

# Summative Study of the *Nano* Mini-exhibition

Summative Evaluation – Appendix C: Hispanic Audiences

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## Table of Contents

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Executive Summary .....	4
Appendix C: Exploratory Study of Hispanic Audiences .....	5
Bilingual Signage Approach of the <i>Nano</i> mini-exhibition .....	5
Exploratory Study Questions .....	7
Methods and Considerations.....	7
Considerations for Protocol and Instrument Design .....	7
Considerations for Data Analysis and Reporting .....	9
Study Contexts .....	10
Supplemental Findings – OMSI Hispanic Visitors.....	15
Sustained Use .....	15
Interest and Enjoyment.....	15
Social Interaction, Broad Age Range, Further Exploration .....	16
Learning About Nano Content .....	17
Spanish Translations and Language Preferences.....	18
Supplemental Findings – Science Spectrum Hispanic Visitors .....	19
Sustained Use .....	19
Interest and Enjoyment.....	20
Social Interaction, Broad Age Range, Further Exploration .....	20
Learning About Nano Content .....	21
Spanish Translations and Language Preference .....	23
Discussion and Future Questions For the ISE Field.....	24

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## Executive Summary

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In the spring of 2012, the Nanoscale Informal Science Education Network (NISE Net) Public Impacts evaluation team conducted a summative study of the *Nano* mini-exhibition: a 400-square foot, modular exhibition that will be replicated and installed at over 70 partner institutions. The Network's goals for *Nano* led to the following summative evaluation questions:

1. What is the projected reach of the *Nano* mini-exhibition?
2. Is *Nano* successful in providing visitors with an engaging experience and promoting visitor learning of nano concepts?
3. Is *Nano* successful in these ways for different types of contexts and for different types of audiences, including Hispanic visitors and visitors with disabilities?
4. Does *Nano* catalyze new or expanded public programming around nano at the host institutions?

These questions were answered through a range of methods, including a counting study, visitor observations, surveys, interviews, and questions asked to Network partners who currently had the mini-exhibition on display in January, 2013.

## Findings

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### **1. The estimated reach of the *Nano* mini-exhibition is sizeable and broad.**

Conservatively speaking, an estimated 7.1 million people will come into contact with the mini-exhibition annually, assuming that a) all available copies are out on the floor, and b) all copies are displayed for an entire year, as required by the contract that all recipients sign.

### **2. *Nano* is successful in providing visitors with an engaging experience and in promoting visitor learning of nano concepts.**

Visitor data across all study sites demonstrates that the mini-exhibition was successful across all of the indicators defined by the *Nano* design team, including sustained use, interest and enjoyment, social interaction, broad age range, further exploration, and learning about nano content.

### **3. *Nano* is successful within different types of institutions.**

Examining the data by institution type reveals that *Nano* was successful in engaging visitors and promoting learning of nano concepts both in the science center context as well as the children's museum context.

### **4. *Nano* shows promise for being successful for Hispanic visitors and visitors with disabilities.**

Small exploratory studies conducted at four institutions provide insight into the experiences of visitors from these audience groups within their local contexts. While broad generalizations should not be made from this data, *Nano* did appear to be successful with the specific visitors who participated in these studies.

### **5. Network partners say *Nano* is catalyzing new and enhanced programming.**

The vast majority of partners who responded reported implementing new or expanded programming as a result of the mini-exhibition.

## Appendix C: Exploratory Study of Hispanic Audiences

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As described in the Summary of Findings, the Nanoscale Informal Science Education Network (NISE Net) Public Impacts Evaluation group embarked on a three-year study in March, 2012, to explore the public impacts of the most resource-intensive educational products developed by the Network. During this first year of the study, the Public Impacts Evaluation focused on conducting a summative evaluation of the *Nano* mini-exhibition.

As part of the summative study, an exploratory study of Hispanic visitors was conducted at two partner organizations. The sample sizes at both sites were quite small, and as such, the findings generated from the exploratory study should not be broadly generalized and assumed to be representative of all Hispanic visitors in all types of institutions across all of NISE Net's geographic regions. Rather, the information gathered through this small study should be seen as beginning to shed light on how *Nano* may work as an experience and learning environment for Hispanic visitors.

This appendix will provide a more complete description of our study methods as well as supplemental findings that support and expand on those presented in the Summary of Findings.

### **Bilingual Signage Approach of the *Nano* mini-exhibition**

As described in earlier sections of this document, *Nano* is an interactive mini-exhibition that engages family audiences in nanoscale science, engineering, and technology. Hands-on exhibits present the basics of nanoscience and engineering, introduce some real world applications, and explore the societal and ethical implications of this new technology. The mini-exhibition was originally designed to have footprint of 400 square feet. There are seven main components, including four panels (*What Happens When Things Get Smaller?*, *Where Can You Find Nano? I Spy Nano*, *What's New About Nano?* and *What Does Nano Mean for Us*), the *Balance Our Nano Future* tippy table, the *Small, Smaller, Nano* ferrofluid interactive display, and *Build a Giant Carbon Nanotube*. The mini-exhibition also contains a *Static Beads* component and a seating area with a variety of nano-themed books and reading boards. Currently, over seventy identical copies of *Nano* will be produced and distributed to Network partners; as of January, 2013, 43 copies have been shipped. For a more detailed description of the mini-exhibition, see [http://www.nisenet.org/catalog/exhibits/nano\\_mini-exhibition](http://www.nisenet.org/catalog/exhibits/nano_mini-exhibition).

