Summative Study of the Public Impacts of Nano-Rich Organizations

Summative Evaluation

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Executive Summary

The Nanoscale Informal Science Education Network (NISE Net) created a national community of researchers and informal science educators dedicated to fostering public awareness, engagement, and understanding of nanoscale science, engineering, and technology ("nano"). The goals of NISE Net were to create a national community of partners to engage the public in nano, to develop and distribute educational experiences that raise public awareness and understanding of nano, and to generate knowledge about public and professional learning through evaluation and research. NISE Net includes over 600 museums, universities, and other organizations. Network partners work together to engage the public in new topics related to science, engineering, and technology. Collectively, the efforts of partner organizations give the Network broad reach to diverse public audiences across the United States.

From Fall 2014 through Fall 2015, the NISE Network Public Impacts evaluation team conducted a descriptive summative study aimed at understanding the variation, combination, and concentration of ways in which Network partners utilized Network educational resources and products together with their own resources to offer the public opportunities to engage in learning about nanoscale science, engineering, and technology ("nano"). This study was designed to explore how the NISE Network's range of resources were used by the diverse range of Network partners, and how individual institutions felt that they were doing at providing their publics with positive experiences and learning outcomes. Taken together with other NISE studies of the *Nano* exhibition (Svarovsky, Goss, Ostgaard, Reyes, Cahill, Auster, & Bequette, 2013), the Nanodays kits (Svarovsky, Tranby, Cardiel, Auster, & Bequette, 2014), and a summary of the reach of the Network (Svarovsky, Goss, & Kollman, 2015), this study forms part of the overarching view of the public impacts of the network.

Throughout this study, the term "nano rich" is used to describe certain organizations within the network. Nano rich organizations are defined by the evaluation team as places that offer a wide variety of nano-related materials and experiences for their public audiences. In a nano rich organization, these materials and offerings are, as much as possible, infused into their programs and exhibitions; a visitor to a nano-rich location is likely to engage with nano in at least one format during their visit. The definition of "nano rich" is further explained on page 8 and operationalized throughout this study.

This study was designed to explore how the NISE Network's range of resources were used by diverse Network partners and understand how well individual institutions felt they were doing at providing their publics with positive experiences and learning outcomes. This study does not examine the actual impacts of the network on the public, but rather the potential for impacts through a more nuanced understanding of what was offered to the public.

Two questions guided the study:

1. What does the NISE Network look like with respect to partner organizations' public offerings about nano?
2. What are the different ways that nano-rich partner organizations have created opportunities for their public audiences to engage with nano-related content through programs and exhibits?

Two areas of focus addressed these two questions, respectively. In Focus 1, the evaluation team gathered previously collected data and requested information from leaders within the Network who were familiar with the partners' work in order to build an overview of the nano-related

public offerings of all 203 Tier 1 and Tier 2 partner organizations[1] in the NISE Network. In Focus 2, the evaluation team conducted interviews with 19 staff members at 14 of these nano-rich organizations, gathering more details about organizations that provided an especially rich mix of nano-related offerings for their audiences (identified in Focus 1). The goal of Focus 2 was to better understand the characteristics of the organizations' nano-related offerings, staff members' views of the intended messages and the success of those offerings, and characteristics of the audiences that staff members hoped to reach.

Findings

Focus 1 results indicate:

- Most Tier 1 and 2 organizations provided more than one opportunity for their public audiences to engage with nano-related content.
- There was a great deal of variation in the extent to which NISE Net's Tier 1 and 2 partner organizations provided nano-related offerings, including offerings that previous evaluation studies had determined to have a high public impact. Within Tier 1 and 2 partners, differences existed in:
  - The duration that nano offerings were made available to the public,
  - The frequency with which nano offerings were made available to the public,
  - The variety of nano offerings made available to the public, and
  - How much of an organization's public was likely to encounter nano-related content.

More importantly:

- Organizations of many different sizes could be nano-rich with respect to their own audiences. In fact, the nano richness of an organization had less to do with its size and more to do with whether it provided multiple opportunities for its audiences to participate in a variety of nano experiences.
- Organizations of many types (science museums, children's museums, universities) could be nano-rich with respect to their own audiences, showing that there was not one type of Network partner organization that was more likely to be nano-rich than another.

Results from Focus 2 provided additional details about the consistency and variability with which nano-rich organizations (as determined in Focus 1) incorporated nano into their work:

- Staff members at these organizations reported having several different ways *at any one time* in which audience members might encounter and learn about nano, including activities, exhibits, and programs with nano.
- Each nano-rich organization had several topics—both about nano and about STEM in general—that they hoped audience members were taking away from these experiences.
- Most staff members believed that they were successful in getting their intended messages across.

[1]Organizations participating in the NISE Network were categorized based on their level of network participation and involvement into one of several Tiers. Tier 1 - Core Partners: These grant-funded partners operate the Network, and work to raise the capacity of the Network's partners to engage the public in nano through the development and distribution educational and professional development products. Tier 2 - Nano-Infused Partners: These institutions are the very involved in the Network and engage the public in nano in their communities in multiple ways through ongoing programming beyond hosting annual NanoDays events. Additional organizations participating in the Network but at a less intensive level of involvement were categorized into Tiers 3-6 and are not the subject of this report.

- Nano offerings and learning goals extended to all segments of their audiences, including casual visitors and people enrolled in special programs, school children and community members, children and adults.

Through Focus 1, the detailed analysis of existing records for all organizations in Tiers 1 and 2, and Focus 2, the conversations with a smaller number of organizations, this study provides evidence that the NISE Network allowed for distribution of products to a wide range of sites and audiences.

This study indicates that:

- **Educational products were distributed and used by a variety of organizations differing in size, geographic location, and type.** In particular, focus 2 organizations included 6 children's museums, 6 science centers or museums, and 2 universities that were located in 6 of 7 NISE Net regional hubs in urban, suburban and rural locations, and ranged from annual attendance of under 10,000 visitors to over 500,000 visitors.
- **Educational products were shared with all museum audiences, not only science-oriented audiences.** Audiences included casual visitors, repeat visitors, school groups, youth attending afterschool programs and camps, adults attending lectures and other programs, general audience attending public events off-site, and members.
- **Educational products were distributed to all kinds of museums including science centers or museums and children's museums.** These organizations opted to use a variety of products to share with their audiences.
- **NanoDays kit materials were used and repurposed through a range of programs and settings.** Organizations used materials during NanoDays events, outreach events to communities, school programs, to supplement their mini-exhibition, and for events and lectures.

It is useful here to contrast these findings with common pitfalls that sometimes occur in large, multi-institutional projects and networks, any of which could have happened (but didn't) in this project:

- Educational products could have been kept solely in the hands of larger organizations or organizations more central to the network.
- Materials could have been used only for audiences who sought out current or advanced STEM education experiences.
- Children's museums could have seen NISE Network educational products and materials as inappropriate for their audiences and declined to use them.
- Organizations could have used educational materials and products only during the days they were required to use them.

Overall, the study of the public impacts of nano-rich organizations supports the conclusion that, to a large degree, the NISE Network succeeded in providing informal educators with offerings that could foster public awareness, engagement, and understanding of nanoscale science, engineering and technology, not only via the NISE Network's major products, but also via access to other products, materials, programming, and resources. Furthermore, public engagement products (materials, programming, and resources) often aligned with the demands of Network partners' particular physical spaces, institution types, audiences, engagement goals and learning goals. Based on our data and interviews, when choices could have been made to restrict what was offered or who it was shared with, the Network and the organizations that make up the network seem to have made choices that resulted in a wide distribution and use of these products.

Introduction and Evaluation Questions

The Nanoscale Informal Science Education Network created a national community of researchers and informal science educators dedicated to fostering public awareness, engagement, and understanding of nanoscale science, engineering, and technology ("nano"). The goals of NISE Net were to create a national community of partners to engage the public in nano, to develop and distribute educational experiences that raise public awareness and understanding of nano, and to generate knowledge about public and professional learning through evaluation and research. NISE Net includes over 600 museums, universities, and other organizations. The Network is organized into regions, each with a Regional Hub Leader that serves as primary point of contact and provides advice, encouragement, and support to partners. Network partners work together to engage the public in new topics related to science, engineering, and technology. Collectively, the efforts of partner organizations give the Network broad reach to diverse public audiences across the United States.

In spring 2012, the Public Impacts Evaluation Group of NISE Net embarked on a set of three coordinated studies to explore the public impacts of educational products developed by the Network. The first two studies focused on the public impacts of the most resource-intensive educational products developed by the Network: the *Nano* exhibition (Svarovsky et al., 2013) and the annual NanoDays kit and event festival (Svarovsky et al., 2014). In the last year of the NISE Network, the third study sought to move beyond focusing on individual products to providing information about whether and how NISE Net partner organizations provided multiple opportunities for visitors and other members of their audience to engage with nano-related content. Organizations might, for example, have a *Nano* exhibition on display, host an annual NanoDays event, use materials from the current and past NanoDays kits in programs throughout the year, present theater programs that include nano content, use a small grant from NISE Net (called "mini-grants" internally) to develop a pretend "nano lab" experience or a theater program, or have any combination of these or other offerings, including nano content or products not from NISE Net. These organizations, which we refer to as being *nano-rich*, provided many opportunities for their audience members to engage with and learn about nano. This third study, which began in Fall 2014, is the focus of this report. Together with those other NISE studies of the *Nano* exhibition and the Nanodays kits, and a summary of the reach of the Network (Svarovsky, Goss, & Kollman, 2015), this study forms part of the overarching view of the public impacts of the Network.

The primary aim of this study was descriptive: to provide information about how partner organizations in the NISE Network provided opportunities to "foster public awareness, engagement, and understanding of nanoscale science, engineering, and technology."[2] We were guided by the following evaluation questions:

1. What does the NISE Network look like with respect to partner organizations' public offerings about nano?
2. What are the different ways that nano-rich partner organizations have created opportunities for their public audiences to engage with nano-related content through programs and exhibits?

[2]See "Home," www.nisenet.org. The Network has expanded and the goals have broadened to "fostering public awareness, engagement, and understanding of current science, technology, engineering, and math (STEM)." During the time of this study, the earlier language was used.

This study focused on understanding more about the patterns of how Network products were distributed and used; it was not about rating any particular organization as being higher performing than another. We use both the term rating and categorization in this report for the process of identifying and describing how products were implemented by Network partners. It's also important to note that while this work provides insight into the potential for impacts on the public, it did not measure actual impact of the network on the public. When the term "high impact" is used, we refer to the potential for impact, not actual measured impact.

Two foci addressed these questions. Focus 1 examined nano-related offerings across the NISE Network to characterize the extent to which 203 partner organizations highly involved in the Network have incorporated nano-related content into their public offerings. For Focus 1, we drew on data that had been collected for previous NISE Net studies and reports, and information provided by NISE Net's Regional Hub Leaders (that is, NISE Net staff members who provide support for partner organizations within one of seven geographic regions of the Network). Focus 2 provided more detailed information about the nano-related experiences and learning goals provided by organizations identified in Focus 1 as providing especially rich opportunities for their audiences to engage with and learn about nano. Information for Focus 2 came from interviews with 19 staff members at 14 children's museums, science centers/museums, and universities that were selected at the conclusion of Focus 1 analysis.

Below are definitions of terms used in this report:[3]

> **NISE Network:** The Nanoscale Informal Science Education Network (NISE Net) created a national community of researchers and informal science educators dedicated to fostering public awareness, engagement, and understanding of nanoscale science, engineering, and technology. NISE Net was funded through two consecutive 5-year awards from the National Science Foundation.
>
> **Nano:** Nanoscale science and engineering is an emerging field in which scientists study the novel properties and behaviors of systems operating at the nanoscale. (The prefix *nano* means "one billionth.") In this report we often use the term *nano* as shorthand for nanoscale science, engineering, and technology.
>
> **Educational products**: NISE Net produced and distributed both physical and digital versions of educational products designed to engage multiple and diverse public audiences in learning about nano. To the extent possible, these products were designed to be versatile and flexible, and were open-source resources that could be modified and adapted to work for different organizations. Educational products included a variety of public programs, hands-on activities, exhibits, and media. Among the most widely distributed and used products were NanoDays kits, which included hands-on activities and related professional resources, and the small-footprint *Nano* exhibition:
>
> > **NanoDays**: NanoDays was the NISE Net's signature event—an annual celebration that mobilized hundreds of organizations across the country to engage staff, volunteers, and members of the public in learning about nano. NanoDays kits were the Network's most widely used set of resources. More than 1,600 NanoDays kits were distributed to Network partners over a period of eight

[3]See "Frequently Asked Questions (FAQs)," www.nisenet.org/faqs.

years. Each year's kit included both educational products and professional resources.

***Nano* exhibition**: *Nano* is a 400 square foot exhibition that engages visitors in learning about nano through interactive components and real phenomena. The Network produced 93 copies of the exhibition, which were displayed at 140 organizations during the funded period of the NISE Net grant (though 2017).

Mini-grants: NISE Net awarded small grants (up to $3,000) to help partner organizations incorporate Network products into their ongoing public offerings, build staff capacity to engage public audiences in learning about nano, and reach new or additional audiences in nano-related activities.

Partner organizations: Network partners included children's museums, science centers, universities, libraries, and other organizations and other organizations dedicated to informal and lifelong learning. There was no membership fee or process to join NISE Net; any organization that was involved in or created or received materials from the NISE Network was considered a Network partner. In order to manage Network activities, the Network categorized partner organizations into several tiers according to their involvement, roles, and responsibilities. Partners were free to participate in the Network in varying ways and to varying degrees depending on their organizations' mission, capacity, and other factors. The internal Tier categorization system helped the Hub leaders (and Network leadership more generally) understand and make decisions based on organizations' varying participation in the Network. The Nano Rich evaluation study focused on all 203 Tier 1 and Tier 2 partner organizations in the NISE Network at the time of the analysis (early 2015). Tier definitions are provided below.

Regional Hubs: At the time of this study, the Network was organized into seven regional hubs, each with a **Regional Hub Leader** who served as a point of contact, information, and support for Network partners.

Tiers: Organizations participating in the NISE Network were categorized by Regional Hub leaders based on their level of network participation and involvement into one of several Tiers. This study focuses on the more active and closely involved partners, those categorized as Tiers 1 and 2:

- Tier 1 - Core Partners: These grant-funded partners operate the Network. Core partner institutions are charged with leading the field in raising public awareness, understanding, and engagement with nanoscale science, technology, and engineering. This includes developing informal educational products, creating professional development opportunities, and building the capacity of other Network institutions and partners.
- Tier 2 - Nano-Infused Partners: These institutions are the primary recipients of Network resources and professional development efforts, including regional workshops, online workshops, and network-wide meetings. The goal of the Network is to have nano content be "infused" into Tier 2 institutional programming by the end of Year 10. The Network is actively working to increase the capacity of nano-infused partners to deliver nano education experiences beyond NanoDays as an ongoing, sustainable part of their institutions' programming.

Organizations participating in the Network at a less intensive level of involvement were categorized into Tiers 3-6 and are not the subject of this report

Nano-rich organizations: Partner organizations that present a wide variety of nano-related materials and offerings for their public audiences. These materials and offerings were infused into their programs and exhibitions. Describing the nature of Tier 1 and Tier 2 nano-rich organizations, and their use of Network products to engage the public, is the focus of this report.

Although linked to the extent of an organization's public impact, this study defined nano richness independent of an organization's size or the size of its audience: a small organization with only a few nano-related programs and exhibits may be considered nano rich because nano-related content is included in a significant share of its offerings and much of its audience is exposed to nano-related offerings. In contrast, a large museum with many nano-related exhibits and programs may be less nano rich if the exhibits are placed in a low-traffic area or only a few visitors participate in nano-related activities.

Focus 1: Describing the Network

What does the NISE Network look like with respect to partner organizations' public offerings about nano?

The first focus of the Nano Rich evaluation study documented the extent to which partner organizations across the network provided opportunities for the public to engage with nano-related content.

The team began analysis with two interconnected goals in mind: (a) since the NISE Net frequently requested data from staff members at partner organizations, it was important to use data that had already been collected for other NISE Network studies as much as possible, rather than asking professional partners to participate in another NISE Network interview or survey. (b) The team wanted to tap into Regional Hub Leaders' extensive knowledge about the organizations in their hubs, an information source not used in previous NISE Network evaluation studies. In order to find a way to measure the level to which NISE Network partners were getting a variety of nano products to the public, the first task was to define the factors at play: the organizations to include in the data set, and the indicators to examine for these organizations.

Selecting the Data Set
We began by selecting the organizations to include in the evaluation. We decided to include all Tier 1 and Tier 2 organizations so that we would have a broad range of organization types and settings with extensive involvement in NISE Net. Because an organization's tier designation may change over time, we selected to study the 201 organizations in NISE Network's database that were designated as Tier 1 or Tier 2 on April 30, 2014. Tier 1 is comprised of 14 organizations whose staff operate the network, which includes developing and distributing resources for the partner organizations, organizing professional development opportunities, and planning and running a variety of gatherings. Tier 2 includes museums, universities, and other organizations that participated in NISE Net events, attended regional and network-wide meetings, and received materials from the network; over the course of the study, we added two organizations that became Tier 2, and continued to include six organizations that moved from Tier 2 to Tiers

3, 4, or 6. In total, the study included 203 organizations. Approximately 400 additional organizations with less involvement in the network (Tiers 3–6) were not included in the study.

Selecting Measures of Nano Richness

The evaluation team searched previous NISE Net reports, surveys, findings, and databases for information about the nano-related public offerings of the organizations in the study. From these sources, we developed four indicators that provide information about the extent to which organizations provide opportunities for their public audiences to engage with nano:

1. The potential public impact of NanoDays events, based on reports completed by staff members in participating organizations who received kits.
2. The potential public impact of the *Nano* exhibition based on NISE Net's records about which organizations received an exhibition and whether it was or was not shared with another organization.
3. Whether the organization received a NISE Net mini-grant that was used to increase its public offerings around nano, taken from NISE Net's records.
4. The extent of the organization's use of materials from NanoDays kits outside of the 2014 NanoDays events, based on reports completed by staff members at participating organizations, as well as their use of other products, developed by the Network or from another source.

In addition, we created two indicators using categorizations provided by the Regional Hub Leaders:

5. Regional Hub Leaders' categorizations of the public impact of 2014 NanoDays events at the organizations within their hub.
6. Regional Hub Leaders' categorizations of the overall nano richness of the organizations within their hub.

Details about each indicator, the methods we used to measure them, and the results of the analyses are in the following sections.

INDICATOR 1: Public Impacts Evaluation Team Categorizations of 2014 NanoDays Reports

1) What is the indicator?

One way that NISE Net's partner organizations brought nano experiences to their audiences is through participation in the annual NanoDays celebration. Each year, all organizations that receive a NanoDays physical kit were required to host a NanoDays event and complete a report. We used their responses to the following questions from the 2014 NanoDays Report to characterize the potential for public impact of each organization's event:

- **Infrastructure**: We noted whether or not an organization hosted a NanoDays event, collaborated with other organizations on the NanoDays event, and/or had volunteers.
- **Activities and Experiences**: Respondents were presented with a list of 11 types of activities and experiences (see Table 1) and, for each, asked to indicate whether or not it was included among their NanoDays events.
- **Beyond-NanoDays 2014 Materials**: In order to track organizations' use of additional nano materials *not* included in the current year's NanoDays kit, respondents were presented with a list of four types of nano materials (see Table 1) and, for each, asked to indicate whether or not they used it in their 2014 NanoDays events.

2) What organizations are included in the analysis?

The evaluation team included in the analysis the 154 Tier 1 and Tier 2 organizations that submitted NanoDays 2014 reports. In the overall analysis of nano richness across the network (below), the 49 organizations that did not submit a 2014 NanoDays report were included as "missing information" on this indicator.

3) What is being measured?

The evaluation team used responses from the reports to create a measure of the potential for public impact of each organization's 2014 NanoDays events.

First, we looked at the number and percentage of organizations that included various nano activities and/or experiences in their events (see Table 1).

With respect to **infrastructure** of NanoDays, almost all of the organizations in our sample hosted a NanoDays event (96%) rather than participating in another organization's event, and called on volunteers to help (90%). Almost two-thirds (64%) of the organizations collaborated with other organizations.

For **activities and experiences** (sources described in next item), almost all (99%) organizations included short, hands-on activities and demonstrations, and three-fourths of the organizations included posters or displays. No other type of activity or experience was included in a majority of organizations' events, although videos and media (45%) and exhibits (46%) were common. Only a few organizations included other nano experiences, such as Science Cafés, forums, and laboratory tours.

