

2010 Delivery and Reach Study

NISE Network 2010 Summative Evaluation

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Executive Summary

The Delivery and Reach study was part of the summative evaluation efforts to assess the impacts of the NSF-funded Nanoscale Informal Science Education (NISE) Network during years one through five and inform future development work in years six through ten of the project. While other summative evaluations addressed the impact of Network activities on public and professional audiences, the Delivery and Reach study documented the delivery of nano education activities at Network partner institutions and estimated the public reach of those activities. The study was driven by four evaluation questions:

1. *Which institutions delivered nano education programs and activities between July 2009 and June 2010?*
2. *What nano education activities were delivered by NISE Network partner institutions during this time period?*
3. *What factors influenced the delivery and reach of nano education activities?*
4. *How many individuals were reached by nano education activities during NanoDays 2010?*

Data was collected through a variety of methods, including the online NanoDays report, the NanoDays 2010 kit application, an online survey to all partner institutions, Tiers 1–3, public encounter estimates during NanoDays 2010, information from the Network database, and visits to 26 partner institutions. Overall, the study provided strong evidence that the Network has been successful in connecting with a range of institutions across the country and supporting these institutions in the delivery of nano education programs and activities. Key findings and implications are outlined below.

Key findings

1. *The Network has been highly successful connecting with a variety of institutions and supporting the delivery of nano education programs and activities.*

The Network has succeeded in connecting with a large number of institutions across the country, including museums, science centers, colleges and universities, schools, government policy organizations, and libraries. The overwhelming majority of partner institutions (98% of partner survey respondents) delivered some type of nano education program or activity during year five of the project. Many delivered and programs both during and outside of NanoDays.

2. *A number of mechanisms, including recruitment efforts, Network professional development opportunities, and NanoDays, have supported the Network's success.*

The Network includes a broad range of institutions and all of these, including small museums and universities, are contributing substantially to public outreach efforts. There were very few significant differences in the delivery of nano education activities and programs between different types of organizations. In other words, small museums, universities, and other types of institutions delivered activities and programs at a

comparable level to large museums. This is encouraging since these types of organizations represent the majority of the network. These findings also suggest that smaller institutions, such as small museums, may be dedicating a disproportionate level of resources to nano education compared to larger institutions.

There were differences in the delivery of nano education activities and programs by involvement tier, however. According to the study, Tier 1 and 2 institutions, compared to Tier 3, are providing a greater number, variety, and depth of nano education experiences. For example, Tier 1 and 2 institutions were over two times more likely to deliver cart demonstrations or facilitated activities at least a couple of times per month compared to Tier 3 institutions. Regardless of whether or not these differences were the result of professional development efforts targeted at Tier 1 and 2, the findings do suggest that the Network has succeeded in identifying and mobilizing a core group of institutions that are more deeply engaged in the topics of nanoscale science, engineering, and technology (NSET).

Across all involvement tiers, NanoDays has been a popular focus for partner institutions and potentially a catalyst for collaboration, further involvement in the Network, and increased investment in nano education. Participation in NanoDays was related to which activities institutions delivered, the sources of those activities, and the timing and frequency of activity delivery. Institutions that participated in NanoDays 2010 were three times as likely to deliver cart demonstrations or facilitated activities at least once a month compared to those institutions that did not participate. It is important to note that NanoDays provides a common route through which partner institutions deliver Network activities without participating in Network professional development.

Potential directions for years six through ten

1. *Increase the types of activities that institutions are delivering.*

Currently, institutions are primarily delivering facilitated activities and cart demonstrations (e.g., “exploring” NanoDays kit activities). In-depth experiences, such as science cafés and forums, are rarely offered. For example, based on the NanoDays reports, the NanoDays kit exploring activities were used by 99% of responding institutions during NanoDays 2010, while every other element of the kit was used by less than 10% of institutions. Science cafés and theater presentations were each used by only 2% of institutions. The Network might look closely at the reasons that institutions reported delivering some activities and not others, as well as the modifications that institutions are making to Network activities, to help identify barriers that organizations face in delivering more in-depth programs. One opportunity is for the Network to help institutions combine multiple smaller activities into longer programs. Overall, evaluation findings highlight the importance of activity modifications in shaping how Network educational products reach the public through partner institutions.