The NISE Network is committed to making educational products accessible to non-English speaking audiences, particularly Spanish speakers (as Spanish is anticipated to continue to be the second most common language nationwide). The Network has adapted its most popular programs for Spanish-speaking audiences, placing the highest priority on translating products that directly serve public audiences. More information about NISE Net bilingual resources – including a Translation Process Guide and a Bilingual Design Guide - can be found on the project website, [www.nisenet.org/catalog/spanish](http://www.nisenet.org/catalog/spanish).

Within the mini-exhibition, English and Spanish are used side-by-side throughout the exhibition signage. The *Nano* design team worked with a set of advisors who provided insight about cultural and social relevance for Hispanic groups during the translation

process. They also provided feedback on translations as they were developed. The resulting bilingual text is presented consistently throughout the exhibition in different colors to assist visitors, as seen in Figure 1, which illustrates text from the *What Happens When Things Get Smaller?* Panel, and in Figure 2, which illustrates text from the *Small, Smaller, Nano* component. Lastly, the Audio Description for blind and low-vision visitors is also available in Spanish.

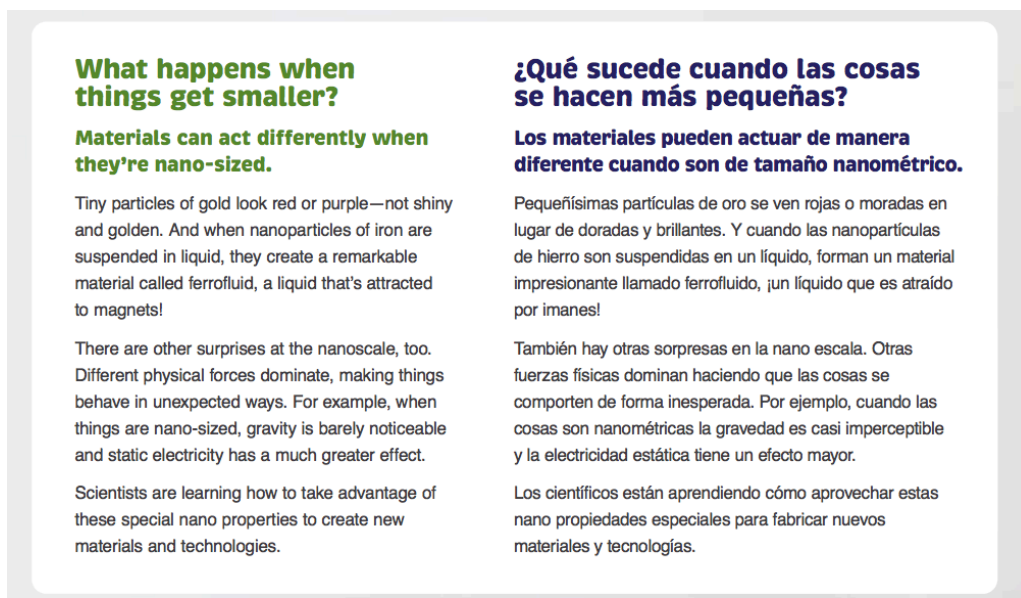


Figure 1. Bilingual text on *What Happens When Things Get Smaller?* Panel.

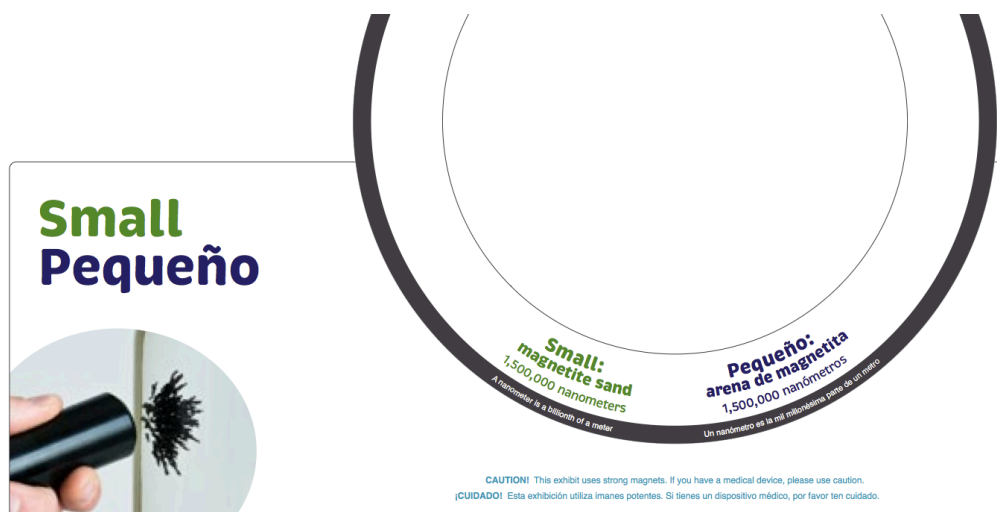


Figure 2. Bilingual text on the *Small, Smaller, Nano* component.

## Exploratory Study Questions

Given the inclusion of Spanish translations in the mini-exhibition, the Network was interested in learning about how *Nano* was working for Hispanic Audiences, both in terms of providing an engaging experience and promoting learning of nano concepts. In addition, the exploratory study examined the level to which the broader general audience for *Nano* – across all of the study sites – noticed the Spanish translations and how they reacted to them.

Thus, the main questions for this exploratory study were:

1. Is *Nano* successful in providing a small sample of Hispanic visitors with an engaging experience and promoting visitor learning of nano concepts?
2. Overall, did visitors across all of the different data collection sites notice the Spanish translations? If so, did the translations impact their experience?