Materials from Beyond NanoDays 2014 refers to the ways in which partners used various nano materials (including and in addition to NanoDays materials) at times *other* than NanoDays events. Almost all organizations reused items from previous NanoDays kits (94%), and most

used materials that they or their collaborators had created (61%). Many organizations used something from the NISE Net online catalog (42%) or from other sources (31%).

Table 1
Number (and Percent) of Tier 1 and Tier 2 Organizations That Included Various Factors in Their NanoDays 2014 Events (N = 154)

Factors	No. of Organizations	Percent of Organizations
Infrastructure		
Hosted an event	148	96
Volunteers supported the event	138	90
Collaborated with other organizations on the event	99	64
Activities and Experiences		
Short hands-on activities and demos	153	99
Posters or displays	116	75
Exhibits	71	46
Videos and media	69	45
Longer educational programs	49	32
Guest speakers or lectures	35	23
Stage presentations	33	21
Museum theater	16	10
Lab tours	10	7
Science Cafés	9	6
Forums (scientist and public dialogue and deliberation)	8	5
Materials from Beyond NanoDays 2014		
From past NanoDays kits	144	94
Created by themselves or their collaborators	94	61
From NISE Network online catalog	65	42
Other	47	31
None	6	4

Additionally, we looked at how many of the factors each organization included in its NanoDays events (see Table 2). Of the 11 Activities and Experiences factors, only one organization reported not including any of the factors, and no organization included more than eight. Most (60%) organizations included 3-5 types of activities and experiences in their events. As to Materials from Beyond NanoDays 2014, most organizations included at least one type of these materials (96%), and a majority of organizations used 2 or 3 types (64%).

Table 2
The Number of Factors (see Table 1) Included in Tier 1 and Tier 2 Organizations' 2014 NanoDays Events

No. of Factors Included	No. of Organizations	Percent of Organizations
Activities and Experiences		
0	1	1
1	15	10
2	24	16
3	33	21
4	31	20
5	29	19
6	12	8
7	6	4
8	3	2
9	0	0
10	0	0
11	0	0
Materials from Beyond NanoDays 2014		
0	6	4
1	29	19
2	57	37
3	41	27
4	21	14

4) How did the evaluation team conduct the analysis?

Based on the frequencies and the nature of the factors shown above, we created a coding scheme to characterize offerings that were likely to have a high, medium, or low public impact. Overall, offerings included: onsite and family programs, onsite displays, offsite programs, and adult programs.

- We grouped similar factors into categories (see Table 3). For example, we grouped together longer educational programs, guest speakers or lectures, stage presentations, and museum theatre as types of onsite and family programs.
- We assigned points to each factor or category of factors (see Table 3).

Using these categories, we were able to analyze the variety of activities and experiences that organizations offered during their NanoDays events.

- We selected factors that we believed would be likely to support high, medium, and low public impacts (see Table 3). We created an initial coding scheme that we modified in response to comments provided by NISE Network members familiar with NanoDays. These terms refer to the potential for impact, not a measured impact on the public.

High public impact organizations (a) hosted a NanoDays event, (b) broadened their outreach by collaborating with other organizations and involving volunteers, (c) provided a variety of ways for their audiences to interact with nano, and (d) used materials from past NanoDays kits and at least one additional source.

Medium public impact organizations (a) hosted a NanoDays event, (b) may have collaborated with other organizations or involved volunteers, (c) provided at least two ways for audiences to interact with nano, and (d) used materials from a source in addition to the current kit.

Low public impact organizations may or may not have hosted an event.[4] If they hosted, they may or may not have had volunteers or collaborations with other organizations, had one or no types of activities, and did not use any educational materials other than the current kit.

[4] Note that some of these Tier 1 and Tier 2 organizations did not receive a 2014 NanoDays kit and did not host their own events; others may have collaborated with another organization's event.

Table 3
Factor Point Values and Factors Used to Characterize NanoDays Hosts as High, Medium, and Low Public Impact

Factor	Points	Public Impact Ratings		
		High	Medium	Low
Infrastructure (0–3 points)				
Hosted a NanoDays event	1	Yes	Yes	One or more of these
Collaborated with another organization	1	Yes	One or both of these	
Had volunteers	1	Yes		
Activities and Experiences (0–4 points)				
Short, hands-on activities and demos	1	Yes	Yes	Activities from none or more of these categories
Onsite and Family Programs Longer educational programs Guest speakers or lectures Stage presentations Museum theater	1	At least one activity from two or more of these categories	At least one activity from one or more of these categories	
Onsite Displays Video and media Exhibits Posters or displays	1			
Offsite and Adult Programs Science Cafés Forums Lab tours	1			
Materials from Beyond NanoDays 2014 (0–2 points)				
Used materials from past NanoDays kits	1	Yes	At least one material from one or more of these categories	None or more of these materials
Additional sources NISE Net online catalog Creations by selves or collaborators Any other source	1	At least one material from one or more of these categories		

Note. Organizations that met all requirements in the column headed "High" were classified as having a high public impact. Organizations that did not meet the requirements for a high public impact but met all the requirements in the column headed "Medium" were classified as having a medium public impact. All other organizations were classified as having a low public impact.

5) What are the results?

Figure 1 represents the results of our analysis: Moving from left to right are scores for the organizations that received high, medium, and low ratings for the public impact of their NanoDays 2014 events. Each organization's rating is broken down into its three factor scores: Materials Beyond NanoDays 2014, Activities and Experiences, and Infrastructure. Overall scores ranged from 1 to 9, though an organizations' ultimate rating is determined by the factors above and not by overall score. (See Appendix A, Table A1, for the breakdown of scores by factor.) Using the rating criteria we developed, 49 (32%) organizations were rated as having a high public impact, 71 (46%) as medium, and 34 (22%) as low. Ratings varied by factor: For instance, 92 (60%) organizations included all three factors of infrastructure and 116 (75%) organizations included both factors of additional nano materials. In contrast, only 19 (12%) organizations

included all four types of activities; 15 (10%) included just one type of activity, and the majority of organizations included two or three of the four types of activities (61 organizations or 40% and 58 organizations or 38%, respectively).

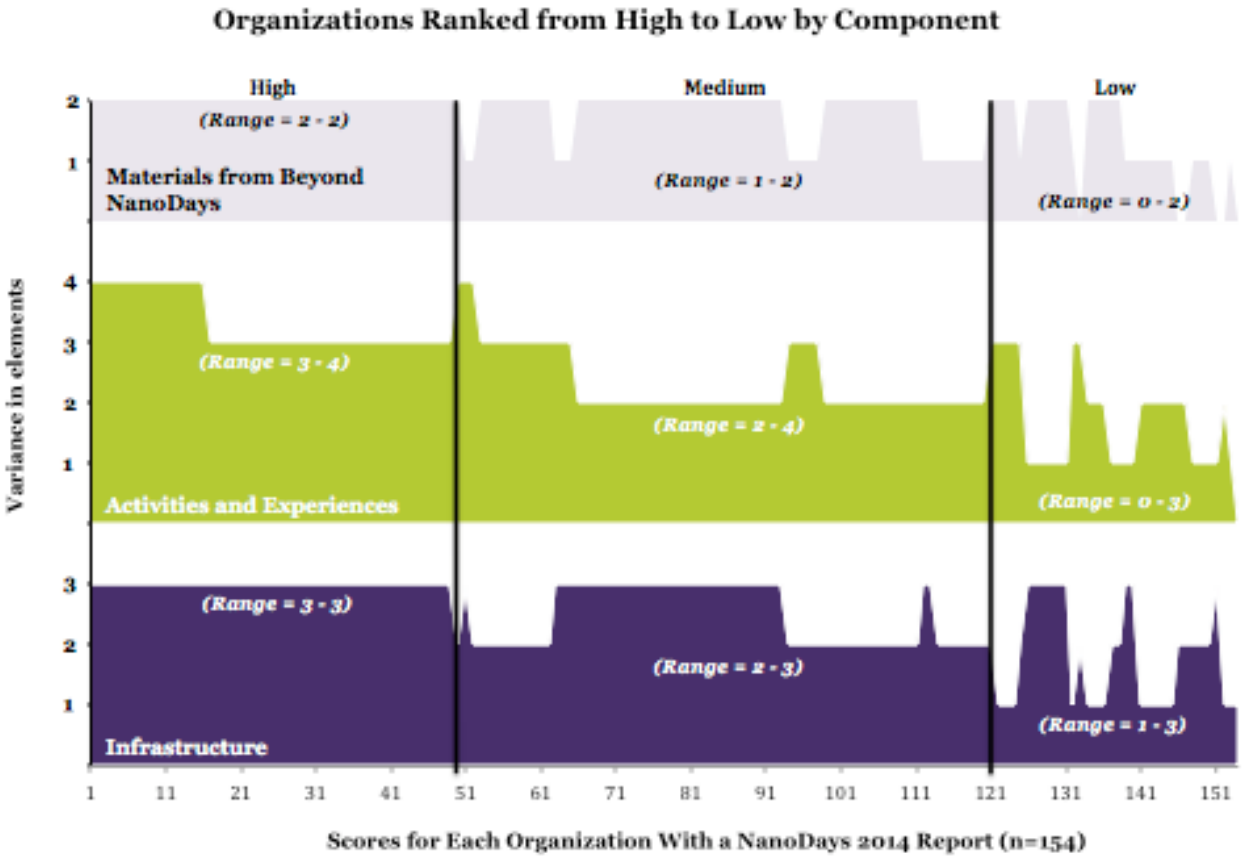

Figure 1. Ratings of Tier 1 & Tier 2 organizations' NanoDays 2014 events for three factors (Materials from Beyond NanoDays, Activities and Experiences, and Infrastructure) based on reports submitted by partner organizations. Scores are organized as follows: within each category (high, medium, low) organizations that scored higher within the range are to the left, and those that scored similarly are grouped together.

As can be seen in Figure 1, organizations may receive different ratings for each factor. Although some organizations were highly rated on all three factors, an organization that received an overall low rating for public impact may have scored high for Materials from Beyond NanoDays 2014, medium for Activities and Experiences, and low for Infrastructure.

The results of Indicator 1 point to variability in the ways that Tier 1 and Tier 2 NISE Net partner organizations organized their NanoDays events. They varied in the infrastructure they provided, the number and type of activities and experiences they made available to their audiences, and how they used materials from the NISE Network and other sources. In our analysis, though, we created a portrait of NanoDays events that were likely to have an especially high public impact. These events were characterized by organizations hosting the event, collaborating with others, and involving volunteers; providing a wide variety of different types of nano-related activities and experiences; and using educational materials from several sources. Using these criteria and the information submitted by the organizations, almost one third fit the criteria; nearly an

additional half of the organizations fit the criteria for a medium public impact. The flexibility with which organizations could adapt NISE Network resources to their specific strengths and goals made NanoDays events a powerful mechanism for partner organizations to bring nano to their audiences, as well as accomplish other Network goals such as building and strengthening partnerships between museums and scientists.

INDICATOR 2: Regional Hub Leaders Ratings of NanoDays 2014

1) What is the indicator?

Regional Hub Leaders are familiar with many aspects of the organizations in their regions, and we tapped into their knowledge by asking them to rate the potential for public impact of the NanoDays 2014 events offered by the organizations in their hubs. These ratings were intended to supplement the ratings based on the NanoDays 2014 reports (Indicator 1) by drawing on the Regional Hub Leaders' knowledge of both the variety of ways that organizations across the network conducted their NanoDays events and the Regional Hub Leaders' knowledge of the events held by the individual organizations with which they were most familiar.

2) What organizations are included in the analysis?

We included 198 organizations in the analysis: All Tier 1 (n = 14) and Tier 2 (n = 184) organizations in NISE Net's database at the time of the analysis. There were 5 organizations included in our data set that were not among the Tier 2 organizations at the time ratings were assigned by the Regional Hub Leaders, and 34 organizations that either did not hold a NanoDays event in 2014 or the Regional Hub Leaders lacked sufficient information to assign a public impact rating. In the overall analysis of nano richness across the Network (below), these 39 organizations were included as "missing information" on this indicator.

3) What is being measured?

To achieve some consistency among the Regional Hub Leaders' ratings of organizations' NanoDays 2014 events, we provided them with rating instructions that included a rubric, a scoring guide, and annotated scored examples (see Appendix B). Although we asked the Regional Hub Leaders to provide a single, overall rating (high, medium, or low public impact) for each of their organizations' NanoDays 2014 events, we used the rubric to draw their attention to four features of the events:

- Visitor Exposure (how many nano activities were provided for 2014 NanoDays participants and whether some activities came from outside the current NanoDays kit),
- Variety of Public Offerings (the types of nano activities provided),
- Audience Awareness of the Event (whether visitors were aware of and came to the setting specifically for the event), and
- Volunteers (the numbers, types, and roles of volunteers in the event).

Instructions asked the Regional Hub Leaders to take into account an organization's size when assigning ratings: "A small organization with only a few nano-related programs and exhibits may be considered nano-rich because nano-related content is included in a significant share of its offerings and much of its audience is exposed to nano-related offerings. In contrast, a large museum with many nano-related exhibits and programs may be less nano-rich if the exhibits are hidden in a low-traffic area and only a few visitors participate in nano-related activities."

In addition to three levels of public impact, Regional Hub Leaders could select a fourth response category, "I don't know."

4) How did the evaluation team conduct the analysis?

The evaluation team participated in two phone calls with the Regional Hub Leaders. In the first call, we requested their help, provided general instructions about the categorizations, and reviewed the scoring rubrics with them.[5] Following the first call, we sent the Regional Hub Leaders three hypothetical descriptions of organizations' NanoDays events with annotated rubrics indicating how they can be applied to specific events to derive an overall rating (see Appendix B). We reviewed these in the second call, answered questions, and requested that the Regional Hub Leaders rate the organizations in their hubs within the next three weeks. We received ratings from all of the Regional Hub Leaders.

We took the ratings provided by the Regional Hub Leaders to create frequency and percent distributions of high, medium, and low public impacts of organizations' 2014 NanoDays events. For this indicator, we included organizations that did not have a NanoDays 2014 event as having a low public impact.

5) What are the results?

The Regional Hub Leaders rated from 45% to 81% of the organizations in their hubs as having NanoDays 2014 events with potential for high public impact (Table 4). Overall, of the 164 organizations that held an event and that Regional Hub Leaders had enough information to rate, 105 (66%) were rated as having potential for a high public impact, 42 (26%) as having potential for a medium public impact, and 17 (10%) as having potential for a low public impact. A majority (6 out of 9) of Tier 1 organizations received high ratings, two were rated as having NanoDays 2014 events with medium public impact, and one with a low public impact.

[5]We asked the Regional Hub Leaders to provide two ratings: one for NanoDays 2014 (Indicator 2) and one for an overall measure of nano richness (Indicator 6) for each organization in their hub. In our phone calls and materials, we presented instructions and rubrics for both ratings.

Table 4
Frequency and Percent Distribution of Regional Hub Leaders' Ratings of Tier 1 and Tier 2 2014 NISE Network Partner Organizations' NanoDays 2014 Events (N = 198)

Region	Organizations in the Hub (N)	Organizations with No Event (N)	Public Impact Ratings F (%)			I Don't Know
			High	Medium	Low	
Mid-Atlantic	19	2	12 (71)	5 (29)	0 (0)	0
Midwest	44	9	26 (81)	6 (19)	0 (0)	3
Northeast	39	1	26 (72)	8 (22)	2 (6)	2
South	19	6	6 (46)	5 (38)	2 (15)	0
Southeast	26	5	12 (57)	3 (14)	6 (29)	0
Southwest	28	1	14 (56)	9 (36)	2 (8)	2
West	23	1	9 (45)	6 (30)	5 (25)	2
TOTAL	**198**	**25**	**105 (64)**	**42 (26)**	**17 (10)**	**9**

Note. Percentages do not include organizations with no event and "I don't know" responses. Percentages may not total 100 due to rounding. Including organizations that did not have a NanoDays event in 2014 in the low public impact category on this indicator (and excluding organizations that Regional Hub Leaders did not have enough information to rate) results in the following distribution: High impact: 105 organizations (56%); Medium impact: 42 organizations (22%); Low impact: 42 organizations (22%).

The results of Indicator 2 indicate that, according to Regional Hub Leaders, the majority of Tier 1 and Tier 2 organizations in NISE Network held NanoDays events in 2014 that had a potential for high public impact, and relatively few had potential for a low public impact. A review of the data indicated that high public impact ratings were not limited to the largest museums and research organizations but were spread across different types and sizes of organizations. This variability was confirmed by the finding that public impact ratings varied even among Tier 1 organizations, which tend to be large and were highly involved in NISE Net.

INDICATOR 3: Nano Exhibition

1) What is the indicator?

Nano is a 400-square foot interactive exhibition, developed by NISE Net, "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."[6] In total, 93 copies of the exhibition, intended for long-term display in museums, were made available free-of-charge to NISE Net's partner organizations through a competitive application process. Some copies were given to single organizations free of charge to own by themselves, and some were given to two or more organizations to share, usually with the exhibition on display at each organization for about half of the year.

We reasoned that displaying a *Nano* exhibition was a good opportunity for organizations to expose their visitors to nano-related content, and that having one full-time would reach more members of a museum's audience than having one on display only part-time.

2) What organizations are included in the analysis?

We included in the analysis all 203 Tier 1 (n = 14) and Tier 2 (n = 189) NISE Network organizations. *Nano* exhibitions were distributed in three waves. At the time of our analysis (fall 2014), the first two waves had been delivered. This meant that 70 exhibitions had been distributed and were being displayed full or part-time by 91 organizations as of the time of our analysis.

3) What is being measured?

We reasoned that the organizations that owned and put the *Nano* exhibition on public display increased the likelihood that their visitors would engage with nano-related content, and that organizations that had an exhibition full-time would reach more members of their audience than would organizations that shared the exhibition with another organization. Therefore, we used whether an organization had an exhibition full-time, part-time, or not at all as an indicator of each organization's ability to expose its public audiences to nano.

4) How did the evaluation team conduct the analysis?

We categorized the 203 organizations into three levels of public impact based on whether they owned a *Nano* exhibition full-time, part-time, or not at all. Some organizations in the last category received an exhibition in the third wave, after our analysis, which took place in winter 2015–2016.

5) What are the results?

As shown in Figure 2, 20% (n = 41) of the organizations included in the analysis owned a *Nano* exhibition, 25% (n = 50) were sharing it with another organization, and 55% (n = 112) had not received one.

[6]See "About Exhibits, Nano mini-exhibition," www.nisenet.org/about-exhibits#nanominiexhibition.

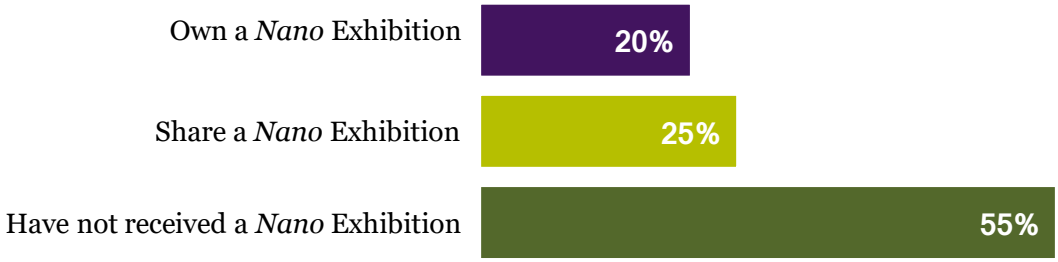

Figure 2. The percentage of organizations that owned, shared, or had not received a *Nano* exhibition (N=203).

More than the other indicators, ratings on this one may not fully reflect an organization's commitment to providing opportunities for its public audiences to engage with nano-related content. Not all of NISE Net's partner organizations had the capacity to display a *Nano* exhibition—some lacked the space for it—and organizations generally did not have control over decisions about whether they would receive one (there were more applications for exhibitions than NISE Network could award) and whether it was to be shared or not. Our analysis also did not include the approximately 30 additional exhibitions that were delivered in 2015. For the organizations that received an exhibition, other reports indicate that the impact of a Nano exhibition could be profound, in that it led to greater awareness among staff members of nano and NISE Network and resulted in additional nano programming (Beyer, Guberman, & Iocavelli, 2017; Svarovsky et al., 2013).

INDICATOR 4: Mini-Grants

1) What is the indicator?

