Printer (n=48, 46)</b>	38%	61%
<b>Surface Area (n=46, 45)</b>	48%	58%

## Relevance

Visitors were asked whether the program connected to anything that they might know or think about. For each program, between half and three fourths of visitors formed a connection; overall, three fifths formed a connection (see Table 7). These trends are similar to the formative data where relevance was consistently the lowest rated category of impact when compared to interest, enjoyment, and main messages.

**Table 7: Visitors' Perceptions of Relevance**

	Percent of visitors
<b>Overall (n=414)</b>	<b>61%</b>
<b>Wheel (n=182)</b>	64%
<b>Dreams (n=141)</b>	54%
<b>Inkjet Printer (n=47)</b>	72%
<b>Surface Area (n=44)</b>	57%

Those who found some relevance in the program were asked to describe, in their own words, the way the program connected to something they already knew or thought about. Half (53%) of the visitors saw a connection to something they already knew, one quarter (25%) connected because of an interest in technology, and one fifth (20%) connected the program to some thing they had previously experienced (see Table 8).



**Table 8: Connections Described**

	Previous knowledge	Interest in technology	Previous experience	Other
<b>Overall (n=222)</b>	<b>53%</b>	<b>25%</b>	<b>20%</b>	<b>2%</b>
<b>Wheel (n=100)</b>	46%	35%	16%	3%
<b>Dreams (n=68)</b>	63%	15%	21%	2%
<b>Inkjet Printer (n=32)</b>	41%	28%	31%	0%
<b>Surface Area (n=22)</b>	73%	5%	23%	0%

## Enjoyment and Interest

Almost all visitors enjoyed the program they saw (Table 9). About half (54%) enjoyed it so much they would encourage others to see it, and another two fifths (43%) found it enjoyable. Dreams stood out as the only program that did not have the highest percentage of respondents in the highest category.

**Table 9: Visitor Enjoyment of Programs**

	So enjoyable I'd encourage others to see it	Enjoyable	Didn't really enjoy it	Not enjoyable at all
<b>Overall (n=438)</b>	<b>54%</b>	<b>43%</b>	<b>3%</b>	<b>1%</b>
<b>Wheel (n=189)</b>	59%	41%	0%	0%
<b>Dreams (n=147)</b>	37%	54%	8%	1%
<b>Inkjet Printer (n=53)</b>	70%	28%	2%	0%
<b>Surface Area (n=49)</b>	65%	35%	0%	0%

Visitors also rated their interest in the program they saw. About two thirds (63%) rated their interest in the highest category, and one third (35%) in the second highest (see Table 10). Dreams stood out again because roughly the same percentage of visitors rated their interest in the highest category (49%) as did in the second highest category (45%). All other programs have the highest percentage in the highest interest category.

**Table 10: Visitor Interest in Programs**

	So interested I'd listen to it again	Interested, but wouldn't listen again	Wasn't really interested	Not interested at all
<b>Overall (n=436)</b>	<b>63%</b>	<b>35%</b>	<b>3%</b>	<b>&lt;1%</b>
<b>Wheel (n=189)</b>	65%	34%	1%	0%
<b>Dreams (n=146)</b>	49%	45%	6%	1%
<b>Inkjet Printer (n=52)</b>	69%	29%	2%	0%
<b>Surface Area (n=49)</b>	88%	12%	0%	0%

In their own words, visitors described the most interesting part of the program. Three fifths (59%) of visitors found the content of their program the most interesting. Just under one quarter (23%) of visitors were most interested in something specific to the program not related to the content (i.e. puppets, the printer, the wheel). Less than one fifth found either the interactivity or general fun and the presenter/performer to be interesting (see Table 11).

**Table 11: What was Most Interesting**

	Content	Program specific	Fun/Interactive	Presenter/Performer
<b>Overall (n=330*)</b>	<b>59%</b>	<b>23%</b>	<b>18%</b>	<b>12%</b>
<b>Wheel (n=140*)</b>	64%	17%	24%	11%
<b>Dreams (n=102*)</b>	49%	22%	23%	20%
<b>Inkjet Printer (n=47*)</b>	83%	15%	2%	2%
<b>Surface Area (n=41*)</b>	37%	59%	2%	5%

\*Some visitors gave more than one response.