It should be noted that these questions and this study focus on the printed translations in the mini-exhibition, and do not include the Audio Descriptions in Spanish that were also available.

## Methods and Considerations

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Conducting a study focused on a traditionally underrepresented minority group such as Hispanic visitors requires several additional considerations throughout the different phases of the work. In order to develop culturally appropriate methods, analyses, and findings, the Public Impacts team was purposefully assembled to include an experienced, bilingual/bicultural evaluator who had extensive experience working with Hispanic audiences. (In a similar manner, our team included an evaluator experienced in conducting evaluations with visitors with disabilities, which led to the other small exploratory study described in Appendix D.)

As the team designed and conducted our study, we engaged in discussions about common evaluation methods and practices that could be slightly modified in order to be more culturally appropriate and responsive to the Hispanic audiences we hoped to study. Below, we provide a list of these modifications, which we present as one example of how to begin to think about doing more culturally responsive evaluations. Certainly, each of these areas could be further expanded and explored; our goal is not to provide a definitive set of considerations for this work, but rather, to simply share and document our process.

### Considerations for Protocol and Instrument Design

While the instruments and protocols were being designed for the general audience portion of our summative study, we engaged in conversations about how to modify these pieces for the Hispanic audiences work.

### ***Protocol Modifications***

The protocol for our general audience sample began with an uncued observation of a target visitor group with the *Nano* mini-exhibition, where the data collector filled out an observation form to record visitor behaviors. After the target group was finished their time at *Nano*, the nearest adult in the group was approached and invited to participate in the survey and interview portions of the study.

As we were thinking about the exploratory study and observing Hispanic visitors, two modifications were suggested by our experienced bilingual evaluator and incorporated by our team:

- Noting the language use during the group observation. Groups were noted as speaking primarily in Spanish, English, or a mix of both.
- Asking about language preference during the post-observation intercept. Visitors who were asked to participate in the other portions of the study were asked what language they preferred to engage with the survey and interview. Our bilingual/bicultural data collectors were then able to proceed with the rest of the protocol in the preferred language of the visitor.

These additions contributed to our analysis and ultimately allowed us to see differences in the language preferences of Hispanic audiences specific to the two sites we studied.

### ***Instrument Modifications***

As a team, we discussed whether or not to change the general audience instruments we were developing in order to better align with the experiences of Hispanic audiences. Ultimately, we decided not to significantly modify any of the survey or instrument questions specifically for Hispanic audiences. However, we did do the following during the instrument development phase:

- Edited our demographics section of the survey to be more inclusive overall, including:
  - A question about participant gender was edited to include an “other” option, going beyond “male” and “female”.
  - Racial categories were aligned with census categories, and an option for “Two or more races” was added.
  - An ethnicity question was added where visitors could identify themselves as “Hispanic/Latino”, “Not Hispanic/Latino”, “Not sure”, or “Other”.
  - A follow up question to the ethnicity question – providing visitors with a way to identify the cultural backgrounds they associated with if they were Hispanic/Latino – was asked.
  - Additional categories were added to the “total annual income” question and the “highest level of education” question in order to provide more nuanced understandings of our respondents.
- Translated the survey and interview instruments into Spanish, and then piloted them with Spanish speakers at one of the study sites. The translation of the instrument and further revisions went through a quality control process, which



entailed the review of materials by at least two bilingual evaluation staff members in addition to the original translator.

- Asking more follow-up questions as appropriate. Our bilingual data collectors often attempted to ask more follow up questions to Hispanic visitors after a specific question in the interview (“*Did you notice the Spanish translations? If so, how did they impact your experience?*”) in order to gain a richer understanding of their experience. In particular, data collectors probed further on the notion of impact, frequently asking “How so?” after the initial response provided by the Hispanic visitor.

## **Considerations for Data Analysis and Reporting**

After all the data was collected for the summative study, our team discussed different ways to analyze the data and report findings from Hispanic visitors.

### ***Data Analysis Modifications***

Our experienced bilingual/bicultural evaluator suggested the following practices:

- Conducting data analysis in Spanish when the data was collected in Spanish. By having bilingual evaluators doing the qualitative coding of open-ended responses in the original language, there was less risk of losing context and meaning due to translation into English. Similarly, as coding schemes were refined, the bilingual evaluators continued to do the qualitative coding on the Hispanic audience data, allowing for further preservation of the original language.
- Translating into English in order to communicate with the rest of the team as well as to provide examples in English if/when needed. Once again, the quality-controlled process of translation was used with the collected data, in order to ensure accuracy. The English versions of the responses were used during team meetings to share responses and perspectives from Spanish-speaking Hispanic visitors.
- Checking frequently with the rest of the team about the emergent themes and coding scheme development. Often times, when studying different audiences, emergent themes for visitor responses differ by group. In this study, there was quite a bit of similarity between the emergent themes from the general audience analysis and the Hispanic audience analysis, which became evident as different members of the team worked together on parallel analysis activities.
- Hispanic visitor data should be aggregated for analysis only within a particular institution, not across institutions. Due to the vast regional differences in the use of language (amid other factors, such as the history of the Hispanic/Latino community in a particular area) that exist, it was not appropriate to combine data from different exploratory study sites for analysis.