The NISE Network made available a limited number of small stipends (up to $3,000), called *mini-grants*, "to support initiatives by NISE Network partners to engage their local audiences in nanoscale science, engineering, and technology topics. Eligible projects fit into at least one of three categories: (1) New efforts to integrate nano into existing programming, (2) New efforts to reach new or traditionally underserved audiences with nano programming, or (3) New partnerships between museums and nano researchers."[7] A total of 193 mini-grants were awarded by the end of 2015. This indicator assessed whether or not organizations received a NISE Network mini-grant, in what category, and how many.

2) What organizations are included in the analysis?

We included in the analysis all of NISE Net's 203 Tier 1 (n = 14) and Tier 2 (n = 189) organizations.

3) What is being measured?

We reasoned that an organization that applied for and received a NISE Network mini-grant and used it to increase its ability to expose its audience to nano-related content might have a greater public impact compared to organizations that did not receive a mini-grant or received one and used it for a purpose other than public outreach with respect to nano, and would have a greater potential for public impact than they themselves would have had before.

4) How did the evaluation team conduct the analysis?

Data for the analysis came from the reports submitted by organizations that received a mini-grant in Years 6–9 of the NISE Network project. We tried several approaches to assess the nano richness of NISE Net partner organizations based on the submitted mini-grant reports. In particular, we were interested in how the mini-grants were used: Could we distinguish between uses that had a direct public impact (e.g., including nano content in a public exhibit) from those that had an indirect public impact (e.g., helping teachers to incorporate nano content into their lesson plans)? We also noted whether organizations had received one or two mini-grants. (At the time of the analysis, no organization had received more than two mini-grants.)

After several attempts to code this distinction and growing uncertainty about the importance of knowing whether the public impact was direct or indirect, we decided to contrast mini-grants that had any goal of bringing nano to the public with those that did not. A review of all the mini-grant reports indicated that 100% were used to increase the recipient organization's public impact. This left just two categories: (a) organizations that did not receive a mini-grant and (b) organizations that received one or two mini-grants, which they used to bring nano to its public audiences directly or indirectly.

5) What are the results?

Of the 203 organizations included in the analysis, 104 (51%) received at least one mini-grant that was used to increase their ability to engage the public with nano-related content; these organizations received a high public impact rating (high potential for impact) on this indicator.

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[7] See "NISE Network Mini-grants," www.nisenet.org/nise-network-mini-grants.

This group included one Tier 1 organization (7% of the 14 Tier 1 organizations) and 103 Tier 2 organizations (54% of the 189 Tier 2 organizations). The 99 organizations (49% of all) that did not receive a mini-grant were rated low on this indicator.

Table 5
Frequencies (and Percentages) of Mini-Grant Public Impact Ratings by Organizational Tier Years 6 - 9

Organizational Tier	Received One or more Mini-Grants Frequency (%)	Public Impact Rating[ab]		
		Received one mini-grant Frequency (%)		Received two mini-grants Frequency (%)
		1	2	2/2
1 (n=14)	1 (7)	0	1 (100)	N/A
2 (n=184)	102 (55)	0	81 (79)	21 (21)
3 (n=4)	1 (25)	0	1 (100)	N/A
6 (n=1)	0 (100)	N/A	N/A	N/A
Total (n=203)	104 (51)	0	83 (80)	21 (20)

[a] Public Impact Ratings: 0 = Organization did not receive a mini-grant; 1 = The mini-grant did not have a public impact; and 2 = The mini-grant had a public impact.
[b] Percentages under public impact ratings (Received one mini-grant frequency and received two mini-grants frequency) are based off of the total that had received one or more mini-grants

INDICATOR 5: The Use of NanoDays Materials Outside of NanoDays

1) What is the indicator?

Previous NISE Network evaluation studies (e.g., Svarovsky et al., 2015) indicate that many—perhaps all—of the partner organizations that receive kits for NanoDays use the materials (especially the hands-on activities) in their public programs throughout the year. Each organization that receives a NanoDays kit is asked to complete a report providing information about the nature of their NanoDays event and their use of kit materials. We used information from the reports about how and how often organizations reported using materials from NanoDays kits *outside* of NanoDays to measure the extent of which partner organizations exposed their public audience members to nano content. This indicator is based on a question in the 2014 NanoDays reports submitted by participating organizations: "We'd like to ask you a few questions about how you have used NanoDays kit materials in the past outside of NanoDays events: Please identify approximately how often your organization uses NanoDays kit materials for additional programming outside of NanoDays events." The question was structured so that organizations reported how they used NanoDays materials outside of NanoDays events, and approximately how often they used the materials throughout the year *excluding* NanoDays.

2) What organizations are included in the analysis?

Included in the analysis are the 154 Tier 1 and Tier 2 organizations that completed a 2014 NanoDays report. An additional 49 organizations in Tiers 1 and 2 did not complete a report, and therefore most likely did not receive a kit. In the overall analysis of nano richness across the network (below), these 49 organizations were included as "missing information" on this indicator.

3) What is being measured?

We expected organizations that used NanoDays kit materials in a variety of ways and settings, such as in floor demos and after school programs, and that did so more frequently, would have a greater public impact with respect to their audiences compared to organizations that used them in fewer settings and did so less frequently.

The NanoDays 2014 Report included a question that asked respondents to consider whether and how often they used kit materials in nine types of activities outside of NanoDays, with eight response categories (see Table 5).

As can be seen in Table 5, the most common uses of NanoDays kit materials were in cart demonstrations or brief tabletop activities presented outside of NanoDays and in K-12 school outreach programs. In calculating percentages, we excluded responses that were "Not sure" or that were missing from our sample. Of the remaining sample, over 92% reported using kit materials in cart demonstrations or table top activities in settings outside of NanoDays, and 35% of this sample reported doing so once a week or more; 87% reported using kit materials for school outreach programs, and 19% reported doing so once a week or more. Special events were also another common use of NanoDays kit materials: 93% reported that they use NanoDays materials in special events, although by their nature special events were infrequent (several times a year). A majority of organizations also reported using NanoDays materials in camps (71%), outreach activities with community partners (75%), and professional development (73%), and many reported doing so several times a year or more. Fewer than half of the organizations reported ever using materials in longer museum programs (40%) or long-term display of

materials in public spaces (37%), and 92% reported that lesson activities in college courses were not applicable to their organization.

Table 6
Frequency (and Percent) Distribution of Uses of Tier 1 and Tier 2 NanoDays 2014 Kit Materials Outside of NanoDays (N = 154)

Type of Activity	Not sure or missing F	Not applicable F (%)	Once a year F (%)	Several times a year F (%)	Once a month F (%)	Once a week F (%)	Several times a week F (%)	Daily F (%)
Cart demonstrations/ brief table top activities	9	8 (6)	4 (3)	59 (41)	23 (16)	18 (12)	23 (16)	10 (7)
K-12 school outreach activities (e.g. classes, after school programs, field trips, science fair)	16	13 (9)	11 (8)	66 (48)	22 (16)	14 (10)	9 (7)	3 (2)
Special events (e.g. family events, chemistry events, nano-related events other than NanoDays, family nights, festivals)	16	7 (5)	24 (17)	92 (67)	9 (7)	6 (4)	0 (0)	0 (0)
Camps (e.g. summer camp, holiday camp, day camp)	19	29 (21)	36 (27)	58 (43)	3 (2)	4 (3)	3 (2)	2 (1)
Outreach activities with ongoing community partners (e.g. libraries, scouts, Boys & Girls club…)	29	25 (20)	22 (18)	61 (49)	14 (11)	2 (2)	1 (1)	0 (0)
Professional development (for museum staff, school teachers, college students)	27	27 (21)	41 (32)	48 (38)	9 (7)	2 (2)	0 (0)	0 (0)
Longer museum programs (e.g. forums, classes, labs, science club)	35	60 (50)	17 (14)	33 (28)	6 (5)	2 (2)	1 (1)	0 (0)
Longer term display of materials in public spaces (e.g. within exhibits, on the museum floor, on a table)	35	63 (53)	7 (6)	14 (12)	3 (3)	7 (6)	0 (0)	25 (21)
Lesson activities within college courses	34	92 (77)	12 (10)	14 (12)	1 (1)	0 (0)	0 (0)	1 (1)

Note. Percentages do not include "not sure" and missing responses. Percentages may not equal 100 due to rounding. Shaded cells represent the highest percentage of organizations.

4) How did the evaluation team conduct the analysis?

We explored a variety of methods to analyze the data. For instance, we tried collapsing the six frequency ratings (never – daily) into fewer categories, or ignoring frequencies altogether and focusing on only the different uses that organizations made of NanoDays materials. In the end, we decided to include all the data we had available, assigning *point values* for frequency of each type of use (0 = not applicable or missing, 1 = once a year, 2 = several times a year, and so on). This resulted in a possible maximum score of 54 (9 [activities] x 6 [used daily]).

5) What are the results?

As shown in Figure 3, scores ranged from 0 to 34, indicating that it was possible for organizations to offer a range in both the types of nano activities they offered and the frequency with which they were offered. Except for the nine organizations that received scores of zero,[8] almost all organizations reported using NanoDays kits in a variety of ways throughout the year. About one third of the organizations received a score of 0–9, one third between 10 and 16, and one third between 17 and 34. As shown in Figure 4, these scores were used to designate organizations as low (n = 48), medium (n = 56), or high (n = 50) with respect to public impact on this indicator. Most organizations in the high impact group had:

- two to four types of activities that they offered frequently (once a week or more)
- several other activities that they offered less frequently

[8]The Public Reach Estimates (Svarovosky et al., 2015), found that since 2011 "100% of partners who completed NanoDays reports indicate the use of kit materials beyond the window of NanoDays events" (p. 9). The difference between that finding and the results reported here are likely due to different treatment of missing, "not sure," and "not applicable" responses.

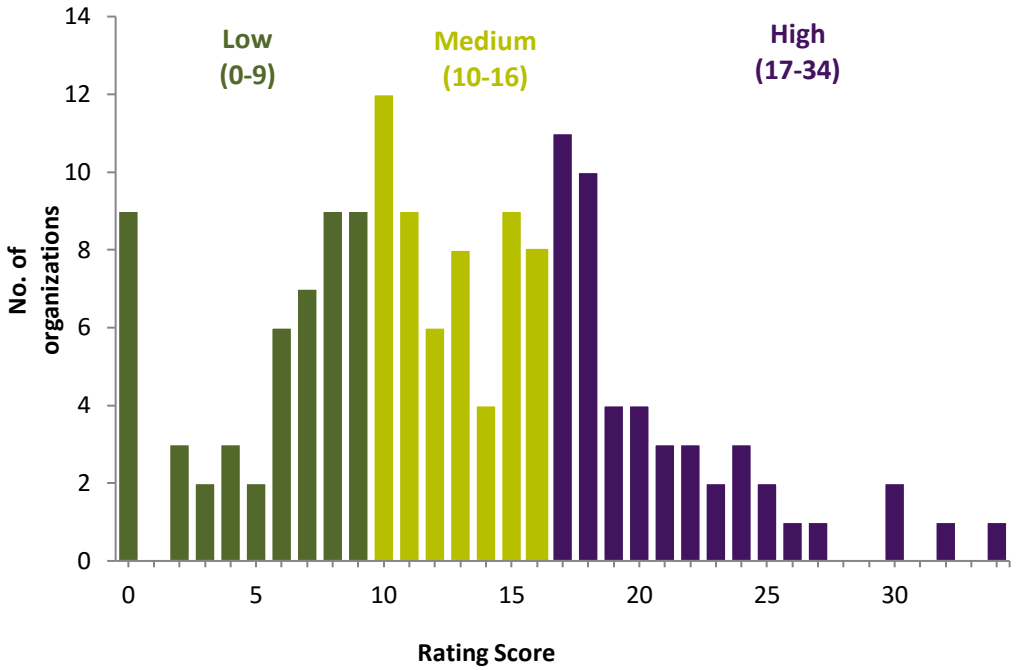

Figure 3. Distribution of scores for NISE Network partner organizations' use of NanoDays kit materials outside of NanoDays.

Figure 4. The number of organizations rated high, medium, or low for the use of NanoDays kit materials outside of NanoDays.

INDICATOR 6: Regional Hub Leaders' Categorizations of Overall Nano Richness

1) What is the indicator?

In addition to asking NISE Net's Regional Hub Leaders to rate the public impact of the NanoDays 2014 events of organizations in their hubs (see Indicator 2), we also asked them to provide finer-grained categorizations of the Tier 1 and Tier 2 organizations' potential for overall public impact with respect to nano content, a quality we described as *nano richness*. Hub leaders already categorize partner organization involvement in Network activities into Tiers 1-6, and this overall richness was an even finer grained categorization of Tier 1 and Tier 2 organizations. Again, we wanted to tap the Regional Hub Leaders' extensive knowledge of the nano-related opportunities that the organizations within their hubs made available for their public audiences. We considered Regional Hub Leaders' perception of an organization's overall nano richness as an additional indicator contributing to a full description of the variability of nano offerings among the organizations comprising the NISE Network.

2) What organizations are included in the analysis?

We included 198 organizations in the analysis: All Tier 1 (n = 11) and Tier 2 (n = 187) organizations included in NISE Net's database at the time that Regional Hub Leaders provided ratings (July 2014). There were an additional 5 organizations in our data set that were not that were not among the Tier 2 organizations at the time ratings were assigned by the Regional Hub Leaders. In the overall analysis of nano richness across the network (below), those 5 organizations and the 11 organizations for which Regional Hub Leaders responded that they could not provide a public impact rating (i.e., they chose, "I don't know"), were included as "missing information" on this indicator.

3) What is being measured?

Similar to Indicator 2, we provided Regional Hub Leaders with guidance and instructions for rating the overall nano richness of the organizations within their hubs, including a rubric, a scoring guide, and annotated scored examples (see Appendix B); the final rating was ultimately a product of their own opinion and expertise. Although we asked the Regional Hub Leaders to provide a single, overall rating (high, medium, or low public impact) for each of their organizations, we used the rubric to draw their attention to four aspects of an organization's nano-related public offerings: NanoDays events, public engagement with one of NISE Net's *Nano* exhibitions, the inclusion of nano-related content in public programs and exhibits outside of NanoDays, and outreach activities that include nano-related content.

Instructions asked the Regional Hub Leaders to take into account an organization's size when assigning ratings: "A small organization with only a few nano-related programs and exhibits may be considered nano-rich because nano-related content is included in a significant share of its offerings and much of its audience is exposed to nano-related offerings. In contrast, a large museum with many nano-related exhibits and programs may be less nano-rich if the exhibits are hidden in a low-traffic area and only a few visitors participate in nano-related activities."

In addition to three levels of nano richness, Regional Hub Leaders could select a fourth response category, "I don't know."

4) How did the evaluation team conduct the analysis?

As described for Indicator 2, the evaluation team participated in two conference calls with the Regional Hub Leaders. In the first call, we requested their help, provided general instructions about the ratings, and reviewed the scoring rubrics with them, including the rubric for rating an organization's overall nano richness.

Following the first call, we sent the Regional Hub Leaders three hypothetical descriptions of organizations' nano offerings with annotated rubrics indicating how they can be applied to specific organizations to derive an overall rating. We reviewed these in the second call, answered questions, and requested that the Regional Hub Leaders rate the organizations in their hubs within the next three weeks. We received ratings from all of the Regional Hub Leaders.

We took the ratings provided by the Regional Hub Leaders to create frequency and percent distributions of high, medium, and low public impacts of organizations' overall nano richness.

5) What are the findings?

Table 6 contains the distribution of Regional Hub Leaders' ratings of partner organizations' overall nano richness. (Figure A1 in Appendix A shows the distribution of Regional Hub Leaders' Ratings for the 187 organizations they rated; that is, not including "I don't know" ratings and one organization that was not rated.) Overall, the hub leaders rated almost half (46%) of the Tier 1 and Tier 2 organizations as providing a high level of public engagement with nano-related content. Regional Hub Leaders rated relatively few organizations (21%) as having a low public impact. The implications of this distribution of ratings are discussed in the following section.

Table 7
Frequency (and Percent) Distribution of Regional Hub Leaders' Ratings of NISE Network Tier 1 and Tier 2 Partner Organizations' Overall Nano Richness (N=198)

Region	Organizations in the Hub (N)	Public Impact Ratings F (%)			I Don't Know F
		High	Medium	Low	
Mid-Atlantic	19	12 (63)	5 (26)	2 (11)	0
Midwest	44	19 (50)	13 (34)	6 (16)	6
Northeast	39	20 (51)	14 (36)	5 (13)	0
South	19	5 (26)	8 (42)	6 (32)	0
Southeast	26	6 (25)	9 (38)	9 (38)	2
Southwest	28	14 (56)	8 (32)	3 (12)	3
West	23	10 (43)	5 (22)	8 (35)	0
TOTAL	**198**	**86 (46)**	**62 (33)**	**39 (21)**	**11**

Note. Percentages do not include "I don't know" responses. Percentages may not total 100 due to rounding.

OVERALL FINDINGS: Focus 1

These analyses can be used across the full set of organizations to better understand the nature of our term "nano richness." Figure 5 includes the number of organizations that received high, medium, and low ratings for five of the six indicators. 100% of the organizations that received a mini-grant used the grant to engage the public in nano and received a high rating; the 49% of organizations that did not receive a mini-grant were rated low in the indicator.

Figure 5 shows that the number of organizations assigned a high, medium, or low rating varied by indicator. For instance, 112 organizations received a low public impact rating based on the Indicator 3 (the *Nano* Exhibition rating) but only 50 received a low rating on Indicator 5 (the Use of NanoDays Materials Outside of NanoDays ratings). That suggests that organizations may have differed in how they focused their efforts to engage their audiences with nano: Some were more likely to achieve a high public impact through the *Nano* exhibition or mini-grant program, and others by using NanoDays kit materials throughout the year or by hosting elaborate NanoDays events.

Figure 5 also indicates that there are large differences between two indicators of the public impact of NanoDays 2014, one based on an analysis of reports submitted by staff members at partner organizations (Indicator 1) and one based on ratings from the Regional Hub Leaders (Indicator 2). As shown in Figure 5, using criteria developed from the submitted reports, the distribution of high, medium, and low public impact ratings is 49, 71, and 34 organizations, respectively. In contrast, Regional Hub Leaders rated many more organizations as having potential for a high public impact, and many fewer as having potential for a low public impact, for their NanoDays 2014 events; their distribution was 105, 42, and 17 for high, medium, and low public impact, respectively. An examination of the differences in categorizations between the Regional Hub Leaders and the evaluation team's coding scheme results is described in more detail below. This comparison revealed more about the nature of how organizations provide NanoDays events that have potential for a large public impact.

Figure 5. Summary of the number of Tier 1 and Tier 2 organizations receiving high, medium, and low ratings for indicators of nano richness. Indicator 4 (Mini-Grants Ratings) is not included: All organizations that received a mini-grant (104 of 203 organizations in the analysis) used it to increase their public offerings with respect to nano and, therefore, scored high on this indicator.

Figure 6 contains a comparison of ratings from Indicators 1 and 2. The horizontal bars show the number of organizations that received a high (top bar), medium (middle), or low (bottom) ratings on Indicator 1, the ratings based on the analysis of NanoDays 2014 reports by the evaluation team. Colors are used to indicate the number of organizations that received high (purple), medium (green), and low (gray) ratings from the Regional Hub Leaders. For instance, the top horizontal bar indicates that for NanoDays 2014, 48 organizations were rated as having potential for a high public impact based on the reports they submitted; of those 48 organizations, Regional Hub Leaders also rated 45 as having potential for a high public impact, but 2 as having a medium public impact and 1 as having a low public impact.