2. *Increase the frequency that institutions are delivering nano education activities and programs.*

The majority of respondents to the partner survey indicated that their institutions had delivered nano education activities and programs no more than a couple of times per year. Delivery frequency was highest for cart demonstrations or facilitated activities. However, only about a third of institutions (35%) reported delivering cart demonstrations or facilitated activities at least once a month or more. The Network should investigate further what factors motivate institutions to deliver programs and activities more often. One promising strategy is supporting institutions in integrating NISE Network activities into existing programs.

3. Support institutions in addressing societal and ethical issues related to NSET.

One of the goals of the Network during years one through five of the project was to increase public understanding of societal issues related to NSET. Based on partner feedback, many institutions struggled with addressing this goal. Of the 142 respondents that answered at least one of the open-ended questions on the NanoDays report, 58% indicated either that their institutions struggled with addressing goal three or that they felt that the goal was inappropriate for their audiences and contexts. These results suggest two challenges for the Network: (1) supporting some institutions in engaging visitors with societal issues related to NSET and (2) convincing other institutions that this goal is important and can be addressed in an informal learning environment.

4. Meet the needs of a broad range of partner institutions.

The Network is serving a broad range of partner institutions. Although there is much these institutions share in common, there are also important differences in the types of audiences they serve, the activity formats they focus on, and the ways they modify NISE Network activities and programs to fit with their existing programs and organizational goals. During the next five years the project, the Network could choose to develop programs and resources that work well for a variety of contexts or focus on the specific needs of particular groups of organizations.

Introduction

The Delivery and Reach study was part of summative evaluation efforts to assess the impacts of the NSF-funded Nanoscale Informal Science Education (NISE) Network during project years one through five and inform future development work in project years six through ten. While other summative evaluation studies address the impact of Network activities on public and professional audiences, the Delivery and Reach study was designed to broadly document the delivery of nano education activities at Network partner institutions and estimate the public reach of those activities. The study was driven by four evaluation questions:

1. *Which institutions delivered nano education programs and activities between July 2009 and June 2010?*
2. *What nano education activities were delivered by NISE Network partner institutions during this time period?*
3. *What factors influenced the delivery and reach of nano education activities?*
4. *How many individuals were reached by nano education activities during NanoDays 2010?*

Overall, information gathered through the Delivery and Reach study was intended to help NISE Network leadership better understand the scope and potential impact of the Network, including the types of nano education activities that were delivered and when, where, and how frequently they were delivered. Combined with findings from other summative evaluation activities, this information can inform the direction of the Network during the next five years of the project. The findings also have implications for other informal science education (ISE) practitioners interested in the broad implementation of ISE activities and programs and the development of national networks of researchers and ISE institutions. This report was written to inform the NISE Network executive and operations groups, project development teams and committees, and the National Science Foundation. A variety of project team members collaborated in the development of the report, including the NISE Network evaluation team and the Committee of Visitors.

The report is organized around the two major evaluation methods that comprised the study: the online NanoDays report, which captured the activities of Network partner institutions that applied for a NanoDays kit in 2010, and the online partner survey, which elicited information about nano education delivery and reach from all Network partner institutions, involvement tiers 1–3 (see below for definitions of involvement tiers). Additional data were collected from the NanoDays kit application, public encounter estimates during NanoDays 2010, the Network database, and on-site visits to 26 partner institutions. Findings specific to NanoDays 2010 are reported first, followed by data on the delivery and reach of Network partner institutions throughout year five. At the end of the report, we summarize findings and implications across all study methods. This report is designed to complement other summative evaluation findings, including evaluation of NISE Network exhibits and programs and Network professional development. Findings from all year five summative studies are summarized in the synthesis report prepared by the Museum of Science, Boston.

The project team can use these evaluation findings to inform years six through ten of the project in general and, specifically, to develop strategies for supporting the delivery and

reach of nano education experiences at partner institutions. An important consideration when reviewing this report is the ever changing nature of the NISE Network. Since the beginning of the project, the Network has continued to evolve and grow in response to evaluation findings and feedback from partner institutions. Prior to year five, the Network had already begun to set new goals and implement changes for years six through ten. For example, the concept of “involvement tiers” was developed during year four as part of years six through ten planning. Because these tier definitions quickly became an integral part of the Network structure, we chose to include them in the analysis of year five evaluation data. Some of the findings in this report, therefore, will reflect the history of the Network, while others will suggest future opportunities and potential for growth and improvement.