### ***Report Writing and Dissemination***

Part of the challenge with writing up the findings from the exploratory work was related to the need of summarizing large, Network-wide studies. Often, executive summaries must leave out all but the main message of any particular finding, and given the importance of contextualizing the exploratory findings from each of the two sites where we conducted this work, finding ways to describe and talk about the small study on Hispanic audiences was challenging. However, working with our bilingual/bicultural evaluator and several other members of the NISE Net evaluation team, we feel our final summaries balance the need for both brevity and context. Some key considerations along the way included:

- Thinking about how to write and talk about the participants. When we began study planning, we were focused on understanding the experiences of Spanish-speakers within *Nano*. However, as our data collectors went out to different sites, it became clear that in one of the locations, very few of the Hispanic visitors who were asked to participate in the study actually preferred to speak Spanish – instead, they preferred to speak English. Thus, the descriptions of our target sample for the exploratory study changed to Hispanic visitors, and then we noted language preference both during the exhibit observation and through the self-report of the visitor during the survey and interview portions of the study.
- When writing up findings from the study, be extremely thoughtful about not making comparisons between the underrepresented target group and other groups. This study was exploratory in nature, not comparative. It was not set up specifically as a comparative study between Hispanic and non-Hispanic audiences. Thus, making direct comparisons between groups was inappropriate from a methodological standpoint.
- Also, be extremely thoughtful about not overstating claims, and remind readers of this frequently. Throughout the writing of the study documents, our experienced bilingual evaluator – as well as others within the NISE Net Evaluation Team – carefully read over drafts of report sections as they were being produced and offered useful feedback in terms of framing claims appropriately in terms of scope and certainty. The main concern here was to ensure that the small sample size of the study was taken into consideration when stating claims, and that it was not at all appropriate to generalize findings from this small study to all Hispanic visitors to the mini-exhibition, let alone the broader Hispanic population writ large.

These modifications to our general audience methods strengthened and enriched our exploratory study of Hispanic audiences. Certainly, these ideas and practices are not an all-encompassing list of considerations when studying underrepresented bilingual audiences, and continued discussion – both across the Network and the ISE field – of these techniques would appear to be quite productive and worthwhile.

### **Study Contexts**

The exploratory study of Hispanic audiences took place at two of the five partner sites that were primary data collection sites for the general audience study.

***Oregon Museum of Science and Industry (OMSI); Portland, OR***

The NISE mini-exhibition at the Oregon Museum of Science and Industry (OMSI) is installed in the Turbine Hall exhibit floor on the main level, 1 out of 2, of the building. This floor contains an Earthquake House, a lunch room for visitors, a group of engineering exhibits, the Physics Chemistry and the Vernier Technology Lab, Automation exhibit, the Inventor’s Ball Room, along with a spinning wheel table, probability ball drop exhibit, computer hardware exhibits, and robotic exhibits.

The mini-exhibition installation at OMSI contains all the nine components developed by NISE and a seating area including all books and materials for the seating area. The mini-exhibition occupies approximately 415 square feet and it is located in an alcove on the river side of the building right in front of the elevator located in the northwest part of the hall. The mini-exhibition is shaped in a rectangular form with the reading rail panels facing the river view wall and the rest of the components distributed throughout the rest of the alcove space. Staff are not stationed at the mini-exhibition specifically, and there were no floor staff re-setting or cleaning exhibit components while data collection was conducted.

Data from OMSI contributed to the counting study, core study, and small exploratory study of Hispanic visitors portions of the summative evaluation.

***Hispanic Visitor Sample at OMSI***

The Hispanic audience sample at OMSI consisted of 28 complete sets (including an observation, a survey, and an interview) of visitor data. Demographic data for this group is presented in Tables 1-14 on visitor Gender, Age, Race, Ethnicity, Cultural Background, Languages Spoken at Home, If the Household is MultiLingual, Education, Income, Disability, Type of Disability, Use of Science in Daily Work, Previous Visits to the Museum, Interest in Science, and Previous Exposure to Nano.

**Table 1. Gender (n=28)**

Male	Female
39.3%	60.7%

**Table 2. Age (n=26)**

Under 21	21-29	30-39	40-49	50-59	60+
3.8%	26.9%	54.0%	15.4%	0.0%	0.0%

**Table 3. Race (n=12)**

African-American	White	American Indian or Alaskan Native	Native Hawaiian or Other Pacific Islander	Asian	Not Sure	Two or More
0.0%	33.3%	8.3%	0.0%	0.0%	33.3%	25.0%

**Table 4. Ethnicity (n=28)**

Hispanic/Latino	Not Hispanic/Latino	Not Sure	Other
100.0%	0.0%	0.0%	0.0%

**Table 5. Cultural Background (n=28)**

Mexican	Puerto Rican	Salvadoran	Guatemalan	Peruvian	Other
89.3%	3.6%	3.6%	3.6%	7.1%	3.6%

**Table 6. Languages Spoken at Home (n=28)**

English	Spanish	Other
35.7%	92.9%	7.1%

**Table 7. Is Household Multi-lingual (n=28)**

Yes	No
32.1%	67.9%

**Table 8. Education Level (n=27)**

Less than high school	Completed high school	Some college or technical ed.	College degree	Post-graduate degree
37.0%	25.9%	18.5%	14.8%	3.7%

**Table 9. Income (n=25)**

Under \$20,000	\$20,000-\$39,999	\$40,000-\$59,999	\$60,000-\$79,999	\$80,000-\$99,999	\$100,000-\$149,999	\$150,000+
20.0%	52.0%	16.0%	8.0%	4.0%	0.0%	0.0%

**Table 10. Disability (n=28)**

Yes	No
7.1%	92.9%

**Table 11. Type of Disability**

Mobility (n=2)	Learning (n=1)
50.0%	100.0%

**Table 12. “Do You Use Science in Your Daily Work?” (n=26)**

Yes	No
42.3%	57.7%

**Table 13. Visits to the Museum in the Last Two Years (n=28)**

None	1-2 times	3-4 times	5 or more times
28.6%	42.9%	17.9%	10.7%

**Table 14. Scale Questions Regarding Interest in Science and Previous Exposure to Nanoscience**

	N	Mean	SD
Interest in Science (on a scale of 0-10)	28	8.46	1.48
Previous Exposure to Nanoscience (on a scale of 1-4)	28	3.18	0.91