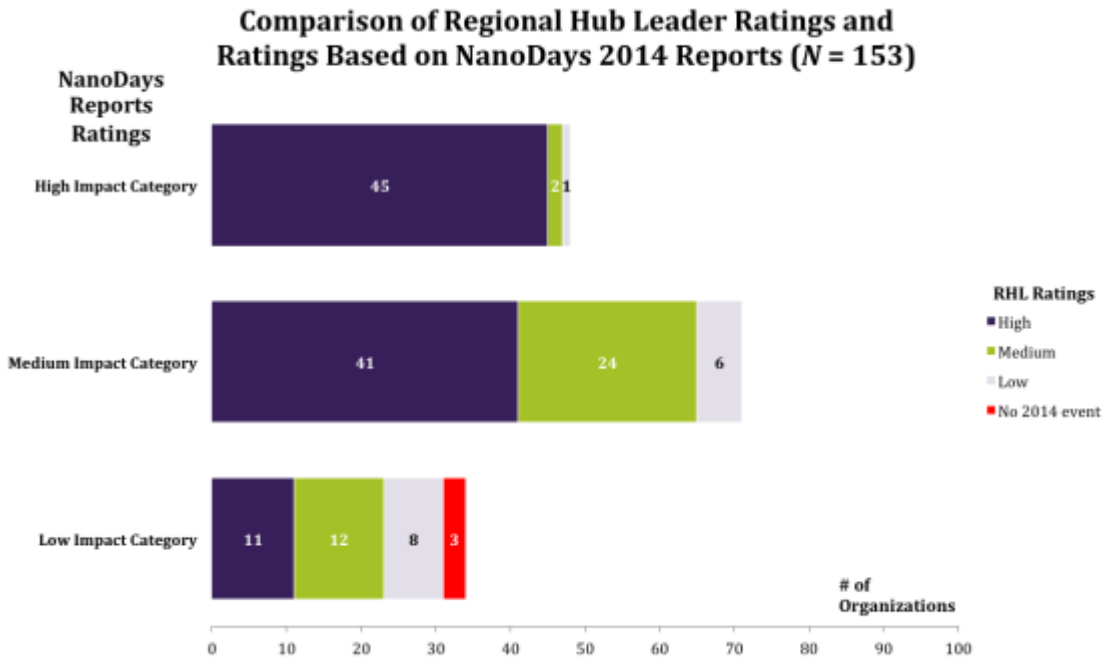

Figure 6. Number of organizations that received high, medium, and low public impact ratings based on reports submitted by participating organizations. Colors indicate how the organizations were rated by Regional Hub Leaders.[9]

Overall, almost all (45 of 48; 94%) of the organizations that were rated high based on the reports also were rated high by the Regional Hub Leaders. The primary difference was with respect to the medium ratings: Of the 71 organizations that were rated as medium based on the reports, the Regional Hub Leaders rated 41 (58%) of them as high, 24 (34%) as medium, and 6 (8%) as low. That is, Regional Hub Leaders rated as high many of the organizations that received medium ratings based on the reports.

We sought to better understand the nature of NanoDays events with a high public impact by comparing mismatches between the Regional Hub Leaders' ratings and the ratings derived from our analysis of the submitted reports. For instance, we looked at the 11 organizations that were

[9] Only 48—rather than 49—organizations are included in the high category based on NanoDays Report ratings because one organization was not rated by the Regional Hub Leaders.

coded by the evaluation team as having a low impact for their 2014 NanoDays event based on their reports but were rated as having a high public impact by the Regional Hub leaders.

Several characteristics of NanoDays events explain differences in the ratings between the evaluation team coding scheme and the Regional Hub Leaders. In general, the Regional Hub Leaders used more flexible criteria to rate an organization as having a high public impact compared to the criteria based on the reports. As shown in Table 7, for organizations to receive a high public impact rating, the criteria developed from the submitted NanoDays reports required that they host their NanoDays celebration, collaborate with other organizations and include volunteers in the event, provide a wide range of activities and experiences, and use a variety of educational materials. In contrast, the Regional Hub Leaders rated many organizations as having a high public impact even if they lacked some or all of these characteristics. That is, according to the Regional Hub Leaders, it was possible for organizations to have a high public impact even when organizations were not the host of the event, did not collaborate with others or have the support of volunteers, offered a limited set of activities and experiences, and used only the educational materials from the current NanoDays kit. Although many organizations (such as those receiving high ratings on both Indicators 1 and 2) chose to devote considerable resources to NanoDays, the Regional Hub Leaders' ratings suggest that it also is possible for NanoDays events to have a large public impact with a more modest investment. Both indicators may be valid measures of the public impact of NanoDays events, but by prioritizing different aspects of the events they differ in where they draw the line between high, medium, and low impacts.

Overall, the Regional Hub Leaders were able to justify ratings that were higher than the Report analysis produced, suggesting that some institutions were able to use products creatively and flexibly to great effect. The two rating scales should be seen as complementary to each other.

Table 8
Differences in NanoDays Event Ratings from Reports and Regional Hub Leaders

Characteristic[a]	Characteristics Required for a High Public Impact Rating	
	Indicator 1 Ratings Based on NanoDays Reports	**Indicator 2 Ratings From Regional Hub Leaders**
Hosting the Event	Had to host the event.	Did not have to host the event.
Collaboration and Volunteers	Had to collaborate and have volunteers.	Had to collaborate or have volunteers.
Activities and Experiences	Had to offer at least three different types of activities and experiences.	May have offered only one type of activities and experiences.
Educational Materials	Had to include at least two types of educational materials (in addition to those included in the current kit).	May not have used any educational materials (other than those included in the current kit).

[a]See Table 2 for details of these characteristics.

We were also curious about the ways that organizations ranked across all the indicators and what these patterns indicate. Figure 7 provides more detailed information about the nature of the 203 organizations included in the Focus 1 analyses. Ratings on each of the six indicators are represented by colors on the columns: dark blue for a high public impact rating, medium blue for a medium impact rating, and light blue for a low impact rating; white indicates that there was not enough information to assign a rating to an organization. Ratings for each of the 203 organizations, for the six indicators, are presented in rows. The seven organizations (rows) at the top of the figure have high ratings on all six indicators; the 10 organizations (rows) below them have high ratings on 5 indicators, and so on, down to the bottom 46 organizations (rows), that have no high ratings.

The chart highlights several key findings about NISE Net's Tier 1 and Tier 2 partner organizations' of nano-related offerings for the public. First, there is a lot of medium and dark blue in the chart, indicating that these organizations are offering many opportunities for the public to engage with nano content. It is important to note that this is, most likely, a conservative estimate of these organizations' nano offerings; one must add the white spaces in the figure—which may represent nano-related offerings that we were unable to learn enough about to assign a rating—and also recognize that the indicators we were able to develop using the data we had available most likely do not capture the organizations' full nano offerings.

Second, Figure 7 reveals a great deal of variability among NISE Net's Tier 1 and Tier 2 partner organizations with respect to nano-related public offerings as measured by these six indicators

of nano richness. Only seven organizations were rated high on all six indicators, and most organizations received a variable mix of high, medium, and low ratings.

Finally, Figure 7 indicates that there were different ways that organizations could be nano rich. Most organizations received a mix of high, medium, and low ratings. As discussed with respect to Figure 5, this suggests that organizations differed in how they went about bringing nano to their audiences, with some emphasizing NanoDays, others emphasizing nano in their on-site programs and outreach, and so on.

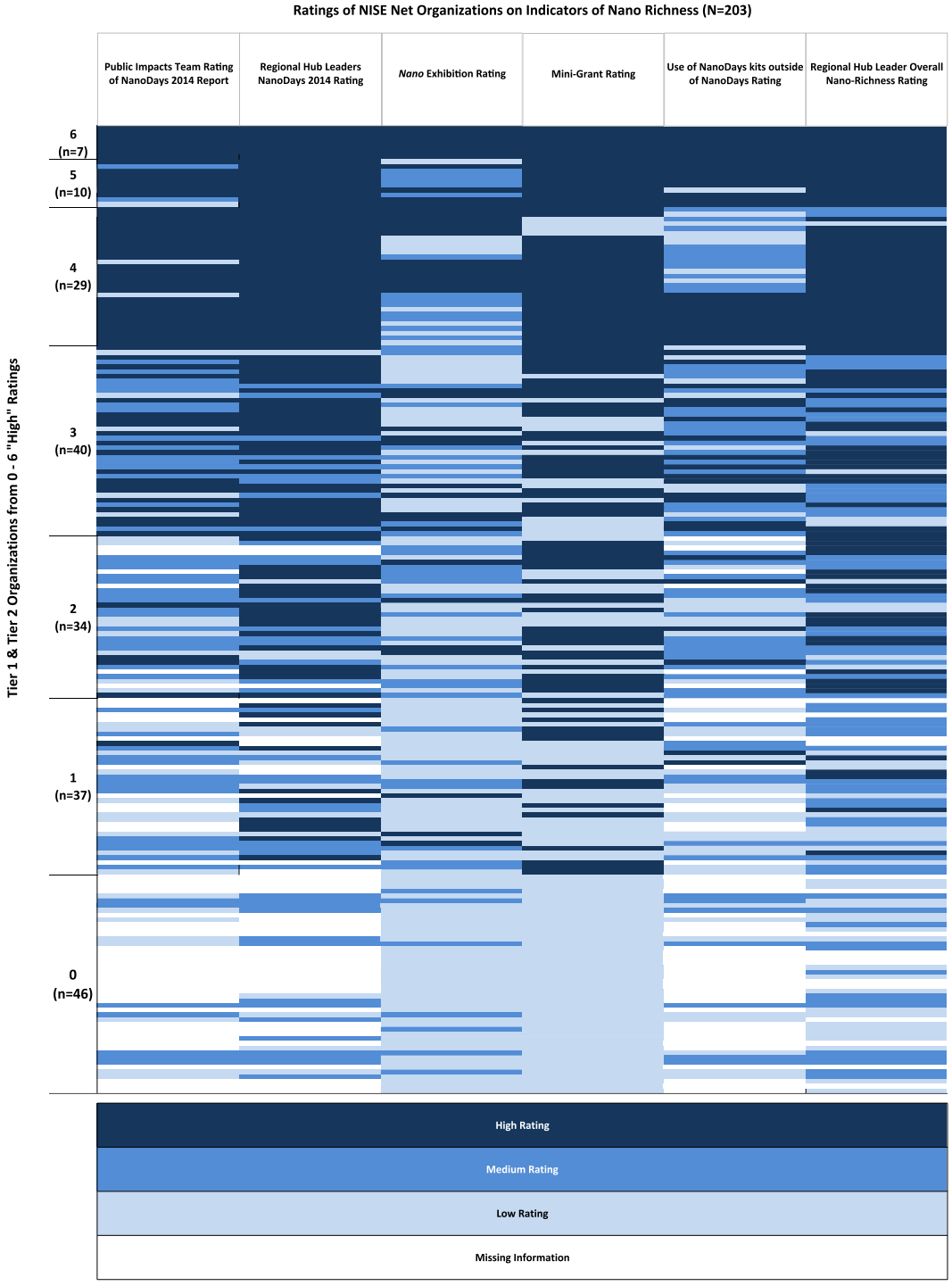

Figure 7. Ratings of NISE Network Tier 1 and Tier 2 organizations by number of high ratings on six indicators of nano richness.

According to the indicators of nano richness that we derived, Tier 1 organizations were no more likely to have many high ratings than Tier 2 organizations. In fact, of the 14 Tier 1 organizations, none received 5 or 6 high ratings. The distribution of ratings for Tier 1 organizations is provided in Table 8. It's important to note that Tier 1 organizations were not eligible to receive mini-grants. Also, some Tier 1 organizations played special roles in the Network, such as providing technical advice, and were not expected to provide much public outreach. The goal of the Network was to share resources broadly and widely, not to keep them to central partners, and these data support that this goal was generally met.

Table 9
Number of High Ratings on Indicators for Nano Richness for Tier 1 NISE Network Organizations (N = 14)

No. of High Ratings	No. of Organizations
0	6
1	0
2	2
3	2
4	4
5	0
6	0

In the final analysis of the indicators of nano richness, we sought to better understand the nature of nano-rich organizations by examining the indicators on which they were most likely to score high and low. We looked at organizations that received high ratings on four (n = 29) or five (n = 10) of the six indicators and examined the indicators on which they did not receive a high rating. The results of this analysis are presented in Table 9. For instance, the first data row in the table shows that of the 39 organizations that received four or five high ratings on the six indicators, 21 of them did not receive a high rating on Indicator 1 (Public Impacts Team Ratings of NanoDays 2014 Reports).

As can be seen in Table 9, when organizations received high ratings on four or five of the six indicators, they most likely were missing high ratings on Indicator 1 (NanoDays 2014 ratings from reports), Indicator 3 (*Nano* Exhibition ratings), or Indicator 5 (the use of NanoDays kit materials outside of NanoDays). In contrast, all of these organizations received a high rating on Indicator 2 (Regional Hub Leaders' ratings of NanoDays 2014), and most received high ratings on Indicator 4 (mini-grant ratings) and Indicator 6 (Regional Hub Leaders' overall ratings).

Table 10
For Organizations that Received High Ratings on Four (n = 29) or Five (n = 10) Indicators, the Indicators for Which They Did Not Receive High Ratings

Indicator Number	No. (%) of Organizations That Did Not Receive a High Rating on the Indicator[a]
1	21 (54)
2	0 (0)
3	22 (56)
4	4 (10)
5	19 (49)
6	2 (5)

Note. Indicator 1 = Public Impacts Team Ratings of NanoDays 2014 Reports, Indicator 2 = Regional Hub Leaders' Ratings of NanoDays 2014, Indicator 3 = *Nano* Exhibition ratings, Indicator 4 = Mini-Grant ratings, Indicator 5 = The Use of NanoDays kit materials outside of NanoDays ratings, and Indicator 6 = Regional Hub Leaders' Ratings of Organizations' Overall Nano Richness.

[a]Percentages are based on the number of organizations that received high scores on four or five indicators, 39.

These results suggest that nano-rich organizations (i.e., organizations with four or more high ratings) were, compared to organizations with fewer high ratings, more likely to have received a mini-grant and to receive high ratings from the Regional Hub Leaders for NanoDays 2014 and for overall nano richness. They did not receive as many high potential impact ratings on indicators based on reports of what they provided for their public audiences during NanoDays 2014, whether or not they were able to make the *Nano* exhibition available for their visitors full time,[10] and the extent to which they used materials from NanoDays kits outside of NanoDays. Of these, the analysis of the NanoDays report was different from the Hub Leader rating of the same event, suggesting that some institutions found different ways to present rich events, and more exhibitions were distributed over the course of the project. This careful account of the nano-related public offerings may be, if anything, an underreporting of the offerings of the network as a whole.

In summary, the Focus 1 analyses indicate that there is a great deal of variability among NISE Net's Tier 1 and Tier 2 organizations in their nano-related public offerings. Although they offer many opportunities for their audiences to engage with nano-related content, what they offer and the intensity with which they do so varies among the organizations. The evaluation team did not find differentiation based on Tier level or on size, and little difference based on type of organization.

[10] More exhibitions were distributed after these data were collected.

Focus 2: Describing Nano-Rich Organizations

What are the different ways that nano-rich partner organizations have created opportunities for their public audiences to engage with nano-related content through programs and exhibits?

Focus 2 builds on and extends the work accomplished in Focus 1. Having documented the variety of ways that Tier 1 and Tier 2 NISE Network partner organizations provided opportunities for members of their audience to engage with nano, in Focus 2 we sought to better understand the nature of organizations that are especially nano-rich. We explored both the commonalities and differences among organizations that were identified in Focus 1 as providing a rich mix of nano-related experiences for their audiences: Who were they hoping to reach with their nano-related offerings, what messages about nano were they hoping to get across, how successful did they think they were in getting these messages across, and how were they going about doing so? In contrast to Focus 1, in which we sought to use data about all 203 Tier 1 and Tier 2 organizations at the time of our analysis, the more intensive and detailed approach of Focus 2 called for different methods. With help from well-informed NISE Net colleagues (including Regional Hub Leaders), we selected a handful of organizations that had received four or more high ratings on the indicators we developed in Focus 1—museums and university programs that we are calling nano-rich organizations—and conducted interviews with staff members to learn more about the characteristics that make them nano rich. In the interviews, we gathered information about three areas:

1. **Experiences:** What kinds of nano-related experiences (e.g., activities, exhibits, and programs) do nano-rich organizations provide for their audiences?
2. **Learning goals:** What messages do staff members at nano-rich organizations hope their public audiences are taking away from their nano-related experiences, and what do they think audience members recognize and connect with in those messages?
3. **Audiences for nano:** For what kinds of audiences do nano-rich organizations provide nano-related experiences, and how do experiences and learning goals vary across different types of audiences?

METHODS

Participants

We sought to interview staff members at 12–20 organizations. Because we were interested in especially nano-rich organizations, we began with the 45 organizations[11] that had received 4 or more high ratings on the indicators we developed during Focus 1 of the study (see Figure 7, above). We again called on the expertise of the Regional Hub Leaders. We shared the list of organizations with them and asked if they were aware of any organizations in their hub that they thought would be especially interesting to include in the study, or if there were reasons to exclude them. (Reasons to exclude organizations included recent changes in staffing, participation in several other NISE Network projects, and the inability of staff to participate due to other commitments.) From the remaining organizations, we selected 21 to email invitations

[11]Although 46 organizations had received four or more high ratings, one was no longer a Tier 1 or Tier 2 organization at the time of the analysis, so the effective sample was 45.

for interviews (see Appendix C). We sought a mix of types of organizations: children's museums, universities, and science centers or museums; geographic location in various regions of the country and different types of communities; and institutions of different sizes, as measured by annual attendance. We reviewed the selected organizations with the Regional Hub Leaders once more and asked them to recommend the staff members at each organization with whom they thought we should request interviews. We were interested in talking with the staff members who were most likely to know about their organization's nano offerings. In some instances, knowledge about nano offerings was distributed across two or more staff members—for instance, one may know about nano programs for school outreach and another about nano demonstrations on the museum floor. In these instances, we sought to interview more than one staff member at the organization.

We conducted interviews with 19 staff members at 14 organizations (see Table 10). These included 6 children's museums, 6 science centers or science museums, and 2 universities. They include both Tier 1 and Tier 2 organizations; were located in six of NISE Net's seven regional hubs, including urban, suburban, and rural locations; and ranged from among the smallest of NISE Net's partner organizations (annual attendance under 10,000) to the largest (annual attendance over 500,000).

Table 11
Number and Positions of Staff Members Included in Focus 2 Interviews by Type of Organization

Type of organization	No. of organizations	No. of staff members interviewed[a]	Staff positions
Children's Museums	6	8	Director (2) Program coordinator (1) Project manager (1) Education (4)
Science Centers/Museums	6	9	Education (5) Program manager (2) Program coordinator (1) Director of Experience Design (1)
Universities	2	2	Program specialist (1) Lab coordinator (1)

[a]We conducted interviews with 1 staff member at ten organizations, 2 staff members at three organizations, and 3 staff members at one organization.

Staff Interview

We developed and pilot tested an interview to collect data from staff members that would provide information to address the three areas in our evaluation: the nano-related experiences, learning goals, and audiences provided by the nano-rich organizations in NISE Net. We focused

the interview on what organizations and staff members had sought to accomplish and what they felt they had achieved in 2014. The complete instrument is in Appendix C.

Originally, we structured the instrument by audience segments. That is, we began by asking about casual visitors: What nano experiences were made available to casual visitors, what were staff members hoping casual visitors would take away from those experiences, and what messages did staff members think visitors were taking away? The interviewer then moved to similar questions about another audience group, school groups, and so on until all of the audience groups had been covered. But in pilot testing the interview, we found that some staff members, especially those at organizations in which responsibilities for nano programs and exhibits were shared by several people, found it easier to provide responses by activity than by audience. Therefore, we added a few questions early in the interview (see "Selecting a Format for the Interview: By Audience or Activity?" in Appendix C) that provided information that interviewers used to decide which way to proceed. In both formats, the interviews included the following topics:

> **Experiences**: We asked staff members: "Please describe any experiences you think [audience group] are likely to have with nano in a typical visit to your organization." We began with a very general question in an effort not to restrict respondents' responses to the typical categories of museum activities. We followed up with several probes to get information about specific types of experiences, taken from previous NISE Network evaluation studies,[12] if the staff member had not mentioned them: floor demonstrations or other kinds of interactions with staff, theater programs, signs or posters. We ended by asking about any other nano experiences that are part of a typical visit.
>
> **Learning goals:** We asked staff members "What are you hoping [audience group] will take away from these nano experiences?" Possible follow-up probes included questions about what they were hoping audience members would understand about nano (content, terms, ideas, and attitudes), to be able to do that is new or different, and whether the response for this audience group differed from responses for other audience groups. We ended by asking if there was anything else the staff member wanted to say about learning goals for the audience group. Although we were especially interested in what visitors were learning in these experiences, we had a broad conception of learning that included enjoyment encountering a new topic, changing attitudes toward science in general and nano in particular, understanding the role nano plays in the local community and larger society, and so forth. Therefore, we phrased the initial question in a way that pilot testing indicated would avoid narrow conceptions often associated with the word *learning*.
>
> We were also interested in staff members' thoughts about whether they had met their nano-related learning goals for their audiences. To avoid sounding inadvertently confrontational, we pilot tested several ways to phrase this question, eventually settling on: "In what ways do you think [audience group] are recognizing and connecting with these take away messages?" Possible follow-up probes included: "What about these nano experiences are resonating with this audience?" and "What makes you think this?" We concluded by asking if the staff member had any other comments on the topic.