Organization of the Network

In year four of project, the Network developed a framework for describing the organization of partner institutions according to “involvement tier” (Table 1). These tier definitions have been used to categorize institutions (not individuals) based on the level of resources that the Network has committed to the institutions and their level of involvement in delivering nano education experiences. The tiers are conceived of as nested categories, so that all Tier 1 institutions are also Tier 2 institutions, and so on.

Table 1. *Definition of Network involvement tiers*

Involvement tier	Definition
1 Core partners	The goal of the Network is to increase the capacity of Tier 1 institutions to lead 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. These funded partners operate the Network.
2 Nano-infused partners	The goal of the Network is that nano content will be “infused” into Tier 2 institutional programming by the end of year 10. The Network is actively working to increase the capacity of these institutions to deliver nano education experiences beyond NanoDays as an ongoing, sustainable part of their programming. These institutions are the primary target of Network resources and professional development efforts, including regional workshops, online workshops, and Network-wide meetings.
3 Broad reach partners	The goal of the Network is that nano informal education will be “introduced” into Tier 3 organizations for at least a limited activity like participation in NanoDays or other type of nano educational outreach. The Network uses an open website and open-source catalog of educational materials, as well as presentations at professional conferences and other activities, to broaden the reach of nano education to these institutions. Tier 3 organizations may take materials or ideas from the Network and use them in their own way or incorporate them into their own programs.

This system has been an important organizing framework for the Network and was used as a way of comparing institutions in the analysis of year five evaluation data. It is important to note, however, that the definitions of the tiers have and will continue to shift. Therefore, comparisons by involvement tier reported in this study should be interpreted cautiously. The Network database also includes involvement tiers four (“involved but no outreach”), five (“interested, not involved”), and six (“not involved”). Because this study focused on the delivery and reach of nano programs and activities, these tiers were not included in the analyses.

Part I: DELIVERY AND REACH OF NANODAYS 2010

Year five of the project (2010) was the third year that the NISE Network encouraged partner institutions across the country to host NanoDays events. Like other national, subject-specific celebrations, such as National Engineers Week, National Chemistry Week, Women's History Month, and EarthDay, NanoDays is an opportunity for organizations to focus public attention on a single topic—in this case, on nanoscale science, engineering, and technology (NSET). NanoDays 2010 officially took place between March 27 and April 4. Over the last three years, the NISE Network has developed and distributed NanoDays kits to support institutions in hosting these events. The kit includes a variety of hands-on activities, promotional materials, and other resources. To receive the kit, institutions are required to complete an application indicating their interest and outlining their plans for NanoDays. Those institutions that are selected to receive the kit are also required to submit a NanoDays report after the event, describing the types of activities and programs they delivered during NanoDays. In 2010, 199 institutions received the kit. A digital version of the kit could also be downloaded for free from the NISE Network website and it is likely that many institutions participated in NanoDays 2010 without receiving the NanoDays kit.

To investigate the delivery and reach of NanoDays 2010, we analyzed data from both the NanoDays reports and kit applications. Analysis included 151 completed NanoDays 2010 reports, representing 147 unique institutions. Respondents were representative of the NanoDays kit applicants and the broader NISE Network based on organization type, involvement tier, and regional hub. During NanoDays, a select group of institutions were recruited to count visitor participation at nano education activities and programs. These counts were used to estimate the number of visitor encounters achieved at institutions who received the NanoDays 2010 kit. Data analysis was guided by the following evaluation questions:

1. *Which institutions participated in NanoDays 2010?*
2. *How did institutions collaborate during NanoDays 2010?*
3. *How did institutions market NanoDays 2010?*
4. *Which activities were delivered during NanoDays 2010?*
5. *Why did institutions choose to deliver certain activities and not others?*
6. *What did institutions report as successes and challenges of NanoDays 2010?*
7. *How did partner institutions support the NISE Network goals during NanoDays 2010?*
8. *How many visitors participated in NanoDays 2010?*

Key findings included:

- **Partner institutions provided overwhelmingly positive feedback** about the NanoDays kit and the Network in general.
- **There were over 470,000 participant encounters** at partner institutions during NanoDays 2010. This estimate was based on data from the NanoDays reports

and counts of public encounters at select institutions. It included both reporting and non-reporting partner institutions that received the NanoDays kit.