**Science Spectrum; Lubbock, TX**

The NISE mini-exhibition at Science Spectrum in Lubbock is installed on the exhibit floor on the lower level, 1 out of 3 of the building. This floor contains a series of exhibits related to human health and biology, dinosaur models, a rock climbing wall and a major exhibit Texas Alive: The Brazos River Journey. There is also a computer lab, a classroom, a tinkering counter, and the birthday party room. The mini-exhibition is located in the corner occupied by the birthday party room and classroom. The reading rail panels and the natural corner of the room limit the perimeter of the exhibit.

The mini-exhibition installation at Science Spectrum contains all the nine components developed by NISE and a seating area. The reading area does not have the books and the laminated materials are incomplete. It fills out approximately 500 square feet in a square shape.

Staff are not stationed at the mini-exhibition specifically, however floor educators leading birthday party activities often re-set exhibit components, mainly the Nano Carbon Tube.

Data from Science Spectrum contributed to the counting study, core study, and small exploratory study of Hispanic visitors portions of the summative evaluation.

**Hispanic Visitor Sample at Science Spectrum**

The Hispanic audience sample at Science Spectrum consisted of 21 complete sets (including an observation, a survey, and an interview) of visitor data. Demographic data for this group is presented in Tables 15-27 on visitor Gender, Age, Race, Ethnicity, Cultural Background, Languages Spoken at Home, If the Household is MultiLingual, Education, Income, Disability, Type of Disability, Us of Science in Daily Work, Previous Visits to the Museum, Interest in Science, and Previous Exposure to Nano.

**Table 15. Gender (n=20)**

Male	Female
65.0%	35.0 %

**Table 16. Age (n=21)**

Under 21	21-29	30-39	40-49	50-59	60+
14.3%	43.0%	38.1%	5.0%	5.0%	0.0%

**Table 17. Race (n=15)**

African-American	White	American Indian or Alaskan Native	Native Hawaiian or Other Pacific Islander	Asian	Not Sure	Two or More
0.0%	53.3%	0.0%	0.0%	0.0%	13.3%	20.0%

**Table 18. Ethnicity (n=21)**

Hispanic/Latino	Not Hispanic/Latino	Not Sure	Other
100.0%	0.0%	0.0%	0.0%

**Table 19. Cultural Background (n=20)**

Mexican	Puerto Rican	Ecuadorian
100.0%	5.0%	5.0%

**Table 20. Languages Spoken at Home (n=21)**

English	Spanish	Other
95.2%	4.8%	0.0%

**Table 21. Is Household Multi-lingual (n=21)**

Yes	No
0.0%	100.0%

**Table 22. Education Level (n=21)**

Less than high school	Completed high school	Some college or technical ed.	College degree	Post-graduate degree
9.5%	19.0%	28.6%	38.1%	4.8%

**Table 23. Income (n=19)**

Under \$20,000	\$20,000-\$39,999	\$40,000-\$59,999	\$60,000-\$79,999	\$80,000-\$99,999	\$100,000-\$149,999	\$150,000+
10.5%	31.6%	31.6%	10.5%	15.8%	0.0%	0.0%

**Table 24. Disability (n=21)**

Yes	No
0.0%	100.0%

**Table 25. “Do You Use Science In Your Daily Work?” (n=21)**

Yes	No
38.1%	61.9%

**Table 26. Visits to the Museum in the Last Two Years (n=21)**

None	1-2 times	3-4 times	5 or more times
47.6%	19.0%	23.8%	9.5%

**Table 27. Scale Questions Regarding Interest in Science and Previous Exposure to Nanoscience**

	N	Mean	SD
Interest in Science (on a scale of 0-10)	21	7.05	2.18
Previous Exposure to Nanoscience (on a scale of 1-4)	21	3.29	0.78

## Supplemental Findings – OMSI Hispanic Visitors

The data reported in the Summary of Findings for Hispanic visitors at OMSI was based on the full analysis performed on the data collected at that institution and with the Hispanic audience. Below, we provide the additional tables and information that could not be included in the Summary of Findings but still contributed in some way to the document. The format of this section will echo that of the Summary and be divided by the indicators of success outlined by the *Nano* design team.

### Sustained Use

**Table 28. Mini-exhibition Use (n=28)**

Indicator	
Mean Dwell Time	11:08 (min, sec)
Median Dwell Time	8:05
Sweep Rate Index	49, assuming 400 sq. ft.

Once again, we are using the median dwell time in the Sweep Rate Index calculation, in order to provide a more conservative estimate of this ratio.

### Interest and Enjoyment

**Table 29. Interest and Enjoyment Reported by Visitors (n=28)**

Interest and Enjoyment	Percent of Visitors or responses
Top two levels of interest	89%
Top two levels of enjoyment	89%
Top two levels of interest for child	72%
Top two levels of enjoyment for child	81%
As or more interesting than other exhibits	94%
Percent of positive adjectives chosen to describe experience	97%, with 86 total adjectives chosen

In addition, 32 of Hispanic visitors at OMSI (n=28) reported finding something about the mini-exhibition challenging. When asked to elaborate on what was challenging, three respondents said the content was confusing or challenging, and six respondents said that components were difficult to use.