[12]Including the 2014 NanoDays reports completed by staff members at partner organizations, used in Focus 1: Indicator 5.

Audiences for nano: In the interview, we explained "I have some questions about how different audiences are engaging with nano at [your organization]. I would like to start by talking about [audience group]." The interviewer proceeded through the following audience groups in this order, providing these descriptions (which were refined through pilot testing):

- **Casual visitors:** "When I say casual visitors, I mean the people who come to your museum/organization to see your exhibits and gallery programs that aren't visiting for a program, event, or as part of an organized group. Casual visitors may come to your museum/organization just once or they may come more frequently. Also, I'm not including school groups or members now—we'll talk about them later."
- **Repeat visitors:** Immediately after talking about casual visitors, we asked about repeat visitors: "People who visit more than once or visit frequently. Do you do anything different with nano for people who visit more than once?"
- **School groups:** We specified "school groups that visit your museum/organization. For now, I'd like to focus on students and teachers (Pre-K–12) coming to you—later we'll talk about when you go out to them."
- **Youth attending afterschool programs and camps:** We specified that we were interested in youth from Pre-K age through high school.
- **Adults attending lectures and other programs:** We asked about adults (we did not specify an age) who attend lectures or programs with nano content.
- **General Audience Attending Public Events Off-Site:** We asked about audiences, typically comprised of both children and adults, who attend public events at which the organizations participate and may present nano-related experiences, such as at community science fairs.
- **Members:** We asked if the museum/organization provided any nano experiences specifically for its members.
- **Other activities/audience groups:** We asked if their visitors have any nano experiences that we had not already covered.

RESULTS

Experiences

To code responses to interview questions about the types of nano experiences organizations provided for their audiences, we started with the activity categories used in previous NISE Network reports (e.g., the 2014 NanoDays reports from partner organizations) and made adjustments to fit the responses we received. We ended up using the 11 types of experiences described below. To be credited with providing a type of experience, an organization needed to offer it at least once in 2014 outside of their NanoDays event (otherwise, it was considered to be part of the NanoDays event).

- **NanoDays:** The organization hosted or participated in a NanoDays event in the past year**.**
- ***Nano* exhibition:** The organization had a *Nano* exhibition on display for its public audiences at least part of the past year.
- **Events and presentations:** The organization had special events, presentations, or lectures with nano content, such as a guest lecture by a nano scientist, in the past year.

- **Cart or floor demonstrations:** The organization had a facilitated cart activity or demonstration with nano content in its public gallery in the last year.
- **Other hands-on activities:** The organization made available for guests hands-on activities with nano content, perhaps (but not necessarily) from a NanoDays kit, in the last year (not coded in another category).
- **Theater programs:** The organization made available on-site theater-based programs with nano content in the last year.
- **Camp or afterschool programs:** The organization made available programs for youth with nano content that meet on a regular basis (afterschool) or for several consecutive days (camp) in the last year.
- **Signs or posters:** The organization had nano-related signs and posters on display in areas where they could be viewed by the public. Signs and posters may include materials from NanoDays kits used outside of NanoDays.
- **Student outreach:** The organization made available programs with nano content for to K–12 students offsite, usually in their schools, in the last year.
- **General community outreach:** The organization made available programs with nano content for child and adult audiences off site and not specifically for school groups in the last year.
- **Nano laboratory or clean room:** The organization made available to the public an area designed for the public to engage in authentic or simulated nano experimentation.

Nano Experiences by Organization

Organization	NanoDays	Mini-exhibit	Events or lectures	Cart or floor demos	Other hands-on activities	Theatre program	Camp or after-school program	Signs or posters	Student outreach	General community outreach	Nano lab or clean room	Total
1	■	■	■	■	■		■	■	■	■		9
2	■	■	■	■		■	■	■	■	■	■	10
3	■	■			■		■	■	■			6
4	■	■	■	■	■		■	■		■		8
5	■	■		■	■	■						5
6	■	■	■	■	■		■		■			7
7	■	■		■		■						4
8	■	■	■	■	■					■		6
9	■	■	■									3
10	■	■	■	■	■	■		■	■		■	9
11	■	■			■	■	■	■	■	■		8
12		■	■	■		■	■				■	6
13	■		■							■		3
14	■		■									2
Total	13	12	10	9	8	6	7	6	6	6	3	86

KEY

Children's Museums | Science Centers or Museums | University

Figure 8. Nano-related experiences offered by organizations that participated in Focus 2 interviews. Filled-in cells indicate that an organization offered the experience.

Figure 8 displays the types of nano experiences offered by nano-rich organizations, based on interviews with staff members, for each of the 14 organizations we studied. Information is provided for each organization, grouped by children's museums, science centers/museums, and universities. Three things stand out about this chart.

First, as can be seen from looking at the individual organizations (across the rows) and the total in the right-most column (Totals), we found that most organizations are providing multiple opportunities for their public audiences to experience nano content. Of the types of experiences included in our coding scheme, organizations provided from 2 to 10 types of nano experiences for their audiences. Universities provided the fewest nano experiences (range: 2–3; mean = 2.5), children's museums the most (range: 5–10; mean = 7.5), and science centers/museums in the middle (range: 3–9; mean = 6).

Second, the chart indicates that some types of nano-related experiences were more common than other experiences. This may be due, in part, to how organizations were selected for inclusion in Focus 2. That is, to be considered a nano-rich organization (and invited for a Focus 2 interview), organizations had to score high on four or more of the Focus 1 indicators, which included measures of the public impact of their 2014 NanoDays event and the *Nano* exhibition. It is therefore not surprising that almost all of the organizations selected for the Focus 2 interviews provided NanoDays and the *Nano* exhibition for their audiences. There was more variability, though, among the other types of experiences, even though we selected only organizations that we considered to be nano rich. Most organizations, including both universities, provided something that was likely to appeal to adults, such as special events or lectures (71%). Of the 12 children's museums and science centers/museums, most also provided experiences that were likely to appeal to children, such as camps and afterschool programs (7 of 12, 58%), and to a wide range of visitors, such as demonstrations in the gallery (9 of 12, 75%) and hands-on activities (8 of 12, 67%). Half of the children's museums and science centers/museums provided theater programs or outreach to students or other community members with nano content, or used signs (from the NanoDays kits or elsewhere) in their public areas; only three organizations provided spaces dedicated to working with nano content.

Finally, Figure 8 also indicates that offerings varied by type of organization. Not surprisingly, universities provided opportunities that were most likely to draw adults—such as NanoDays, lectures and community outreach—but few other nano-related experiences, and children's museums were more likely than the other two types of organizations to offer programs specifically for children, such as camps or afterschool programs and student outreach.

Learning Goals

In the interviews, we asked staff members what they hoped various audiences were taking away from the nano experiences their organizations provided. As noted above, we were interested in a broad range of possible learning goals, including the acquisition of new content knowledge, changes in attitudes toward science in general and nano in particular, new views among participants as science learners, and the like. We were reluctant to specify the learning goals for the staff members we interviewed and possibly limit the range of their responses. However, in coding the responses, we sought to connect our findings with other NISE Net evaluation studies that had assessed what visitors were learning from NISE Net products such as the *Nano* exhibition (Svarovsky et al., 2013) and events (Svarovsky et al., 2014) that had drawn from the NISE Network content map (Bequette et al., 2012). Therefore, we began the coding process with the four key ideas from the NISE Network Content Map:

> **Idea 1:** Nanometer-sized things are very small, and often behave differently than larger things do.
> **Idea 2:** Scientists and engineers have formed the interdisciplinary field of nanotechnology by investigating properties and manipulating matter at the nanoscale.

Idea 3: Nanoscience, nanotechnology, and nanoengineering lead to new knowledge and innovations that weren't possible before.
Idea 4: Nanotechnologies—and their costs, utility, risks, and benefits—are closely interconnected with society and with our values.

Many responses to the interview questions about what staff members hoped audience members were taking away from the nano experiences they provided included topics that extended beyond nano, such as an increased interest in science in general. Therefore, we added to the coding scheme the six strands of science learning from the National Research Council's *Learning Science in Informal Environments: People, Places, and Pursuits,* known as LSIE (Bell, Lewenstein, Shouse, & Feder, 2009), which articulate more general science capabilities supported by informal learning environments. According to the document (p. 43), learners who engage with science in informal environments . . .

Strand 1: Experience excitement, interest, and motivation to learn about phenomena in the natural and physical world.
Strand 2: Come to generate, understand, remember, and use concepts, explanations, arguments, models, and facts related to science.
Strand 3: Manipulate, test, explore, predict, question, observe, and make sense of the natural and physical world.
Strand 4: Reflect on science as a way of knowing; on processes, concepts, and institutions of science; and on their own process of learning about phenomena.
Strand 5: Participate in scientific activities and learning practices with others, using scientific language and tools.
Strand 6: Think about themselves as science learners and develop an identity as someone who knows about, uses, and sometimes contributes to science.

We also added an "other" code for responses still not captured by the coding scheme.

After applying the codes to a sample of interview responses, we refined the coding scheme resulting in the six learning goals described below. Three of the learning goals are specifically about nano concepts, and three are about learning and attitudes toward science in general. In coding, each interview response could have multiple goals attached to it.

Learning Goals Related to Nano Concepts

1. **Understanding of the nanoscale:** Visitors will understand what nano is and does, and that this is an emerging field. This relates to the NISE Network Content Map Idea 1.
2. **Nano leads to new innovations:** Visitors will understand that nano leads to new innovations, with a wide range of research and applications. This relates to the NISE Network Content Map Idea 3.
3. **Nano is relevant to daily lives:** Visitors will understand that nano is relevant to their daily lives, with both benefits and risks, and that people can affect these technologies' development and adoption. This relates to NISE Network Content Map Idea 4.

Learning Goals Related to Science in General

4. **Spark interest in science generally:** Visitors will be more interested in science in general. This relates to LSIE Strand 1: Developing an interest in science.
5. **Possibility of STEM careers:** Youth will be exposed to the possibility of careers in nano or science. This relates to NISE Network Content Map Ideas 2 and 3.

6. **Scientific practices:** Visitors will engage in scientific practices through hands-on activities and discussion. This relates to LSIE Strand 5: Engaging in scientific practice.

The distribution of learning goals by type of organizations is presented in Figure 9. The most frequently mentioned of the learning goals was to show the relevance of nano to daily life, followed by understanding the nanoscale and sparking an interest in science in general (not necessarily nanoscale science). The learning goals mentioned least often were those associated with STEM careers and using scientific practices.

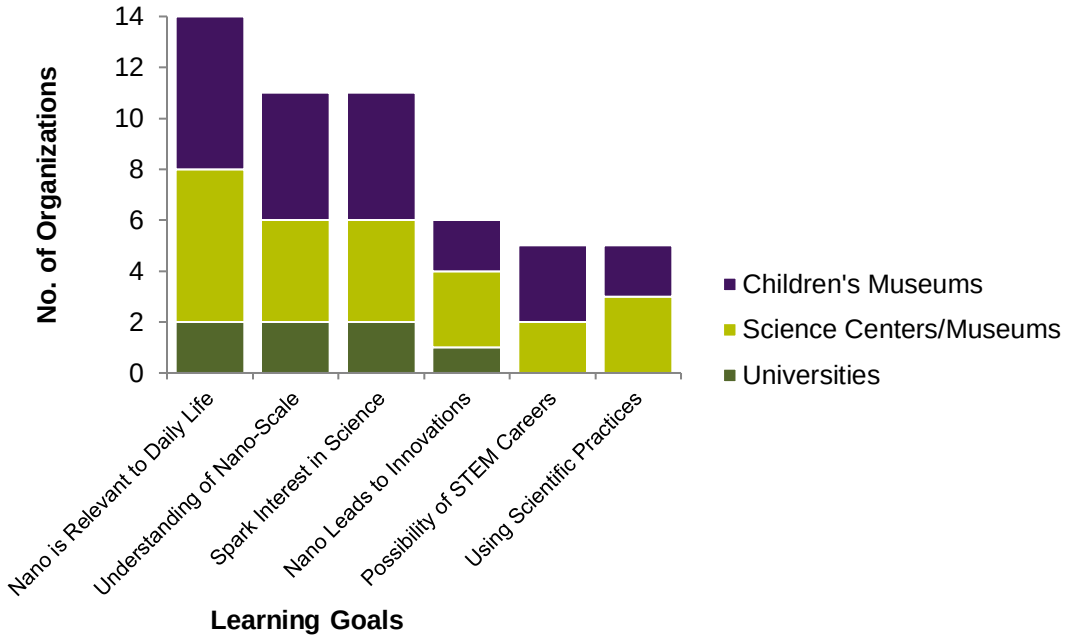

Figure 9. Number of organizations mentioning each learning goal for children's museums (n = 6), science centers/museums (n = 6), and universities (n = 2).

The color of the bars in Figure 9, representing different types of organizations, indicates that some learning goals varied by organization type. In particular, none of the interviewees at universities mentioned that STEM careers or using scientific practices were among their learning goals, perhaps because some of their audiences already were engaged in doing science and headed toward science careers. Children's museums and science centers/museums were similar in the goals that staff members mentioned most frequently (i.e., nano is relevant to daily life, understanding the nanoscale, and sparking an interest in science generally) and least frequently (i.e., that nano leads to innovations, promoting the possibility of STEM careers, and engaging visitors in scientific practices).

The results of our interviews also made clear that individual organizations each had multiple topics that they hoped their audiences would learn about nano. Staff members at each of the 14 organizations mentioned at least two learning goals in their interviews. As can be seen in Figure 10, the number of learning goals mentioned by staff members at an organization ranged from 2 to 6; universities mentioned 2 or 3 learning goals, the majority of children's museums mentioned 3 learning goals (although some mentioned 5 or 6), and science centers/museums ranged from as few as 2 to as many as 6 learning goals.

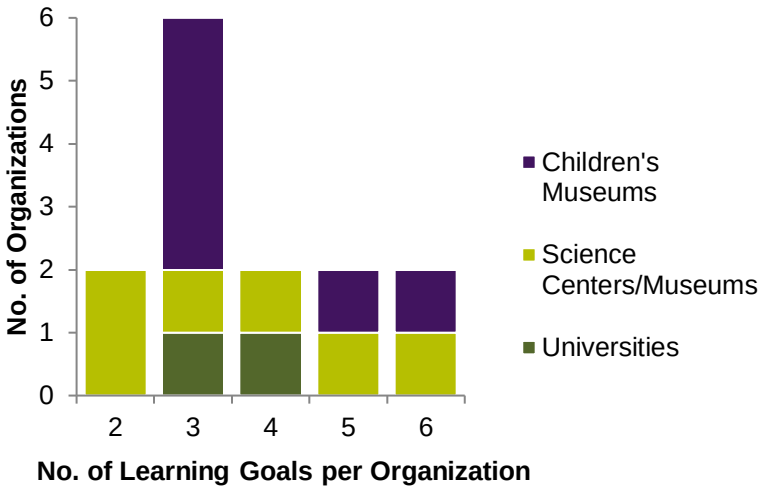

Figure 10. Number of different learning goals mentioned during interviews per organization, for children's museums (n = 6), science centers/museums (n = 6), and universities (n = 2). The six learning goals are provided in Figure 9.

Staff Members' Comments About Learning Goals. In this section, we provide examples of learning goals as described by staff members during their interviews. These provide details about the messages that staff members were hoping audience members would take away from the nano-related experiences they were provided, and more information about the distribution of learning goals across the organizations in our study.

Goals Related to Nano Concepts. Staff members at 11 of the 14 organizations mentioned goals of **creating an understanding of nanoscale phenomena** and that things behave differently at the nanoscale.

> *Example:* Staff members at several museums said they hoped their visitors would learn that nano is a billionth of a meter and at that scale things act differently.

> *Example:* A staff member at a children's museum said that they want to explain what nano is, what it does, the size of a nanometer, seeing on the macro, and seeing on the micro.

Staff members at 6 of the 14 organizations wanted participants to think about how nano leads to **new knowledge and innovations**. Several expressed this as a "wow" factor.

> *Example:* A staff member at a science center/museum said that she hoped visitors would learn that nano is part of emerging technologies and that people are impacted by exciting and important nanotechnology research.

Staff members at all 14 organizations wanted audience members to take away an understanding that **nano is relevant to visitors' daily lives and to society**, including its risks, benefits, possibilities, and ethical implications. They wanted visitors to know that we, as a society, have choices to make about nano.

> *Example*: A staff member from a science center/museum said that they want people to be inspired to learn more about nano in their daily lives, such as in food and medicine, so that they can educate themselves and make better-informed decisions as consumers and voters.

Example: Staff members at several museums said that they want visitors to have conversations about the societal and ethical implications of nano technology.

Example: A staff member at a children's museum said she wants youth to know that nano is part of their lives and part of our society.

Goals Related to Science in General. Staff members at 10 of the 14 organizations said they hoped the nano experiences they provided for the public would **spark interest in science more generally**.

Example: Staff members at several children's museum said they want visitors to be more literate about science in general, using everyday examples of nanotechnology such as sunscreen, to get excited about science and realize it can be cool and interactive.

Example: Staff members at several museums said they want to inspire people to want to "do science" at home.

Staff members at 5 of the 12 children's museums and science centers/museums (but neither of the universities) mentioned goals about **engaging visitors in scientific practice through hands-on activities and discussion**.

Example: A staff member at a children's museum wanted older children to be challenged to build their own activities, using their own imagination and the materials they provided.

Example: A staff member at a science center/museum wanted visitors' interactions with nano in the lab to increase their learning of nano through experience.

Staff members at 5 of the 14 organizations had goals related to exposing audience members to the **possibility of careers in nano or science**. This goal was often tied to providing opportunities for youth from groups underrepresented in science careers to engage in science activities and see inspirational models. They wanted to include or represent girls, people of color, special needs children and adults, rural children, and a variety of age ranges as people interested in and doing science.

Example: Staff members at children's museums said they want girls and children of color to feel capable and included in scientific processes, and to show rural children that they can study this type of science in higher education.

Example: A university respondent was interested in equitable gender representation in science.

What Staff Members Think Their Audiences Are Learning. In the interviews, we asked staff members what messages they thought their audience members were taking home from nano-related experiences. This was intended to serve as a complementary line of questioning to what staff members said they were hoping to achieve with their nano-related offerings. Although many staff members expressed some hesitation in making firm statements about audience outcomes—few organizations had collected systematic data—most staff members who responded believed that they had achieved their goals. Sometimes, this was based on subtle behavioral indicators, such as engagement during hands-on activities, head nodding during lectures, and expressions of interest in a question-and-answer period. Other staff members explained that how audience members connected with the messages provided in nano-related experiences varied with the type of experience and the size and composition of the audience. For instance, a few staff members told us that audience members with more science background and people in smaller groups were, compared to others, more likely to get the intended messages.

Audiences for Nano

In the interviews, we asked staff members about the audiences they reached with nano-related content. As noted above, we specifically asked about casual visitors (with some follow-up questions about repeat visitors), school groups, youth attending afterschool programs and camps, adults attending lectures and other programs, general audiences attending public events off-site, and museum members. We also asked if there were other audience groups the staff members knew about that we had overlooked in our interview. We were interested in knowing for which audience groups the organizations provided nano-related experiences and whether the associated experiences, learning goals, and outcomes varied across the different types of audience.

As can be seen in Figure 11, all of the organizations except for one university (93% of the total) provided nano experiences for casual visitors and school groups. Most organizations (79%) also made nano-related experiences available for audiences at public events, youth attending afterschool programs or camps, and adults attending lectures or other kinds of programs. The results suggest that children's museums and science centers/museums like those in this sample provided opportunities for both children and adults to experience nano-related content. Few staff members said that their organizations provided specific nano-related experiences for members. Other audiences for nano, mentioned by only a single staff member, include informal science education practitioners, researchers and scientists, and audiences with special needs.