- **Different types of institutions are focusing on different audiences.** Large and small museums were significantly more likely to report serving family groups (100% and 95% respectively) during NanoDays compared to universities and other types of organizations (60%). Universities and other types of organizations most frequently reported serving school groups (64%), followed by family groups (60%) and adults only (41%).
- **Organizations are committing a substantial amount of staff resources to NanoDays.** Respondents reported a median of 10 internal staff and volunteers that participated in or helped organize the event. Small museums and universities may have invested a larger proportion of staff resources in NanoDays compared to large museums.
- **Collaboration is an important part of NanoDays for many institutions.** Seventy percent of institutions reported collaborating with another organization for the event. Of these institutions that reported collaborating, 100% indicated that at least one of those collaborations began as part of NanoDays 2010. Many organizations listed collaboration both as an important success of NanoDays and as an area where they desired more assistance from NISE Network.
- **Institutions are primarily delivering facilitated activities and cart demonstrations** (e.g., “exploring” NanoDays kit activities). Almost all respondents (99%) reported using the exploring activities from the NanoDays kit. Every other element from the NanoDays kit was used by less than 10% of institutions. There were very few significant differences in the use of activities by organization type, size, or involvement tier. On average, large museums delivered significantly more hours of facilitated activities and cart demonstrations (125 hours) compared to universities and other types of organizations (68 hours).
- **Institutions use a variety of strategies to market NanoDays to their audiences.** Almost all institutions reported marketing NanoDays 2010 to attract audiences to their events. Only 5% of respondents indicated that they did not use any of the marketing strategies listed in the NanoDays report. Universities and other types of organizations were less likely to use many of the marketing strategies compared to large and small museums. Many organizations requested additional assistance from NISE Network in marketing their events to the general public.
- **Institutions often have explicit criteria for choosing to deliver certain activities.** Audience appropriateness, hands-on and engaging, easy setup and implementation, and minimal staffing requirements were the most common reasons institutions chose to deliver certain activities over others.
- **Many institutions struggled to address societal and ethical implications** related to nanoscale science, engineering, and technology (NSET) during their NanoDays events. While some respondents felt that this topic was not appropriate for

their audiences, others requested more guidance and resources to engage the public with the implications of NSET.

Methods

Data on the delivery of nano education programs and activities at partner institutions during NanoDays 2010 were collected through an online NanoDays kit application, an online NanoDays report, and public encounter estimates at select institutions. In order to receive a 2010 NanoDays kit, institutions were required to complete an online kit application. Those institutions that received the kit were also required to use the online NanoDays report to describe the programs and activities they had delivered during their events. This overall approach followed protocol from year four NISE Network evaluation studies (Reich & Goss, 2009). Each of the methods is described in more detail below.

NanoDays kit application

All institutions that received the NanoDays 2010 kit were required to complete a NanoDays kit application. The application was administered through Survey Monkey. Of the 220 institutions that completed the application, 187 received the kit. A small number of kits were intentionally held back and distributed later to a group of 12 institutions, including those attending the Network Spring training workshop). These last institutions were not included in this report because their information was not available at the time of analysis. A copy of the 2010 NanoDays kit application is included in Appendix A.

NanoDays report

In exchange for receiving a NanoDays kit, institutions were required to complete an online NanoDays report describing the activities that had been delivered during the event, staff involved in the event, collaborations with other organizations, marketing efforts, and general feedback on the success of NanoDays 2010 (see Appendix B for a complete copy of the online reporting instrument). The report was administered through Survey Gizmo. E-mails with the report link were sent to all kit recipients on March 23, prior to NanoDays. Reminders were sent to those who had not yet completed the report on April 15, 23, 30, and May 20. The last two weeks of April, phone call reminders were also made. Phone calls were prioritized to target geographic regions that were underrepresented in the submitted reports. Links to the report were also posted on the nisenet.org website. Because of this, 13 institutions who did not receive the NanoDays 2010 kit but did hold a NanoDays event completed the 2010 NanoDays report. These institutions may have downloaded the digital kit from the Network website or used activities and programs from other sources. As an incentive for completing the report, respondents were offered the chance to win free registration and a travel stipend to a major professional development conference.

Although the NanoDays report remained available throughout the summer of 2010, data were downloaded from Survey Gizmo for the purposes of the Delivery and Reach study on May 25. At that time, there were 151 completed reports. Only the completed reports were included in the analysis. In a few cases, multiple reports were submitted by the same institution. These were combined or reconciled as appropriate, depending on whether or

not they represented duplicate reports for the same event or reports of multiple events. In total, data from 147 institutions were included in the analysis.