Hispanic visitors at OMSI most commonly indicated the *Small, Smaller, Nano* component was the favorite part of the mini-exhibition, with 41% of respondents making this choice. The next most frequently identified favorite components were *Build a Giant Carbon Nanotube* (with 18% of respondents choosing this element as their favorite) and generally the panels of the exhibition (with 12% identifying at least one panel as their favorite piece).

### Social Interaction, Broad Age Range, Further Exploration

**Social interaction.** Group interaction was noted in 86% of the observations, suggesting that one of the original design goals of the mini-exhibition – promoting group use of components during the experience – was accomplished for Hispanic visitors at OMSI.

**Broad age range.** *Nano* attracted Hispanic visitors at OMSI from ages 0 (infant) to 49. Almost half (49%) of visitors were also observed to be children, defined as being below the age of 18.

**Table 30. Distribution of Observed Ages Within Visitor Groups (n=96 across 27 group observations)**

Age Range	Percentage	Age Range	Percentage
0-5	19%	30-39	26%
6-8	13%	40-49	8%
9-12	8%	50-59	0%
13-17	9%	60-69	0%
18-20	5%	70+	0%
21-29	10%		

**Further exploration.** Visitors did explore the mini-exhibition beyond the hands-on activities. A majority of groups (86%, n=28) had at least one group member stop at least one panel. *Where Can You Find Nano? I Spy Nano* was the most visited panel, with the majority (82%) of Hispanic visitor groups being observed using it. The other panels were also visited frequently, with 64% of Hispanic visitors being observed at the *What’s New About Nano?* panel, 57% observed at the *What Happens When Things Get Smaller?* panel, and 43% at the *What Does Nano Means for Us?* panel.

Additionally, 71% of Hispanic visitors who were interviewed reported noticing the flip panels, and the majority of visitors who noticed them said they had a positive effect on their experience within the exhibition. The books and reading boards were the least



utilized of the “further exploration” components, with only 20% of Hispanic visitor groups being observed using them. However, it should be noted that all the reading boards were bilingual, but the books were only available in English.

## Learning About Nano Content

The tables below were summarized in the Summary of Findings document and provide evidence to suggest that Hispanic visitors at OMSI were engaging with nano content and learning about different areas of the NISE Net content map. Table 31 shows the percentage of visitors who identified at least one area of the content map when asked two different questions about what they learned at the exhibit. Table 32 shows the distribution of responses across the different areas of emphasis within the content map.

**Table 31. Visitors Who Mentioned at Least One Area of the NISE Net Content Map When Responding to Questions About Learning in the Exhibit (n=28)**

Questions about Visitor Learning	Percent of visitors who mentioned at least one area of the NISE Net content map
Q3. What do you think the exhibit was about overall?	59%
Q10. If a friend asked you what you learned at the exhibit today, what would you tell them?	68%

**Table 32. Distribution of Visitor Responses to Learning Questions Across the Areas of the NISE Net Content Map (n=28)**

NISE Net Content Map areas	Percent of responses, Question 3	Percent of responses, Question 10
Nanometer-sized things are very small.	8%	6%
Nanometer-sized things behave differently.	3%	3%
Nano is about manipulating things on the nanoscale.	6%	3%
New knowledge and innovation that weren't possible before.	28%	18%
Nanotechnologies have risks and benefits.	6%	3%
Nano is connected to our lives.	11%	35%
Other	8%	15%
General comments about science	11%	0%
I don't know	11%	6%
Nature/environment	8%	3%
Nothing	N/A	9%

In addition, 75% of the Hispanic visitors at OMSI answered “Yes” to the question “Did the exhibit connect to anything in your own life?”, suggesting visitors found the experience relevant.

Table 33 reports the non-parametric Wilcoxon Ranked Sign Test performed on the confidence scores of Hispanic visitors, showing a statistically significant increase in confidence from retrospective pre- to post scores.

**Table 33. Difference in Visitor’s Reported Confidence Levels Based on Retrospective Pre and Post Answers (n=28)**

Confidence Items	Percent of visitors reporting top two levels of confidence after visiting the mini-exhibition	Mean confidence score, pre	Mean confidence score, post	Z
Talk about how scientists are able to build things atom by atom at the nanoscale.	36%	1.68	2.32	-3.626**
Describe one example of how nanoscale objects behave differently than other objects.	39%	1.64	2.25	-3.494**
Name a product, technology, or example in nature that involves nanoscale science.	61%	2.00	2.71	-3.256**
Identify at least two factors to consider when thinking about using new nanoproducts or nanotechnologies.	47%	1.75	2.43	-3.275**
Identify at least one way that nano will impact my life in the future.	61%	2.04	2.75	-3.256**

\*\* $p < 0.01$ , Wilcoxon Signed Rank Test; Scale goes from 1-4.

## Spanish Translations and Language Preferences

All but one Hispanic visitor at OMSI (96%, n=28) who was interviewed for the study reported noticing the Spanish translations. Of those who noticed, 85% said the translations had a positive impact on their experience. One visitor reported a neutral impact, and one reported a negative impact.

Of the 23 Hispanic visitors who reported a positive impact on their experience, the most common theme in their responses was that they felt the translations helped make *Nano* feel more inclusive. For example, one visitor said, “I read the ones that are in Spanish because it’s what I understand. In English, I don’t understand English.” Another visitor reported the opportunity to learn more about a particular language, saying “For someone who is bilingual, sometimes we don’t understand a word in Spanish or in English, and I compared both languages. It helped me.” The one Hispanic visitor who reported a negative impact said, “There are confusing words in Spanish”.