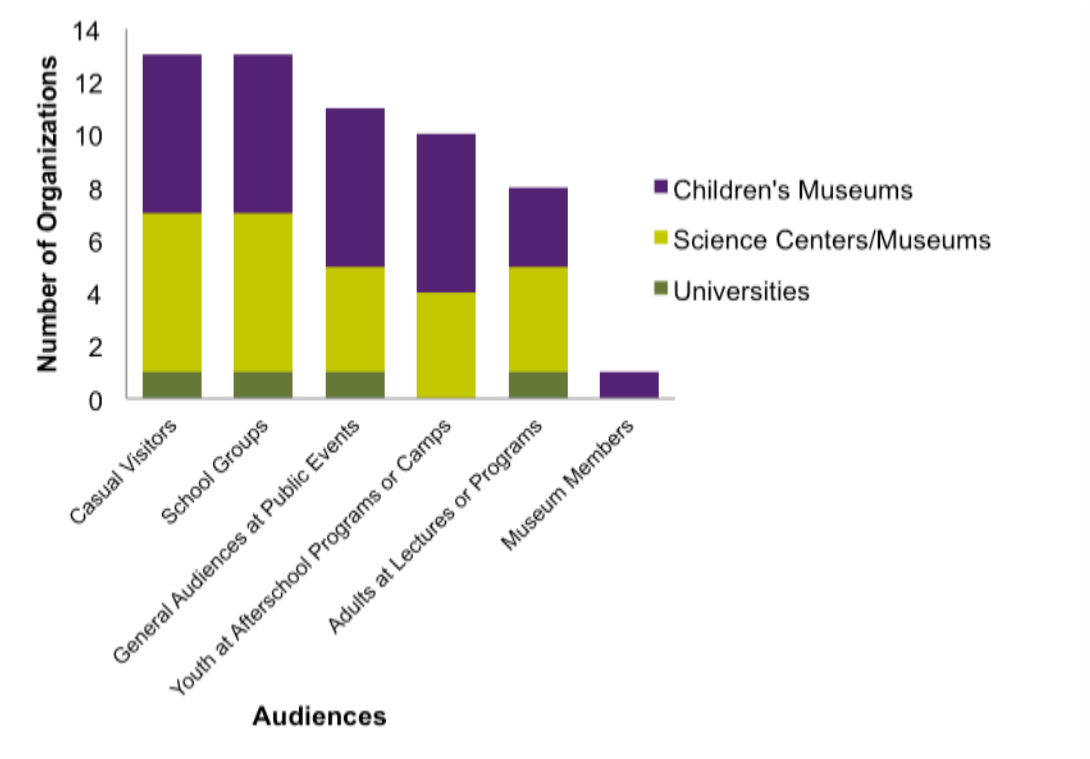

Figure 11. Number of organizations offering nano-related experiences for specific audience groups by children's museums (n = 6), science centers/museums (n = 6), and universities (n = 2).

Differences in Experience Design and Learning Goals by Audience. Staff members at four of the 14 museums in the study reported that they had specific goals for some of their audience groups. Three of the children's museums and one science center/museum had goals for their nano presentations specifically targeted for rural children, girls, or people with disabilities. However, most of the staff members we interviewed said that they did not have qualitatively different experiences or goals for different audiences. That is, they might simplify topics for younger children, or go into topics in more detail for older children and participants in extended programs, such as camps or ongoing afterschool science clubs, but the basic types of activities and messages about nano and science that they were hoping participants would acquire did not vary much across audiences.

Similarly, staff members did not expect large differences in what distinct audience groups would take away from their nano experiences, although some groups might have more opportunities or capacity for their learning to be deeper and richer. For instance, staff members from several organizations mentioned that repeat or frequent visitors were more likely to be exposed to programs that were not always in circulation or were rotated, such as pop-up or table top activities. One staff member described how repeat visitors might focus on different aspects of an offering over time—for instance, initially attending to its most salient characteristics, such as the interactive activity components, and only later noticing the accompanying text. These practices presented opportunities for increased learning. For instance, a staff member at a science center/museum talked about a family that visited every week. The family said that they saw shows over and over again and that they learned something new each time. A staff member at a children's museum echoed this sentiment, saying that repeat visitors explored more deeply on

subsequent visits. Another staff member from a science center/museum suggested that the experience of school groups may be too transitory for students to learn much, but it has been rewarding to see youth in camps, where they have experiences with nano every day, acquire and start using vocabulary and concepts related to nano.

Finally, staff members said that they observed differences in the messages acquired by young children and older audience members, especially with respect to concepts related to societal issues connected to nano. Staff members at several children's museums and science centers/museums said that many young chidren (early elementary school-aged and younger) did not connect with conversations about the ethics of nano and were generally not able to connect nano to their everyday lives. Older children and adults were more capable of refecting on societal and ethical isseus, including weighing the potential benefits and costs of nano.

OVERALL FINDINGS: Focus 2

The analysis in Focus 2 builds on and complements the findings from Focus 1. Whereas Focus 1 provided a snapshot of the public offerings of all of NISE Net's Tier 1 and Tier 2 partner organizations with respect to nano content, Focus 2 provided detailed descriptions of the nano-related experiences and learning goals offered for a range of audiences by a select group of especially nano-rich organizations. The results indicate that for these organizations nano is more than an obscure topic reserved for infrequent events and specialized audiences. Rather, organizations provide a multitude of experiences with nano-related content for their audiences, have several goals—about nano in particular and about science in general—that they hope and believe their audiences take home from these experiences, and provide experiences and have learning goals for a wide range of audiences, including both children and adults, and both casual visitors and participants in special programs.

The staff members we spoke with described a focused set of topics that they hoped their audience members would learn from the nano experiences they provided. Learning goals related to nano content were thoroughly captured by three of the four ideas in the NISE Network Content Map (Bequette et al., 2012), and learning goals associated with science in general (i.e., interest, careers, and practices) are common among informal science educators. Although organizations had, for the most part, similar goals for what they wanted the public to understand about nano (with some variation among different types of organizations), there was substantial variation in the experiences they provided to get their messages across. It is likely that characteristics of each organization—its history, resources, location, mission, and so forth—creates a unique blend of experiences for its audiences.

SUMMARY AND CONCLUSION

The NISE Network was a 10-year effort that, according to its own description, was "dedicated to fostering public awareness, engagement, and understanding of nanoscale science, engineering, and technology."[13] To accomplish this, the Network sought to increase the capacity of researchers and informal science educators to create exhibits and programs that would bring nano-related content to the public, primarily through exhibits and programs offered by informal science educators in settings like children's museums, science centers and museums, and in the programs they deliver offsite. University faculty and staff were also partners in these efforts, especially through their community outreach efforts. In this evaluation study, we sought to describe the extent to which the most active NISE Network members—its Tier 1 and Tier 2 partner organizations—had taken up the charge to bring nano to their audiences. To what extent were partner organizations *infused*—a term NISE Network used, perhaps hopefully, to describe all Tier 2 organizations—with nano content. We went into the study knowing that previous evaluations had shown widespread participation in NISE Net's annual NanoDays events and that requests for a copy of the *Nano* exhibition had exceeded what was available.

Without further evaluation, however, it remained possible that partner organizations were simply eager to access the free materials for NanoDays events and to receive a new exhibition at no cost, and that the overall public impact of nano was restricted to just a few special events or activities that only a small number of people experienced. The results of this evaluation indicate otherwise.

In Focus 1, we found that across the 203 Tier 1 and Tier 2 organizations in our analysis, NISE Net's partners provided many opportunities for their audiences to engage with and learn about nano. Using data collected for other purposes, indicators of the public impact of an organization's NanoDays event, its NISE Network mini-grant, *Nano* exhibition, and use of NanoDays kit materials outside of NanoDays, we found a great deal of variation in the use of NISE Net products and potential for public impact of Tier 1 and Tier 2 organizations. Only a few organizations received a high public impact rating on all six indicators, more were rated low on all six, and most organizations fell in between. In contrast to the measures the evaluation team created, the Regional Hub Leaders categorized almost three fourths of the organizations in their regions as having a high or medium public impact for overall nano richness, suggesting that third parties who knew the organizations best saw these organizations finding ways to create effective events beyond the simpler reporting criteria. Clearly, the NISE Network partner organizations were providing many opportunities—not just NanoDays and the *Nano* exhibition—for their audiences. Also, organizations of all sizes were among the most nano-rich organizations by including nano in many of their offerings, whether they were extensive or more modest. Finally, the data show many ways for organizations to be nano rich.

The analyses in Focus 2 provided more details about the nature of nano-rich organizations. Interviews with staff members at children's museums, science centers/museums, and universities that received high ratings on four or more of the Focus 1 indicators revealed that nano-related content was included in a wide variety of the experiences they planned for their visitors in addition to NanoDays and the *Nano* exhibition, including activities onsite for casual visitors (e.g., carts and demonstrations in the galleries), extended programs for students (e.g.,

[13] See "Home," www.nisenet.org.

afterschool groups and summer camps), and programs intended for families (e.g., community science fairs) and adults (e.g., lectures). Although the universities included in the Focus 2 study provided just two or three different kinds of nano activities, most of the children's museums and science centers/museums made available at least six different types of nano experiences for their audiences. The staff members described a set of messages about nano and about science in general that they hoped their audiences would take home from these experiences, and most had several topics about which they hoped audiences would learn. They also thought they were succeeding in getting these messages across, although the staff members we spoke were not asked to collect specific data to show this. Finally, these nano-related experiences and messages were not intended for only limited audiences but were offered to all types of audiences, including casual visitors and school groups, youth enrolled in extended clubs and camps, families in community events, and adults attending lectures.

In many ways, this careful descriptive study was charged with describing a network that was already well known to its leadership and membership. These results should not seem surprising to those who know the NISE Network well. For this audience in particular, we offer statements of what the network did do:

- **Educational products were distributed and used by a variety of types of organizations differing in size, geographic location, and type.** For example, focus 2 organizations included 6 children's museums, 6 science centers or museums, and 2 universities that were located in 6 of 7 NISE Net regional hubs in urban, suburban and rural locations, and ranged from annual attendance of under 10,000 visitors to over 500,000 visitors.

- **Educational products were shared with all museum audiences, not only science-oriented audiences.** Audiences included casual visitors, repeat visitors, school groups, youth attending afterschool programs and camps, adults attending lectures and other programs, general audience attending public events off-site, and members.

- **Educational products were distributed to all kinds of museums including science centers or museums and children's museums.** These organizations picked a variety products to share with their audiences.

- **NanoDays kit materials were used and repurposed through a range of programs and settings.** Organizations used materials during NanoDays events, outreach events to communities, school programs, to supplement their mini-exhibition, and for events and lectures.

In each way that was measured, the Network chose the more egalitarian and inclusive approach, working to share the nano products in broader not narrower ways.

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Appendix A

Supplemental Results

Table A1

Number of Factors Included in Organizations' NanoDays 2014 Events (N = 154)

Number of Factors	Number of Organizations
Infrastructure	
3	92
2	47
1	15
0	0
Activities and Experiences	
4	19
3	58
2	61
1	15
0	1
Educational Materials	
2	116
1	32
0	6

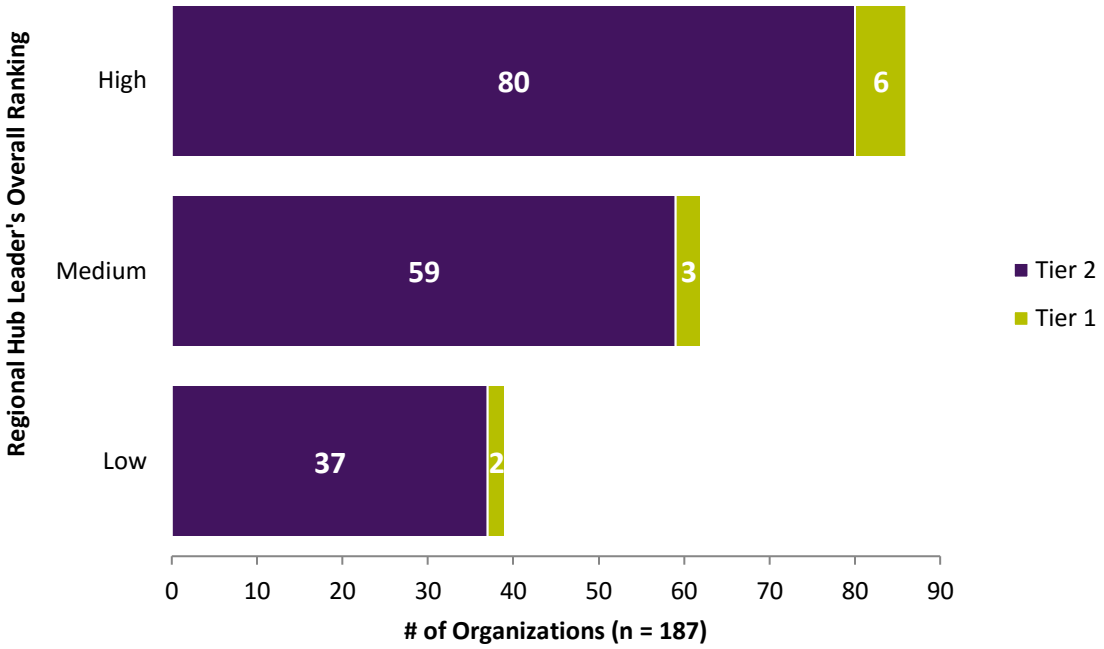

Figure A1. Regional Hub Leader's ratings of organization's overall nano richness (Indicator 6). This chart does not include 11 organizations that Regional Hub Leaders indicated they did not have enough information to rate, and one organization that was not rated because it was no longer a Tier 1 or Tier 2 organization at the time of the rating.

Appendix B

Focus 1 Instruments and Scoring Guides for Regional Hub Leaders (Indicators 2 and 6)

This appendix contains the instruments and scoring guides developed for the Regional Hub Leaders to use in the ratings of organizations' NanoDays 2014 events (Indicator 2) and overall nano richness (Indicator 6)..

Regional Hub Leader NanoDays 2014 Event and Overall Nano-Richness Scoring Guides and Instructions

Dear Regional Hub Leader:
We are asking for your help with the Year 10 Public Impacts Study, which is examining the public impact of nano-rich organizations. By *nano-rich* we mean organizations that are engaging their public audience in nanoscale science, engineering, and technology in multiple ways throughout the year. These nano-rich organizations may have a copy of the mini-exhibition, hold an annual NanoDays event, adapt materials from a NanoDays kit for other programs, incorporate nanoscale science into their theater programs, have used a mini-grant to develop a nano exhibit or program, and so on. A nano-rich organization presents multiple opportunities for its public audiences to be exposed to nano-related content.

Other evaluation studies have focused on the public impact of particular NISE Net offerings, such as the mini-exhibition and NanoDays. In contrast, this evaluation study is looking at organizations that offer a spectrum of nano-related content, and how it has an impact on their public audience. Identifying the degree to which various NISE Net partners are infused with opportunities for the public to engage with nano is the first step in this study.

Because of your knowledge about the NISE Net's partner organizations, we believe the Regional Hub Leaders are well positioned to rate the extent to which Tier 1 and Tier 2 organizations across the Network have made nano-related content available to their public audiences. In particular, we are asking you to rate the Tier 1 and Tier 2 organizations (museums, universities, research centers, etc.) in your region twice: Once to describe their NanoDays 2014 activities and once to describe their overall level of nano richness. We have developed two scoring guides, one for each ranking. Some practice examples are attached in the training guide.

General Instructions

- Please rate each Tier 1 and Tier 2 organization in your regional hub twice. To help you do this, Vrylena has added two temporary columns to Quickbase. One column is for you to enter a rating of each organization's NanoDays 2014 event, and the other column is for you to enter a rating of each organization's overall nano-richness. (Directions for entering your scores into Quickbase are on the first page of the Training Document.)
- It is important to take into account the size of the organizations when assigning them a rating. A small organization with only a few nano-related programs and

exhibits may be considered nano-rich because nano-related content is included in a significant share of its offerings and much of its audience is exposed to nano-related offerings. In contrast, a large museum with many nano-related exhibits and programs may be less nano-rich if the exhibits are hidden in a low-traffic area and only a few visitors participate in nano-related activities. We are not trying to compare the absolute size (such as, number of visitors) of the public impact.

- We are specifically interested in each organization's **impact on the public—what visitors experience**. Other forms of involvement in NISE Net (such as participation in meetings and professional development) are not included in this study.
- We expect that it will take no more than 5 or 10 minutes to provide the two ratings for each organization in your hub. Whenever possible, use your knowledge of the organizations in your hub. You may want to review recent reports or other information from the organizations.

NanoDays 2014 Scoring Guide

Use this scoring guide to rate the nature of NanoDays 2014 events of Tier 1 and Tier 2 organizations in your regional hub. We are specifically concerned with the variety of opportunities that public audiences have to engage with nano-related content. Note that we are not asking you to rate the *quality* of the event; it is possible for a high-quality event to have little impact on an organization's public audiences (and vice versa). Rather, please focus on the extent to which the organization engages its public audiences in opportunities to learn about nano.

How to use this scoring guide:

- Use this guide to rate the degree to which the Tier 1 and Tier 2 organizations in your region engaged their public audiences in NanoDays 2014. Assign one rating to each organization: **high**, **medium**, **low**, **no NanoDays 2014 event**, or **I don't know**.
- Please use *I don't know* sparingly–save it for instances in which you really don't know anything about an organization's NanoDays 2014 event.
- The scoring guide describes several features of NanoDays events to help you get a better sense of the different ratings. Organizations are likely to have some features with a high level of public impact and other features with a medium or low level. It is possible to be rated *high* overall even though some features are at *low* and *medium* levels of public impact. Use your judgment to come up with a single overall rating for each organization.
- The scoring guide is not a checklist. You do not need to provide a rating for each feature. Rather, choose a single rating (high, medium, etc.) for each organization based on your overall sense of the entire NanoDays 2014 event. The features are simply a framework to help structure your reflection of the organization's score.
- We are specifically interested in NanoDays 2014. Please do not include other years or the use of the NanoDays kit outside of the event.

NANODAYS 2014 Event			
Feature	**LOW Public Impact**	**MEDIUM Public Impact**	**HIGH Public Impact**
Visitor Exposure	Visitors were exposed to none, one, or two nano-related activities from the 2014 NanoDays kit.	Some visitors were exposed to several activities from the current and previous NanoDays kits.	Many visitors were exposed to multiple, varied nano-related activities. Visitors were presented with a mix of past and present NanoDays kit activities and additional educational materials adapted from other sources.
Variety of Public Offerings with Nano Content (Use of materials from NISE Net and other sources)	Visitors experienced a limited set of activities, mostly of one or two types (e.g., only cart or table activities). Only a few aspects of nano-scale science were made available to the public.	Some visitors experienced several different types of nano-related activities. Nano-related content was added to a few of the organization's other public offerings that took place during NanoDays. Several aspects of nano-scale science were made available to the public.	Many visitors experienced a large assortment of activities of different types, such as cart and table activities, nano-themed programs, live theater, and presentations from nano scientists. The organization also provided special nano-related outreach in other settings, such as schools.
Audience Awareness of the Event	None or only a few visitors attended specifically because of NanoDays. Many visitors were not aware that a special NanoDays event was taking place.	Some visitors attended specifically because of NanoDays. During the visit, many visitors were aware that a special NanoDays event was taking place.	Many visitors chose to attend because of NanoDays. Most visitors were aware that a special NanoDays event was taking place.
Volunteers	Visitors interacted with no volunteers or only the organization's usual volunteers. These volunteers engaged the public in a limited set of activities, such as presenting only one or two table activities from the 2014 NanoDays Kit.	In addition to the organization's typical volunteers, visitors interacted with volunteers who were recruited specifically for NanoDays, such as local high school or college students. These volunteers interacted with visitors in a few different ways, such as presenting activities from the 2014 NanoDays Kit and from previous kits or other sources.	In addition to the organization's typical volunteers, visitors interacted with a wide range of volunteers from various backgrounds, such as local high school and college students, K-12 and university educators, and nano scientists. The volunteers interacted with visitors in a variety of ways, such as presenting a range of activities from the 2014 NanoDays kit, activities of their own invention, and other forms of programming such lectures and demonstrations.

Overall Nano-Richness Scoring Guide

Use this scoring guide to rate the overall degree to which Tier 1 and Tier 2 organizations in your regional hub are infused with nano-related content in their public offerings. Note that we are not asking you to rate the *quality* of the organization's nano-related content; it is possible for a museum with high-quality nano exhibit to have little impact on its public audiences (and vice versa). Rather, please focus on the extent to which the organization engages its public audiences in opportunities to learn about nano.

How to use this scoring guide:

- Use this guide to rate each Tier 1 and Tier 2 organization in your region in terms of how rich you believe it is with respect to offering nano-related content for its public audiences. Assign one rating to each organization: **high**, **medium**, **low**, **no public outreach**, or **I don't know**.
- Please use *I don't know* sparingly–save it for instances in which you really don't know anything about an organization's nano-related public offerings.
- The scoring guide describes several features of on organization's potential public offerings related to nano; this is to help you get a better sense of the different ratings. Organizations are likely to have some features with a high level of public impact and other features with a medium or low level. Use your judgment to come up with a single overall rating of nano-richness for each organization.
- The scoring guide is not a checklist. You do not need to provide a rating for each feature. Rather, choose a single rating (high, medium, etc.) for each organization based on your overall sense of the entire organization's nano-related content.
- We are interested in the organization as it is currently or in the very recent past.
- Use your knowledge of the organization based on visits there, discussions with staff members, and so forth. It is not necessary for you to review reports or other information from the organization, although you may do so if you want.