These trends about enjoyment and interest are something we will monitor as the study continues in Year 5. The findings suggest that there is an improvement over the general findings from formative studies of the NISE Net programs and exhibits. In the formative findings, all NISE Net programs and exhibits receive more than two thirds (66%) approval ratings on interest and enjoyment by visitors. These summative trends suggest that more than nine tenths (90%) of the visitors rate these programs as enjoyable and interesting.

## Demographics

Visitor demographics were self-reported. Two thirds (67%) of visitors were between the ages of 30 and 49. A little more than three fifths (62%) was female. Just under three quarters (73%) came in groups of adults with children. On a scale of one to ten, with ten being the highest, more than four fifths (85%) of visitors rated their interest in science between six and ten. See the tables below for all of the demographic data.

**Table 12: Age of Visitors (n=439)**

Percent of visitors	
18-21	4%
22-29	6%
30-39	33%
40-49	34%
50-59	10%
60-69	8%
70+	6%

**Table 13: Gender (n=427)**

Percent of visitors	
Female	62%
Male	38%

**Table 14: Group (n=427)**

Percent of visitors	
Adults and children	73%
School group	19%
Adults only	7%
Alone	2%

**Table 15: Interest in Science (n=422)**

Percent of visitors	
1-5	15%
6-10	85%

The additional data collection for these programs will use purposive sampling to ensure that at least 60% of the respondents are family groups. The remaining 40% of the sample will be split among adult pairs, singleton, and elder museum visitors.

## **Appendix 1: Main Message(s) and Learning Objectives**

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### **Wheel of the Future Program Objectives**

The Wheel of the Future program has one broad objective, called the big idea, and three specific learning goals. The big idea is that nanotechnology is an emerging, rapidly developing field. The three learning objectives are:

- 1) To encourage the visitor to learn more about nanotechnology.
- 2) To introduce the visitor to manufactured nanomaterials and how these products may already be affecting their lives.
- 3) To explain the importance of being informed about nanotechnology.

### **Nano Dreams and Nano Nightmares Program Objectives**

Nano Dreams and Nano Nightmares has one broad objective, called the big idea, and three specific learning goals. Dreams' big idea is that things on the nanoscale are very, very small and behave differently than they do at the macro scale. The learning objectives are:

- 1) To understand that molecules and atoms are always shaking, sticking and sliding.
- 2) To understand that things on the nanoscale behave differently than on the "big" or macro scale.
- 3) To be aware that there are potential positive and negative impacts of nanoscale technology.

### **Inkjet Printer Survey Program Objectives**

The Inkjet Printer program has one broad objective, called the big idea, and three specific learning goals. The big idea is that inkjet printers take advantage of novel properties to print pictures and text. The learning objectives are:

- 1) Inkjet printers use tiny technology.
- 2) Water and ink act differently on very small scales.
- 3) Many inkjet printers boil ink to make it move.

### **Surface Area Survey Program Objectives**

The Surface Area program has one broad objective, called the big idea, and three specific learning goals. The big idea is that Nanoparticles have much more surface area than macro-particles, giving them different properties. The learning objectives are:

- 1) Nanotechnology is very small.
- 2) Nanomaterials have different properties than other materials.
- 3) One reason for these different properties is an increase in surface area.

## **Appendix 2: Coding of Main Messages**

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### ***Field of nanotechnology and applications***

Uses the word “nanotechnology” or mentions applications of science.

- What nanotech is.
- Make people aware of the technology.
- Science advancing and helping us in future (i.e. efficiency, eco-friendly)

### ***Field of nanoscience and research***

Uses the word “nanoscience” or “nano” in general, mentions research, or the science in the program, but not science in general.

- The importance of nano.
- Introduction to nanoscience.
- Information on new research.
- New science.

### ***Societal impacts***

Mentions the risks or benefits of nanoscience or the need to be aware of nanoscience.