In addition, the majority of Hispanic visitors at OMSI preferred to use Spanish versions of the survey and interview, as seen in Table 34.

**Table 34. Language Preference (n=28)**

Preferred Language	Percent of Visitors
English	14%
Spanish	61%
English and Spanish	25%

Also, there was one noted instance of a visitor who preferred to do the survey and interview in English who was observed using Spanish within the mini-exhibition. Although the use of English was not specifically noted during the observation, anecdotal evidence from our data collectors suggest the converse also occurred – that a few groups who preferred to do the survey and interview in Spanish were also observed using English within the mini-exhibition.

## Supplemental Findings – Science Spectrum Hispanic Visitors

The data reported in the Summary of Findings for Hispanic visitors at Science Spectrum was based on the full analysis performed on the data collected at that institution and with the Hispanic audience. Below, we provide the additional tables and information that could not be included in the Summary of Findings but still contributed in some way to the document. The format of this section will echo that of the Summary and be divided by the indicators of success listed outlined by the *Nano* design team.

### Sustained Use

**Table 35. Mini-exhibition Use (n=21)**

Indicator	
Mean Dwell Time	7:29 (min, sec)
Median Dwell Time	5:43
Sweep Rate Index	69, assuming 400 sq. ft.

Once again, we are using the median dwell time in the Sweep Rate Index calculation, in order to provide a more conservative estimate of this ratio.

## Interest and Enjoyment

**Table 36. Interest and Enjoyment Reported by Visitors (n=21)**

Interest and Enjoyment	Percent of Visitors or responses
Top two levels of interest	95%
Top two levels of enjoyment	95%
Top two levels of interest for child	93%
Top two levels of enjoyment for child	93%
As or more interesting than other exhibits	47%
Percent of positive adjectives chosen to describe experience	97%, with 79 total adjectives selected

In addition, 14% of Hispanic visitors at Science Spectrum (n=21) reported finding something about the mini-exhibition challenging. When asked to elaborate on what was challenging, one respondent said the content was confusing or challenging, and one respondent said that components were difficult to use.

Hispanic visitors at Science Spectrum most commonly indicated the *Small, Smaller, Nano* component was the favorite part of the mini-exhibition, with 46% of respondents making this choice. The next most frequently identified favorite components were *Build a Giant Carbon Nanotube* (with 23% of respondents choosing this element as their favorite) and generally the panels of the exhibition (with 9% identifying at least one panel as their favorite component).

## Social Interaction, Broad Age Range, Further Exploration

**Social interaction.** Group interaction was noted in 81% (n=21) of the observations, strongly suggesting that one of the original design goals of the mini-exhibition – promoting group use of components during the experience – was accomplished.

**Broad age range.** *Nano* attracted Hispanic visitors at Science Spectrum from ages 0 (infant) to 49. Almost half (49%) of visitors were also observed to be children, defined as being below the age of 18.

**Table 37. Distribution of Observed Ages Within Visitor Groups; (n=74 across 21 group observation)**

Age Range	Percentage	Age Range	Percentage
0-5	22%	30-39	28%
6-8	19%	40-49	0%
9-12	7%	50-59	0%
13-17	1%	60-69	0%
18-20	7%	70+	0%
21-29	16%		

**Further exploration.** Visitors did explore the mini-exhibition beyond the hands-on activities. A majority of groups (86%, n=21) had at least one group member stop at least one panel. *Where Can You Find Nano? I Spy Nano* was the most visited panel, with the majority (76%) of Hispanic visitor groups being observed using it. Two other panels were also visited frequently, with 57% of Hispanic visitors being observed at the *What’s New About Nano?* panel, and 33% observed at the *What Happens When Things Get Smaller?* panel.

Additionally, 71% of visitors who were interviewed reported noticing the flip panels, and the majority of visitors who noticed them said they had a positive effect on their experience within the exhibition. The books and reading boards were the least utilized of the “further exploration” components, with only one visitor group being observed using these pieces. Once again, it should be noted that all the reading boards were bilingual, but the books were only available in English.

## Learning About Nano Content

The tables below were summarized in the Summary of Findings document and provide evidence to suggest that Hispanic visitors at Science Spectrum were engaging with nano content and learning about different areas of the NISE Net content map. Table 38 shows the percentage of visitors who identified at least one area of the content map when asked two different questions about what they learned at the exhibit. Table 39 shows the distribution of responses across the different areas of emphasis within the content map.

**Table 38. Visitors Who Mentioned at Least One Area of the NISE Net Content Map When Responding to Questions About Learning in the Exhibit (n=21)**

Questions about Visitor Learning	Percent of visitors who mentioned at least one area of the NISE Net content map
Q3. What do you think the exhibit was about overall?	48%
Q10. If a friend asked you what you learned at the exhibit today, what would you tell them?	57%

**Table 39. Distribution of Visitor Responses to Learning Questions Across the Areas of the NISE Net Content Map (n=21)**

NISE Net Content Map areas	Percent of responses, Question 3	Percent of responses, Question 10
Nanometer-sized things are very small.	12%	16%
Nanometer-sized things behave differently.	4%	8%
Nano is about manipulating things on the nanoscale.	8%	12%
New knowledge and innovation that weren't possible before.	4%	20%
Nanotechnologies have risks and benefits.	4%	0%
Nano is connected to our lives.	19%	8%
Other	19%	12%
General comments about science	23%	16%
I don't know	7%	4%
Nature/environment	0%	0%
Nothing	N/A	4%

In addition, 52% of the Hispanic visitors at Science Spectrum answered “Yes” to the question “Did the exhibit connect to anything in your own life?”, suggesting visitors found the experience relevant.