Overall Nano-Richness			
Feature	**LOW Public Impact**	**MEDIUM Public Impact**	**HIGH Public Impact**
NanoDays Event	See rating from NanoDays Scoring Guide		
Public Engagement with the Mini-Exhibition	The organization does not have a mini-exhibition or has one located in a low-traffic area where few visitors are exposed to it; staff provides minimal or no public programming using the mini-exhibition.	The organization has a mini-exhibition located in an area with medium traffic where some visitors are exposed to it; staff provides occasional public programming using the mini-exhibition.	The organization has a mini-exhibition located in a high-traffic area where most visitors are exposed to it; staff provides frequent public programming using the mini-exhibition.
Inclusion of Nano-Related Content in Public Programs and Exhibits Outside of NanoDays (Programs, theater, demonstrations, carts, lectures, exhibits, signage, website, etc.)	The organization never or rarely includes nano-related content in its public programs and exhibits outside of NanoDays. When it does so, only a few activities with nano-related content are offered.	The organization includes nano-related content in some of its public programs and exhibits outside of NanoDays. There are no offerings devoted primarily or wholly to nano-scale science.	The organization includes nano-related content in a variety of public programs outside of NanoDays. In addition to weaving Nano into several programs, it offers one or more programs that focus primarily on Nano-scale science. They have developed their own nano–related exhibition using materials from past NanoDays kits and other sources. They include information about Nano on their website.
Outreach Activities that Include Nano-Related Content (Such as school and community groups, lecture series, etc.)	Nano-related content is included in none or very few of the organization's outreach activities.	Nano-related content is included in some of the organization's outreach activities.	Nano-related content is included in many of the organization's outreach activities. In addition to weaving Nano content into several outreach activities, it offers one or more programs that focus primarily on Nano-scale science.

Scoring Guide Training Manual

This document is a tool to measure the overall exposure of public audiences to Nano-related content. The examples that follow include descriptions of organizations and their NanoDays events through the lens of the scoring guide. Although this document reviews each feature of the scoring guides individually, overall scoring decisions should be made holistically—assign each organization one score for NanoDays 2014 and one score for overall Nano-Richness.

Example #1: Organization Z

Organization Z is a small science center located in a rural area, has moderate attendance during the summer and low attendance during the school year. The organization regularly hosts events for schools and adult programs and charges low admission prices.

NanoDays 2014
Organization Z hosted a weeklong NanoDays 2014 event. The celebration featured a kick-off event in which families were invited to participate in a variety of table activities, mostly taken from the NanoDays 2014 kit. A staff member or volunteer facilitated each activity; staff members also led several large-group demonstrations, and a university scientist presented a lecture about her nano-related research that night. The kickoff event was covered in the local newspaper, which drew larger than average attendance in the following days. The remaining days of the NanoDays event included a variety of hands-on table activities from past and present NanoDays kits, facilitated by the organization's usual volunteers and undergraduate volunteers recruited specifically for NanoDays from two partner universities. In addition, the organization provided additional activities from its own educational resources. There was a nano-themed theater show running several times a day and several nano demonstrations in the galleries. As part of their NanoDays celebration, Organization Z collaborated with a scientist at a local university to develop and deliver a teacher workshop regarding nano-themed science curriculum and two lectures for adults. Organization Z also included nano-related content in their outreach programs in middle school classrooms.

[see Figure 1 on the following page]

Figure 1

NANODAYS 2014 Event			
Feature	**LOW Public Impact**	**MEDIUM Public Impact**	**HIGH Public Impact**
Visitor Exposure	Visitors experienced one or two nano-related activities. The activities were most likely from the 2014 NanoDays kit.	Visitors experienced several activities from the current and previous NanoDays kits. The activities were from the NanoDays 2014 kit and kits from previous years.	Visitors experienced multiple nano-related activities. They were presented with a unique mix of past and present NanoDays kit activities with additional educational materials adapted from other sources.
Variety of Public Offerings (Use of materials from NISE Net and other sources)	Visitors experienced a limited set of activities, mostly of one or two types (e.g., only cart or table activities). Only a few aspects of nano-scale science were available for the public.	Visitors experienced several different types of nano-related activities. Nano-related content was added to a few of the organization's other public offerings that took place during NanoDays.	Visitors experienced a large assortment of activities of different types, such as cart and table activities, nano-themed programs and live theater, and presentations from nano scientists. In addition, the organization provided special nano-related outreach in other settings, such as schools.
Audience Awareness of the Event	Only a few visitors attended specifically because of NanoDays. Many visitors were not aware that a special NanoDays celebration was taking place.	Some visitors attended specifically because of NanoDays. Many visitors were aware that a special NanoDays celebration was taking place.	Many visitors chose to attend because of NanoDays. Most visitors were aware that a special NanoDays celebration was taking place.
Volunteers	Visitors interacted with no volunteers or only the organization's usual volunteers. These volunteers engaged the public in a limited set of activities, such as presenting only one or two table activities from the 2014 NanoDays Kit.	In addition to the organization's typical volunteers, visitors interacted with volunteers who were recruited specifically for NanoDays, such as local high school or college students. These volunteers interacted with visitors in a few different ways, such as presenting activities from the 2014 NanoDays Kit and from previous kits or other sources.	In addition to the organization's typical volunteers, visitors interacted with a wide range of volunteers from various backgrounds, such as local high school and college students, K-12 and university educators, and nano scientists. The volunteers interacted with visitors in a variety of ways, such as presenting a range of activities from the 2014 NanoDays kit, activities of their own invention, and other forms of programming, such lectures and demonstrations.

Author
Comment [9]: This event example describes "a variety of activities from past and present kits."

Author
Comment [10]: This organization's NanoDays features hands-on activities, demonstrations, and outreach to K-12 schools and educators.

Author
Comment [11]: This example does not give a clear description of the audience awareness. However, it seems likely that such a large, collaborative event in a rural area (with high media coverage) would bring in many visitors who are aware of the NanoDays event.

Author
Comment [12]: The volunteers included both the science center's volunteer staff and undergraduate students from local colleges and universities.

NanoDays score: High Public Impact
Organization Z adapted activities for their NanoDays event specifically for their public audience. The celebration increased their regular attendance due to publicity of the event, and exposed visitors to a wide variety of nano related content including activities, programming and demonstrations. Organization Z also collaborated with a local university to offer outreach opportunities for educators in the area, therefore exposing an even larger public audience to nano related content.

Overall Nano Richness

Organization Z uses materials from a variety of NanoDays kits in their everyday programming, including facilitated cart and table activities and demonstrations in the galleries. They include some nano-related content and activities (using materials from the kits, nisenet.org, and of their own) in several of their afterschool programs, summer camps, and school-based outreach programs. They include several activities from NISE Net's Nano & Society workshop ("Space Elevator," Flying Cars," and "Invisibility Cloak) in their youth programs onsite and in schools. They applied for a mini-exhibition but were not awarded one (although they hope to share one if it becomes available). Organization Z used funds from their first NISE Net mini-grant to develop a nano-themed theater program that is part of all school field trips. They used funds from a second mini-grant to develop a new exhibition space, called the Nano Lab, in one of their galleries; it contains hands-on activities using materials from several NanoDays kits, including informational signs and looping video, and microscopes that they bought with the grant. They do not have a regular lecture series, but have had two presentations by local nano scientists about their research as special fund-raising events.

Figure 2

Overall Nano-Richness			
Feature	**LOW Public Impact**	**MEDIUM Public Impact**	**HIGH Public Impact**
NanoDays Event	See rating from NanoDays Scoring Guide		
Public Engagement with the Mini-Exhibition	The organization does not have a mini-exhibition or has one located in a low-traffic area where few visitors are exposed to it; staff provides minimal or no public programming using the mini-exhibition.	The organization has a mini-exhibition located in an area with medium traffic where some visitors are exposed to it; staff provides occasional public programming using the mini-exhibition.	The organization has a mini-exhibition located in a high-traffic area where most visitors are exposed to it; staff provides frequent public programming using the mini-exhibition.
Inclusion of Nano-Related Content in Public Programs and Exhibits Outside of NanoDays (Programs, theater, demonstrations, carts, lectures, exhibits, signage, website, etc.)	The organization never or rarely includes nano-related content in its public programs and exhibits outside of NanoDays. When it does so, only a few activities with nano-related content are offered.	The organization includes nano-related content in some of its public programs and exhibits outside of NanoDays. There are no offerings devoted primarily or wholly to nano-scale science.	The organization includes nano-related content in a variety of public programs outside of NanoDays. In addition to weaving Nano into several programs, it offers one or more programs that focus primarily on Nano-scale science. They have developed their own nano-related exhibition using materials from past NanoDays kits and other sources. They include information about Nano on their website.
Outreach Activities that Include Nano-Related Content (Such as school and community groups, lecture series, etc.)	Nano-related content is included in none or very few of the organization's outreach activities.	Nano-related content is included in some of the organization's outreach activities.	Nano-related content is included in many of the organization's outreach activities. In addition to weaving Nano content into several outreach activities, it offers one or more programs that focus primarily on Nano-scale science.

Author
Comment [9]: Organization Z received a high public impact on the NanoDays Scoring guide.

Author
Comment [10]: Although Organization Z hopes to share a mini-exhibition they do not currently share or have one and therefore have a low public impact on this feature.

Author
Comment [11]: Organization Z uses nano content in a variety of everyday programs, including kit materials, activities from nisenet.org, and their own creations. Many visitors are likely to experience a variety of nano-related content.

Author
Comment [12]: Nano content is included in several of the organization's outreach activities and they have used the mini-grants to develop their own nano-focused exhibition and theater programs which reach much of its audience.

Overall score: High Public Impact
Although Organization Z is low for "Public Engagement with the Mini-Exhibition", scores are based on a holistic view of the institution. In this case, the organization has a high impact NanoDays event, uses a large variety of nano-focused content in its everyday programming, and uses nano-content in much of its outreach. Organization Z has also developed a unique exhibition and theater program that are likely to reach much of its audience.

Example #2: Organization X

Organization X is a children's museum located in a major city with high visitor traffic, including tourists, school groups, and the local community.

NanoDays 2014
This organization hosted a one-day event on a Saturday during NanoDays 2014. The event included five table activities, four from the 2014 kit and one from the previous year's kit. Each activity was facilitated by a staff member of volunteer and included a variety of hands-on materials. The activities were all centrally located (with the tables next to one another) near the main staircase. Organization X is home to a large staff of volunteers, mostly high school to college age. A select few of these volunteers facilitated the event, and were given handouts from the 2014 kit as training beforehand. Organization X included information about the event on its website and encouraged volunteers to promote the event through social media, although few visitors attended specifically for the NanoDays events.

Figure 3

NANODAYS 2014 Event			
Feature	**LOW Public Impact**	**MEDIUM Public Impact**	**HIGH Public Impact**
Visitor Exposure	Visitors experienced one or two nano-related activities. The activities were most likely from the 2014 NanoDays kit.	Visitors experienced several activities from the current and previous NanoDays kits. The activities were from the NanoDays 2014 kit and kits from previous years	Visitors experienced multiple nano-related activities. They were presented with a unique mix of past and present NanoDays kit activities with additional educational materials adapted from other sources.
Variety of Public Offerings (Use of materials from NISE Net and other sources)	Visitors experienced a limited set of activities, mostly of one or two types (e.g., only cart or table activities). Only a few aspects of nano-scale science were available for the public	Visitors experienced several different types of nano-related activities. Nano-related content was added to a few of the organization's other public offerings that took place during NanoDays.	Visitors experienced a large assortment of activities of different types, such as cart and table activities, nano-themed programs and live theater, and presentations from nano scientists. In addition, the organization provided special nano-related outreach in other settings, such as schools.
Audience Awareness of the Event	Only a few visitors attended specifically because of NanoDays. Many visitors were not aware that a special NanoDays celebration was taking place	Some visitors attended specifically because of NanoDays. Many visitors were aware that a special NanoDays celebration was taking place.	Many visitors chose to attend because of NanoDays. Most visitors were aware that a special NanoDays celebration was taking place.
Volunteers	Visitors interacted with no volunteers or only the organization's usual volunteers. These volunteers engaged the public in a limited set of activities, such as presenting only one or two table activities from the 2014 NanoDays Kit	In addition to the organization's typical volunteers, visitors interacted with volunteers who were recruited specifically for NanoDays, such as local high school or college students. These volunteers interacted with visitors in a few different ways, such as presenting activities from the 2014 NanoDays Kit and from previous kits or other sources.	In addition to the organization's typical volunteers, visitors interacted with a wide range of volunteers from various backgrounds, such as local high school and college students, K-12 and university educators, and nano scientists. The volunteers interacted with visitors in a variety of ways, such as presenting a range of activities from the 2014 NanoDays kit, activities of their own invention, and other forms of programming, such lectures and demonstrations.

Author
Comment [1]: Organization X hosted a one day event. Their NanoDays featured five table activities with four from the 2014 kit and one from the previous year's kit. No additional materials were used to supplement the kit activities.

Author
Comment [2]: The variety of nano-related content for Organization X's NanoDays was limited to several table activities.

Author
Comment [3]: Although Organization X has high visitor traffic, there was no promotion of NanoDays event other than their website. The organization encouraged their volunteers to promote the event through social media; however, without more publicity or kick-off events it is likely that most visitors were unaware of the NanoDays celebration.

Author
Comment [4]: The volunteers for were their own volunteer staff, with no special training to facilitate the activities outside of handouts from the kit.

NanoDays Score: Low Public Impact
Despite Organization X's high traffic, its NanoDays visitors were unlikely to have been aware of the NanoDays event. Furthermore, the audience would have engaged with only a limited set of nano-related activities.

Overall Nano-Richness

Organization X has incorporated some materials from past NanoDays kits into their regular youth programming, including one lesson in their afterschool program and one lesson in one of their summer camps. Organization X has a mini-exhibition positioned toward the back of the museum so that many visitors do not encounter it. The floor staff attended a training session about the mini-exhibition, but there are few opportunities for staff to interact with visitors around it and they have not yet developed any public programming associated with the mini-exhibition. Organization X offers a series of monthly evening lectures and they are hoping to recruit a nano scientist from the university to talk about her research.

Figure 4

Overall Nano-Richness			
Feature	LOW Public Impact	MEDIUM Public Impact	HIGH Public Impact
NanoDays Event	See rating from NanoDays Scoring Guide		
Public Engagement with the Mini-Exhibition	The organization does not have a mini-exhibition or has one located in a low-traffic area where few visitors are exposed to it; staff provides minimal or no public programming using the mini-exhibition.	The organization has a mini-exhibition located in an area with medium traffic where some visitors are exposed to it; staff provides occasional public programming using the mini-exhibition.	The organization has a mini-exhibition located in a high-traffic area where most visitors are exposed to it; staff provides frequent public programming using the mini-exhibition.
Inclusion of Nano-Related Content in Public Programs and Exhibits Outside of NanoDays (Programs, theater, demonstrations, carts, lectures, exhibits, signage, website, etc.)	The organization never or rarely includes nano-related content in its public programs and exhibits outside of NanoDays. When it does so, only a few activities with nano-related content are offered.	The organization includes nano-related content in some of its public programs and exhibits outside of NanoDays. There are no offerings devoted primarily or wholly to nano-scale science.	The organization includes nano-related content in a variety of public programs outside of NanoDays. In addition to weaving Nano into several programs, it offers one or more programs that focus primarily on Nano-scale science. They have developed their own nano-related exhibition using materials from past NanoDays kits and other sources. They include information about Nano on their website.
Outreach Activities that Include Nano-Related Content (Such as school and community groups, lecture series, etc.)	Nano-related content is included in none or very few of the organization's outreach activities.	Nano-related content is included in some of the organization's outreach activities.	Nano-related content is included in many of the organization's outreach activities. In addition to weaving Nano content into several outreach activities, it offers one or more programs that focus primarily on Nano-scale science.

Author
Comment [1]: As indicated on the NanoDays Scoring Guide, this organization has a low public impact. Even with a low public impact for NanoDays, it is important to take into account other features of Nano richness in the museum so let's move on to the next feature.

Author
Comment [2]: Although the organization has a mini-exhibition and there is staff training, it is important to focus on the actual public impact and visitor engagement with the mini-exhibition. The mini-exhibition is located in an area that visitors are rarely exposed to and there is no public programming associated with it. Therefore, the mini-exhibition has a low public impact.

Author
Comment [3]: Organization X regularly uses nano content in their programming including youth programs and lecturers. The "medium public impact" score is more appropriate than "high public impact" because this organization uses kit materials from the 2014 rather than adapting various materials to suit their particular public audience (such as previous years kits, resources from nisenet.org, etc.).

Author
Comment [4]: Although Organization X does a significant amount of outreach, it rarely relates to nano.

Organization Overall Score: Low Public Impact

Although Organization X is a large museum with high attendance, this organization's public audience is unlikely to attend NanoDays or engage with the mini-exhibition. They do not expose a large portion of their public audience to nano-content regularly. Overall, this organization would have a low public impact.

Example #3: Organization Y

Organization Y is a small science center located in an urban area with free admission and moderate attendance during the school year. The metro area is home to a diverse population, with densely populated K-12 schools. Organization Y hosts many school field trips throughout the year.

NanoDays 2014
Organization Y partnered with a scientist from a local university to host a weekend-long event during NanoDays 2014. The event attracted a small but substantial audience, including visitors who came because they had seen posters from the kit advertising the event at the university and at the science center. The organization also worked with a local university scientist to host several lectures at the featuring nano scientists and graduate students in the nano technology field. The NanoDays activities were spread throughout several areas of Organization Y. Eight table activities were adapted from the 2014 kit; additional activities came from previous kits and were supplemented with in-house educational materials developed by Organization Y's staff. Activities included a looping video, downloaded from YouTube, and a technical video loaned from the university. The first day of the event began with a kick-off celebration in which visitors were able to see nano technology demonstrations (from the 2014 kit) in the lobby near the mini-exhibition. A group of about 10 undergraduate student volunteers, recruited by the university scientist, facilitated the event. Some of the volunteers were bilingual and facilitated activities in both Spanish and English, using the bilingual handouts from nisenet.org. None of the volunteers was specifically trained before the event; they used NISE Net handouts from the website or the kit.

[see Figure 5, on the following page]

Figure 5

NANODAYS 2014 Event			
Feature	**LOW Public Impact**	**MEDIUM Public Impact**	**HIGH Public Impact**
Visitor Exposure	Visitors experienced one or two nano-related activities. The activities were most likely from the 2014 NanoDays kit.	Visitors experienced several activities from the current and previous NanoDays kits. The activities were from the NanoDays 2014 kit and kits from previous years.	Visitors experienced multiple nano-related activities. They were presented with a unique mix of past and present NanoDays kit activities with additional educational materials adapted from other sources.
Variety of Public Offerings (Use of materials from NISE Net and other sources)	Visitors experienced a limited set of activities, mostly of one or two types (e.g., only cart or table activities). Only a few aspects of nano-scale science were available for the public.	Visitors experienced several different types of nano-related activities. Nano-related content was added to a few of the organization's other public offerings that took place during NanoDays.	Visitors experienced a large assortment of activities of different types, such as cart and table activities, nano-themed programs and live theater, and presentations from nano scientists. In addition, the organization provided special nano-related outreach in other settings, such as schools.
Audience Awareness of the Event	Only a few visitors attended specifically because of NanoDays. Many visitors were not aware that a special NanoDays celebration was taking place.	Some visitors attended specifically because of NanoDays. Many visitors were aware that a special NanoDays celebration was taking place.	Many visitors chose to attend because of NanoDays. Most visitors were aware that a special NanoDays celebration was taking place.
Volunteers	Visitors interacted with no volunteers or only the organization's usual volunteers. These volunteers engaged the public in a limited set of activities, such as presenting only one or two table activities from the 2014 NanoDays Kit.	In addition to the organization's typical volunteers, visitors interacted with volunteers who were recruited specifically for NanoDays, such as local high school or college students. These volunteers interacted with visitors in a few different ways, such as presenting activities from the 2014 NanoDays Kit and from previous kits or other sources.	In addition to the organization's typical volunteers, visitors interacted with a wide range of volunteers from various backgrounds, such as local high school and college students, K-12 and university educators, and nano scientists. The volunteers interacted with visitors in a variety of ways, such as presenting a range of activities from the 2014 NanoDays kit, activities of their own invention, and other forms of programming, such lectures and demonstrations.