- The benefits of nanotechnologies and possible dangers.
- To be concerned about nanotechnology.
- We need to know about upcoming technologies.

### ***Nanoscale and things measured in it***

Mentions the nanoscale or small things measured in the nanoscale.

- The idea of nanoscale.
- Nano means small.
- Nanos are very very small.
- Everything in the world is made of molecules.

### ***Behavior of particles or molecules***

Descriptions of how small things move, interact, or work.

- How molecules flow; Brownian motion.
- How nanomolecules work.
- How certain elements interact.

### ***Technology of a printer***

Mentions that the program is about the technology of an inkjet printer, but does not elaborate. Includes technology in general.

- How printers work.
- How an inkjet printer gets ink onto paper.
- How stuff works.

***Printers utilize properties of small molecules***

Describes more of the science behind the technology of an inkjet printer.

- How inkjet printers work and some of the properties of fluids in very small volumes.
- How inkjet printers use physics to function.
- How ink cartridges work and the scientific connection to surface tension.

***Things behave differently when they are small***

Describes how the properties of particles are different depending on their size.

- Things in different sizes react differently.
- Many smaller particles have greater surface area than one large particle.
- That the smaller the surface area the less product you need to create a reaction. The smaller the particle, the greater the reaction.

***Surface area***

Gives general statements about surface area. Does not explicitly mention different sizes.

- Definition of surface area.
- How surface area affects chemical reaction.
- Effect of surface area on activity of material.

***General chemistry***

Gives general statements about chemistry.

- Chemistry.
- Introduction to magnesium.
- How different materials work in different ways.
- How things interact with each other.

***Usefulness of small molecules or particles***

States that small molecules or particles have useful properties.

- Smaller is better.
- Little things are good too!
- How smaller particles are useful.

***Description of museum experience***

Gives general statements about the museum experience, not program specific.

- Importance of science.
- Information in a fun way with positive reinforcement.
- Teach and use creativity.

***Other***

Statements that do not fit in the other codes.

## Appendix 3: Instrument (without spacing)

*Help us improve the program you just saw!  
Please take a few moments to share your opinions below.*

**Only respond if you are 18 or older please**

### 1. How interesting was the program you just saw? (Check one)

- I was so interested I'd see it again. → Go to Question 1a  
 I was interested, but I wouldn't see it again. → Go to Question 1a  
 I wasn't really interested. → Skip to Question 2  
 I didn't find it interesting at all. → Skip to Question 2

### 1a. (*If interested*) What part of the program did you find most interesting?

### 2. How enjoyable was the program? (Check one)

- It was so enjoyable I'd encourage others to see it.  
 It was enjoyable.  
 I didn't really enjoy it.  
 It didn't find it enjoyable at all.

### 3. Does this program connect in any way to anything else that you know or might think about?

- Yes → Go to Question 3a  
 No → Skip to Question 4

### 3a. (*If yes*) In what way does the program connect to something you already know or think about?

### 4. In your own words, what would you say the program was trying to show visitors?

### 5. Before today, how much have you heard about nanotechnology?

Heard nothing at all	1	2	3	4	5	6	7	8	9	10	Heard a lot
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**6. How did this program influence your awareness of nanotechnology?**

<b>Did not influence awareness</b>	1	2	3	4	5	6	7	8	9	10	<b>Highly influenced awareness</b>
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**7. How is this program related to nanotechnology?**

**↓ Tell us a little bit about yourself so we can better  
serve our audience.**

**a. How would you rate your interest in science on a scale of 1 to 10?**

<b>No Interest</b>	1	2	3	4	5	6	7	8	9	10	<b>Extreme Interest</b>
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**b. What is your age?** \_\_\_\_\_

**c. Are you...**  Male  Female

**d. Who did you come with to the museum today? (Check one)**

- I am here alone
- I am with a school or tour group
- I am here with family or another social group that includes children and adults
- I am here with family or another social group that includes adults only

*Thank you for your time and feedback!*

*Before you leave, please return your completed survey to a museum employee.*