Table 40 reports the non-parametric Wilcoxon Ranked Sign Test performed on the confidence scores of Hispanic visitors, showing a statistically significant increase in confidence from retrospective pre- to post scores.

**Table 40. Difference in Visitor’s Reported Confidence Levels Based on Retrospective Pre and Post Answers (n=21)**

Confidence Items	Percent of visitors reporting top two levels of confidence after visiting the mini-exhibition	Mean confidence score, pre	Mean confidence score, post	Z
Talk about how scientists are able to build things atom by atom at the nanoscale.	24%	1.38	1.95	-3.207**
Describe one example of how nanoscale objects behave differently than other objects.	24%	1.29	1.95	-3.071**
Name a product, technology, or example in nature that involves nanoscale science.	52%	1.57	2.24	-2.640**
Identify at least two factors to consider when thinking about using new nanoproducts or nanotechnologies.	28%	1.43	2.00	-2.585*
Identify at least one way that nano will impact my life in the future.	67%	1.86	2.62	-2.724**

\* $p < 0.05$ ; \*\* $p < 0.01$ , Wilcoxon Signed Rank Test; Scale goes from 1-4.

## Spanish Translations and Language Preference

The majority of Hispanic visitors at Science Spectrum (76%, n=21) reported noticing the Spanish translations. Of those who noticed, 31% said the translations had a positive impact on their experience, and the remaining 69% reported a neutral impact. None reported a negative impact.

Of the five visitors who reported a positive impact, the main theme in their responses was that they felt positively about the ways the Spanish translations made the exhibition feel inclusive. For example, one visitor said, “[They are] helpful for other people that cannot read English. There [are] a lot of people that speak other languages here.”

In addition, the majority of Hispanic visitors at Science Spectrum preferred to use English versions of the survey and interview, as seen in Table 41.

**Table 41. Languages Preference (n=28)**

Preferred Language	Percent of Visitors or responses
English	86%
Spanish	5%
English and Spanish	9%

At Science Spectrum, there was at one noted instance of a visitor who preferred to do the survey and interview in English who was observed using Spanish within the mini-exhibition.

## Discussion and Future Questions For the ISE Field

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Although the findings from this exploratory study should not be generalized broadly to all Hispanic audiences, there are three key findings related to the small groups we did study at OMSI and Science Spectrum:

- *Nano* appeared to be successful for these visitors, where success was measured against the indicators set forth by the Network and the *Nano* design team.
- At the two sites, Hispanic visitors had different language preferences when engaging with our data collectors. At OMSI, most Hispanic visitors preferred to conduct the survey and interview portions of the study in Spanish. At Science Spectrum, the vast majority of Hispanic visitors preferred to conduct the survey and interview in English. However, at each location, there was evidence of at least one group that preferred to do the survey and interview in one language, but were observed using the mini-exhibition in the other language. This suggests that having the exhibit be in both languages can be quite useful even if one language is more commonly used than another within a particular group.
- When visitors reported the translations having an impact on their experience with *Nano*, more visitors reported a positive impact than a negative impact within these two study groups as well as the general audience overall (as seen in Appendix A). However, at OMSI, the vast majority (85%) of Hispanic visitors who reported noticing the Spanish translations said that the translations had a positive impact on their experience; at Science Spectrum, it was only 31% – the same proportion as seen in the general audience (as seen in Appendix A). Potential reasons for this could be the differences in language preferences of Hispanic visitors from OMSI and Science Spectrum, or perhaps the familiarity of seeing bilingual translations within a particular institution or community.

In addition to providing findings about the Hispanic visitors that participated in our study, we feel that this work points to three questions for future inquiry:

**1. What is the broader impact of a bilingual exhibition?** Bilingual exhibitions can do more than provide language support to a target audience. These pieces can also impact the perception of the institution, both internally (among the institution staff) as well as externally (within the local community). In particular, exploring the perceptions of the public and the professionals about why bilingual experiences are being developed, and the perceptions about what motivations – such as inclusion, intentions to reflect the community’s demographics and increase accessibility of science content to minorities and underserved communities, etc. – may be behind these efforts, may be quite interesting and fruitful.

**2. What might contribute to notable findings from the Hispanic visitor data?** Though our sample was quite small, there were several findings that stood out and warrant further exploration, such as the lengthy dwell times of Hispanic groups at both sites, and the differences in the ways they described their experiences to our data collectors. What might be are some elements that might cause these findings to exist?



What are the cultural considerations that come into play, such as (a possible lack of) familiarity with museums and science content, levels of education, etc.? What are the connections between measured outcomes and other factors?

**3. What are the different cultural responses to our standard evaluation methods, and how can we be more culturally appropriate in our work?** In this study, we were fortunate to have an experienced bilingual/bicultural evaluator working with us on our team every step of the way in order to develop culturally appropriate instruments, protocols, and interpretations of data. However, a broader question of methods – particularly data collection methods – still exists for the ISE field. To what extent do different cultural groups resonate with our common data collection practices, such as surveys and interviews? How comfortable are different groups with these data collection methods? And how do we balance the notion of ‘rigor’ with the notion of culturally responsive evaluation, such as when the desire for appropriate sampling of one adult per group conflicts with the cultural norm of answering questions together as a family unit?

Certainly, these questions merely scratch the surface of what might be useful to explore further when thinking about conducting culturally appropriate bilingual evaluations. We hope the documentation of our process and the questions we pose here – along with an in-depth examination of current literature on engaging Hispanic Audiences in museums and other informal learning environments – can contribute to the advancement of ongoing conversation about this type of work in our field.