Author
Comment [5]: Visitors had opportunities to engage in a variety of nano-related activities, including eight activities from the 2014 kit and previous kits and multi-media components.

Author
Comment [6]: The variety of offerings included a range of activities and collaboration with another organization to host local scientists as speakers. The medium score indicates that visitors had opportunities to engage in a variety of nano-related activities but there was limited nano outreach and programming.

Author
Comment [7]: Attendance increased due to efforts to publicize the event (with graphic signs). It is also likely that collaboration with the local university, through hosting lectures, created an audience that was aware of the event and the theme of nano.

Author
Comment [8]: Organization Y involved undergraduate volunteers specially recruited to facilitate the event. They were capable of facilitating for a variety of public audiences. The volunteers, however, did not develop any new programs or specifically reach out to the diverse public audience. Therefore, this feature was a medium public impact rather than a high public impact.

NanoDays score: Medium Public Impact
Although Organization Y received a high public impact score on two of the features, it appears to have had a medium public impact. This organization collaborated with a partner organization for lectures from professionals in the field of nano technology and promoted the event in tandem with the local university. However, this organization presented a medium range of types of activities (few demonstrations, no theater events), and did not provide any special programming for K-12 educators or underserved audiences.

Overall Nano Richness

Organization Y has incorporated materials from past NanoDays kits into a variety of activities, including cart activities and demonstrations (usually on weekends, when they are busy) in their galleries, some of their afterschool and camp programs, and one of the outreach programs they deliver in schools. The floor staff (including volunteers) attended a training session about the mini-exhibition, which included strategies for talking with visitors about the exhibit's content and, especially, the societal and ethical issues associated with nano. They have incorporated several activities from NISE Net's Nano & Society workshop (e.g., "You Decide" and "Space Elevator") into their youth programs and some of the floor staff occasionally engage visitors to the mini-exhibition with them. The museum offers a series of monthly evening lectures, including two nano scientists (one from the university and one from industry) recently discussed their research. Collaboration between Organization Y and the university is limited to the undergraduate students who volunteer to be facilitators during NanoDays

Figure 6

Overall Nano-Richness			
Feature	**LOW Public Impact**	**MEDIUM Public Impact**	**HIGH Public Impact**
NanoDays Event	See rating from NanoDays Scoring Guide		
Public Engagement with the Mini-Exhibition	The organization does not have a mini-exhibition or has one located in a low-traffic area where few visitors are exposed to it; staff provides minimal or no public programming using the mini-exhibition.	The organization has a mini-exhibition located in an area with medium traffic where some visitors are exposed to it; staff provides occasional public programming using the mini-exhibition.	The organization has a mini-exhibition located in a high-traffic area where most visitors are exposed to it; staff provides frequent public programming using the mini-exhibition.
Inclusion of Nano-Related Content in Public Programs and Exhibits Outside of NanoDays (Programs, theater, demonstrations, carts, lectures, exhibits, signage, website, etc.)	The organization never or rarely includes nano-related content in its public programs and exhibits outside of NanoDays. When it does so, only a few activities with nano-related content are offered.	The organization includes nano-related content in some of its public programs and exhibits outside of NanoDays. There are no offerings devoted primarily or wholly to nano-scale science.	The organization includes nano-related content in a variety of public programs outside of NanoDays. In addition to weaving Nano into several programs, it offers one or more programs that focus primarily on Nano-scale science. They have developed their own nano-related exhibition using materials from past NanoDays kits and other sources. They include information about Nano on their website.
Outreach Activities that Include Nano-Related Content (Such as school and community groups, lecture series, etc.)	Nano-related content is included in none or very few of the organization's outreach activities.	Nano-related content is included in some of the organization's outreach activities.	Nano-related content is included in many of the organization's outreach activities. In addition to weaving Nano content into several outreach activities, it offers one or more programs that focus primarily on Nano-scale science.

Author
Comment [5]: Organization Y received a medium public impact rating on the NanoDays Scoring Guide.

Author
Comment [6]: Many visitors are exposed the mini-exhibition, although there is little public programming that uses it.

Author
Comment [7]: Organization Y uses kit materials in a variety of public programs, including ideas from the Nano & Society workshop. No offerings are fully devoted to nano.

Author
Comment [8]: There are some efforts to include nano in their school outreach, but most of the organization's outreach activities do not include any nano.

Overall score: Medium Public Impact
Organization Y is a small museum has free admission, with regular K-12 attendance. The NanoDays events drew a new audience to the organization. Organization Y also engages many of its visitors with its mini-exhibition and has monthly lectures and programs touching on nano-content, including societal and ethical issues. Overall, this small organization engages a substantial portion of its public audience and has a medium public impact.

Appendix C

Focus 2 Recruitment Emails and Staff Interview Protocol

First Email

Dear [respondent's first name],

The NISE Network needs your help! As NISE Net approaches its conclusion, we are seeking to understand the overall impact of partner organizations that presented a wide variety of nano activities, exhibits, and programs to public audiences in the last year (2014). We will be conducting interviews with staff at selected organizations across the country. We value your participation in previous NISE Net activities and would appreciate hearing about your experiences and perspectives concerning your involvement in NISE Net.

What would participation involve?

Participation in this study will consist of one phone interview. The interview will last for approximately 30 minutes and we will work with you to select a convenient time to call.

The interview is voluntary. You can quit at any time without any consequences. We will not report the names of people who choose to participate or not to participate, nor will we report the names of the organizations for which they work.

Only trained research or evaluation staff will have access to this information. Your responses will be confidential and shared only in non-identifiable and aggregate formats.

Here's how to respond:

If you'd prefer not to participate in the study, please respond to this email letting me know. I'll make sure you receive no further communication regarding the interview.

If you'd like to participate, please click on the doodle poll link below to indicate the best day and time that you are available to be interviewed during this upcoming month. Keep in mind that you can select your time zone within the poll. **Please respond to the doodle poll by Friday, March 27, 2015**. If the doodle poll does not offer any options that work with your schedule, please contact me or David Milavetz at dmilavetz@smm.org to schedule an alternative date and time.

https://doodle.com/ffgfmu6n6gipbqwh

Thank you for your help with this study. Your perspective is very important to us and we look forward to talking with you. If you have any questions, please contact me at sguberman@smm.org.

Best regards,

Steven R. Guberman
sguberman@smm.org
NISE Network Public Impacts Evaluation Team Lead
Science Museum of Minnesota

Second Email

Dear [respondent's first name],

Thank you for signing up on the doodle poll to schedule a NISE Net interview. According to your response, it appears that **[the best time, Time Zone]** works best for you, and we would like to plan for a member of the research team to talk with you then. If this is no longer a good time, please let me know and we will contact you to schedule a time that works better.

Your participation in the interview is voluntary and what you share will be kept confidential by the NISE Public Impacts Evaluation team. You can stop participating in this study at any time over the course of the interview and it will have no impact on your access to NISE Net resources.

To participate in this study, please respond to this email with the following information:

- **A phone number** that is the best number to call you for the interview
- **Your response regarding the audio recording of your interview**. We are interested in audio recording the interview. Recording the interview will allow us to focus on your responses without having to take notes at the same time. Only trained research and evaluation staff members will have access to the recordings, and we will store names or institutions separate from the recordings. Audio recording is optional and you can participate even if you decline to be audio recorded. **Please read the consent information (below) in its entirety** and:

    - Reply **"I agree to audio recording"** if you wish to participate in the interview and **agree to be audio recorded.**

    OR

    - Reply **"I do not agree to audio recording"** if you wish to participate in the interview but **DO NOT wish to be audio recorded.** Your choice not to be audio recorded will be kept confidential and the interview will not be audio recorded.

Thank you again for your time and support of the NISE Network. Please feel free to contact me with any questions or concerns. We look forward to speaking with you soon!

Best regards,

Steven R. Guberman
NISE Network Public Impacts Evaluation Team Lead
Science Museum of Minnesota

Third Email

Dear [respondent],

Thank you so much for agreeing to participate in the NISE Network Public Impacts Evaluation study. I am a member of the Public Impacts team and I'm excited to hear more about your work in bringing nanoscale science, engineering and technology to the public. Your interview is scheduled for **tomorrow at** _____. Once again the interview will last approximately 30 minutes and will be conducted over the phone at [insert phone #]. You have [agreed or disagreed] to be audio-recorded.

Thanks for your time. Please feel free to contact me with any questions or concerns. I look forward to speaking with you soon!

Best regards,

[Eric LaPlant/David Milavetz/Chris Cardiel]
NISE Network Public Impacts Evaluation Team Member
Science Museum of Minnesota

Phone Interview With Staff

Thank you for taking the time to talk with me today. We are interviewing a handful of staff at organizations that presented a wide variety of nano activities, exhibits, and programs to public audiences during the past year (2014). Many of the questions I have are about the different ways you are involved with nano at your organization, how you engage the public with nano, and what you think the public is getting from these experiences. Does that all sound good?

Finally, I'd like to review a few things about informed consent for your participation in the interview:

Everything we talk about will be confidential. We will not link anything you say in this interview to any identifying information. Your responses will be reported in aggregate with other's responses. I want to encourage you to feel free to be open and honest, which means sharing both the good and the bad. If at any time you don't want to answer a question for any reason just let me know and we can skip it, and if you need to stop the interview for any reason that is perfectly fine, just let me know. Do you have any questions for me before we begin?

INTRODUCTION AND WARM-UP

To start, please tell me a little about how you are involved in bringing nano to the public at [museum/organization]?

- Please describe the nano activities, exhibits, or programs you are involved in.
    - How are you involved: Do you interact directly with the public or do you oversee other staff members who interact with the public?
- Can you tell me about a particular time that a visitor or participant engaged with or saw nano-related content at your organization that sticks out to you?
  Possible probes:
    - What about this experience or observation resonated with you? What about this experience was different from other experiences or observations?
    - Can you tell me more about the content that visitors or participants were engaging with or exposed to on that day?
    - What type of visitors was this content intended for?
        - Examples: Everyday visitors, members, school groups, etc.

I'm wondering if your organization has some nano-related offerings for the public that you are less familiar with or comfortable talking about, and that we should talk to someone else about.

Does anything like that come to mind?

If so, what are these activities?

Who should we talk with to learn more about them?

[Note: Get contact information: Name, position, email.]

SELECTING A FORMAT FOR THE INTERVIEW: BY AUDIENCE OR ACTIVITY?
[If the respondent is involved in just a few specific types of activities with nano content, such as delivering theater programs – and there are other staff members involved in other types of nano offerings, focus the interview on the activity rather than the audience. Use appropriate audience questions (below) after asking who the intended audience is for Activity 1, then Activity 2, etc.]

CASUAL VISITORS
I have some questions about how different audiences are engaging with nano at [museum/organization]. I would like to start by talking about casual visitors. When I say casual visitors I mean the people who come to your museum/organization to see your exhibits and gallery programs that aren't visiting for a program, event, or as part of an organized group. Casual visitors may come to your museum/organization just once or they may come more frequently. Also, I'm not including school groups or members now – we'll talk about them later.

1. Please describe the kinds of experiences you think casual visitors are likely to have with nano in a typical visit to your organization.
   Possible probes:
   - Are there any **exhibits** with nano content they might interact with?
     - Can you please describe them?
   - Are there any **floor demonstrations** or other kinds of interactions with staff that have nano content they might experience in a typical visit?
   - Are there any nano-related **theater programs** they might attend?
   - Are there any **signs or posters** that visitors might encounter?
   - Are there any **other nano experiences** that are part of a typical visit?

2. What are you hoping casual visitors will take away from these nano experiences?
   Possible probes:
   - What do you want them to understand about nano?
     - Examples: **Content, terms, ideas, attitudes**
   - Do you want them to be able to do anything new or different after having these nano experiences?
   - Anything else?

3. In what ways do you think casual visitors are recognizing and connecting with these take-away messages?
   Possible probes:
   - What about these nano experiences are resonating with this audience?
     - What makes you think this?
   - Anything else?

4. So far we have been talking about casual visitors in general. I'd like to ask a few questions about repeat visitors – people who visit more than once or visit frequently? Do you do anything different with nano for people who visit more than once?
   Possible probes:

- ** Are there any nano related exhibits or events that aren't available all the time?
- Do you expect visitors who come more often will take away something different about nano than those who only come one time?
    - How is this different?
- Do you think repeat visitors are connecting with nano content and materials in different ways from one-time visitors?
    - What makes you think this?

SCHOOL GROUPS
Now I'd like to as you some questions about school groups that visit your museum/organization. For now I'd like to focus on students and teachers (PreK – 12) coming to you—later we'll talk about when you go off site to them.

Do any school groups visit your museum/organization?
IF NO: SKIP to Youth Attending Afterschool Programs and Camps

Do students in school groups have any nano experiences that are different from casual visitors?
IF NO: SKIP to Q#2.

1. If so, what are the different ways school groups have experiences with nano?
Possible probes:
    - Are there any **exhibits** with nano content they might interact with?
        - Can you please describe them?
    - Are there any **floor demonstrations** or other kinds of interactions with staff that have nano content they might experience in a typical visit?
    - Are there any nano-related **theater programs** they might attend?
    - Are there any **signs or posters** that school groups might encounter?
    - Are there any **other nano experiences** that are part of a typical visit?
    - ** How do different age groups have different experiences with nano?

2. What are you hoping school groups will take away from these nano experiences?
    Possible probes:
    - What do you want students to understand about nano?
        - Examples: **Content, terms, ideas, attitudes**
    - Do you want them to be able to do anything new or different after having these nano experiences?
    - ** How is this different from what you hope other groups will take away?
    - Anything else?

3. In what ways do you think school groups are recognizing and connecting with the take-away messages you hope they are having with nano?
    Possible probes:
    - What about these nano experiences are resonating with this audience?
        - What makes you think this?

- In what ways are different age groups connecting to these take away messages?
    - What makes you think this?
- Anything else?

YOUTH ATTENDING AFTERSCHOOL PROGRAMS AND CAMPS (pre-k to high school)

Do you have any programming for youth attending afterschool programs or camps that deal with nano?

No: SKIP to Adults Attending Lectures and Other Programs

1. If so, can you describe these experiences?

Possible probes:

- Are there any other encounters with nano content that are different for this audience compared with casual visitors?
    - Describe.

2. What are you hoping youth in afterschool programs and camps will take away from these nano experiences?

Possible probes:

- What do you want them to understand about nano?
    - Examples: **Content, terms, ideas, attitudes**
- What do you hope they talk about during these experiences?
- Do you want them to be able to do anything new or different after having these nano experiences?
- ** How is this different from what you hope other groups will take away?
- Anything else?

3. In what ways do you think youth in afterschool program and camps are recognizing and connecting with these take-away messages?

Possible probes:

- What about these nano experiences are resonating with this audience?
    - What makes you think this?
- Anything else?

ADULTS ATTENDING LECTURES AND OTHER PROGRAMS

Do you have any lectures or programs that are for adults that deal with nano?

No: SKIP to Members

Do adults attending these lectures and other programs have the opportunity to see the same nano content as casual visitors?

1. If so, can you describe the specific experiences for adults?

Possible probes:

- Are there any other encounters with nano content that are different for this audience?

- Describe.

2. What are you hoping they will take away from these nano experiences?
   Possible probes:
   - What do you want them to understand about nano?
     - Examples: **Content, terms, ideas, attitudes**
   - Do you want them to be able to do anything new or different after having these nano experiences?
   - ** How is this different from what you hope other groups will take away?
   - Anything else?

3. In what ways do you think they are recognizing and connecting with these take away messages you hope they are having?
   Possible probes:
   - What about these nano experiences are resonating with this audience?
     - What makes you think this?
   - Anything else?

MEMBERS
Do you have any nano experiences that are specifically for members?
No: SKIP to Outreach

Do members have any nano experiences that are different from casual visitors?
IF NO: SKIP to Q#2.

1. If so, can you describe these experiences?

Possible probes:
- Are there any other encounters with nano content that are different for this audience?
  - Describe.

2. What are you hoping they will take away from these nano experiences?
   Possible probes:
   - What do you want them to understand about nano?
     - Examples: **Content, terms, ideas, attitudes**
   - Do you want them to be able to do anything new or different after having these nano experiences?
   - ** How is this different from what you hope other groups will take away?
   - Anything else?

3. In what ways do you think they are recognizing and connecting with these take away messages you hope they are having?
   Possible probes:
   - What about these nano experiences are resonating with this audience?
     - What makes you think this?
   - Anything else?

OUTREACH
Do you do any outreach programs for public audiences (to schools, community organizations, and other groups) that include nano topics? This does not include any professional development programs for teachers you may have.

No: SKIP to Other Experiences

1. Please tell me about the typical audience for these experiences.
   [Note that there may be several different types of outreach; repeat for each type.]
   Possible probes:
   - Who is typically in the audience?
     - Examples: **School groups? Ages? Backgrounds?**
   - Where are these events usually held?
     - Examples: **Schools? Community centers?**

2. Please describe these experiences?

Possible probes:
- Are there encounters with nano content in these events that are different for this audience?
  - Describe.

3. What are you hoping this audience will take away from these nano experiences?
   Possible probes:
   - What do you want them to understand about nano?
     - Examples: **Content, terms, ideas, attitudes**
   - Do you want them to be able to do anything new or different after having these nano experiences?
   - ** How is this different from what you hope other groups will take away?
   - Anything else?

4. In what ways do you think this audience is recognizing and connecting with these take away messages you hope they are having?
   Possible probes:
   - What about these nano experiences are resonating with this audience?
     - What makes you think this?
   - Anything else?

OTHER AUDIENCES
Do you have any audiences that interact with nano that we haven't talked about yet?

IF NO: SKIP

1. Can you tell me more about these audiences?
   [Note that there may be several different types of audience; repeat for each type.]
   Possible probes:
   - Examples: Underserved, seniors, preschoolers, people with disabilities.
   - How are they different from the other audiences we've discussed?
2. What kinds of experiences do they have that are different from the audiences we've already talked about?

Possible probes:

- Are there any **exhibits** with nano content they might interact with?
  - Can you please describe them?
- Are there any **floor demonstrations** or other kinds of interactions with staff that have nano content they might experience in a typical visit?
- Are there any nano-related **theater programs** they might attend?
- Are there any **signs or posters** that visitors might encounter?
- Are there any **other nano experiences** that are part of a typical visit?

3. What are you hoping this audience will take away from these nano experiences?
   Possible probes:
   - What do you want them to understand about nano?
     - Examples: **Content, terms, ideas, attitudes**
   - Do you want them to be able to do anything new or different after having these nano experiences?
   - ** How is this different from what you hope other groups will take away?
   - Anything else?

4. In what ways do you think this audience is recognizing and connecting with these take-away messages?
   Possible probes:
   - What about these nano experiences are resonating with this audience?
     - What makes you think this?
   - Anything else?

OTHER ACTIVITIES

Do your visitors have any nano experiences we haven't talked about yet?
IF NO: SKIP to Audience Segments

1. If so, please describe these experiences.
   [Note that there may be several different types of activities; repeat for each type.]

Possible probes:
- Are there encounters with nano content that are different for this experience?

2. What are you hoping people will take away from these nano experiences?
   Possible probes:
   - What do you want them to understand about nano?
     - Examples: **Content, terms, ideas, attitudes**
   - Do you want them to be able to do anything new or different after having these nano experiences?
   - Anything else?

3. In what ways do you think these audiences are recognizing and connecting with these take-away messages?
   Possible probes:
   - What about these nano experiences are resonating with for these people?
     - What makes you think this?

- ** How is this different from what you hope other groups will take away?
- Anything else?

AUDIENCE SEGMENTS
The last topic I would like to cover is to get your thoughts about how we might connect with these different audiences to conduct a survey about their experiences with nano. If possible, we would like to conduct this survey online, either by sending an email to people inviting them to participate, or by giving them a direct link to the survey. We have a couple of ideas that we want to run by you to see if any of them seem like a possibility.

- For the audiences you have email addresses for—such as members—do you think it would be possible for your organization to either share their email addresses with us, or to send an email to them on our behalf?
- Do you think it would be possible for someone at your site to collect email addresses for us from your visitors or at special events?
- What are the best ways you have found for getting in touch with these different audiences other than by email? For instance, might it be possible to hand out cards to your visitors with information about the survey?
- Do you have other thoughts or ideas about how best to connect with these members of your audience?

THANKS for taking the time to talk with me today. Do you have any questions for me before I let you go?