Public encounter estimates

We measured the overall public reach of NanoDays 2010 across partner institutions by generating an estimated number of “public encounters” at institutions that received the NanoDays 2010 kit, including institutions that did and did not complete the NanoDays report. The term “public encounters” is used instead of number of participants because it was impossible to determine whether participant count estimates represented unique individuals or duplicates across several activities. To estimate number of public encounters, we generated an estimated number of encounters per activity type, institution type, and institution size. This was done in three steps, following the protocol developed in the year four summative evaluation (see Reich & Goss, 2009).

First, partner institutions were recruited to count public encounters at select activities and programs. The NanoDays 2010 kit application included a question asking institutions to indicate whether or not they would be willing to participate in evaluation activities. The 110 institutions that indicated they would be willing to participate were contacted via e-mail using Mail Chimp, an online mail campaign service. Two e-mail reminders were sent, followed by one round of telephone calls. Telephone reminders were specifically targeted at medium, small, and very small museums, as well as universities and other types of institutions. The goal of this reminder strategy was to help ensure that study participants would better represent the institutions that had received the NanoDays 2010 kit. Institutions that agreed to participate were assigned to count public encounters at specific activities, following the activity selection and counting protocol developed in year four (Reich & Goss, 2009). Data for each activity type were compiled and the medians calculated by institution type and size.

Second, through the NanoDays report, institutions were asked which activity types they delivered and with what frequency. Finally, the estimated median counts for each activity by institution type and size (as calculated in the first step), combined with the frequency of each activity type reported by institutions in the NanoDays report, was used to generate an approximate number of public encounters for each institution. This number was compiled, cross-checked with other assumptions, and adjusted accordingly. This entire process is outlined in detail below.

Network database

Analysis of the delivery and reach of partner institutions during NanoDays 2010 relied on data from the Network online database. Early in the project, The Network began to track data from participating individuals and institutions through Quickbase, an online database service (<http://quickbase.intuit.com/>). Several times a year, project staff and regional hub leaders update the database using a variety of information sources, including NanoDays kit applications, evaluation data, and personal knowledge of partner institutions. For some types of institutional information, such as organization type, categorizations are based on information directly from partner institutions. In other cases, however, classifying partner organizations is done according to the best judgment of project staff. For example, regional hub leaders classify institutions by involvement tier

based on their knowledge of the institutions' involvement with the Network. Although project leaders sent a reminder to hub leaders about the definitions of involvement tiers prior to the June 2010 update of the database, differences in how these tier levels are interpreted may make these classifications less reliable.

Data analysis

Close-ended responses from the kit application and the NanoDays report were analyzed using SPSS 17. Because the majority of data were categorical, analyses were done with Pearson's chi-square tests unless noted. Open-ended responses were coded inductively using Microsoft Excel, following a manifest content analysis approach, and included in the final quantitative analysis. For each question, one coder reviewed responses and noted key points and main messages. This initial round of coding was used to develop a draft code list based on emergent themes and patterns among the responses. After discussion and review with the lead evaluator, the code list was finalized and each response was recoded using this final list. Multiple codes could be assigned to each participant response. When there were overlapping responses to several questions, these questions were coded as a group.

After final coding was complete, a second coder recoded a portion of the data to check for interrater reliability. This coder had reviewed the existing codebooks but had no knowledge of the codes assigned by the first coder. For each question, 50 responses were recoded and then compared to the first round of coding. If an 80% interrater reliability rate was achieved, discrepancies were resolved but the remainder of responses was not recoded. If the rate was below 80%, discrepancies were discussed and resolved and the second coder coded another 50 responses. This process was repeated until an 80% reliability was achieved. To count as agreement, codes needed to match exactly for each response, even if the response was assigned multiple codes. For example, if the first coder assigned a response three separate codes, to achieve agreement, the second coder needed to have assigned the same response the exact three same codes. A second round of coding was required for only one question. When discussing findings from open-ended questions below, we include only relevant portions of the responses.

Findings

Which institutions participated in NanoDays 2010?

In total, 220 institutions applied for the NanoDays 2010 kit. Of these, 187 received kits. Twelve additional kits were sent to institutions who did not apply during the regular application period. These last institutions were excluded from this report because kit application data were not available at the time of the analysis. As of May 25, 2010, 151 reports had been submitted, representing 147 unique institutions. Table 2 compares institutions that received the NanoDays kit to those that completed the NanoDays report, as well as to all partner institutions, based on data from the Network database. Thirteen of these institutions completed the NanoDays report without having applied for the NanoDays kit.

Table 2. Comparison of institutions that completed the NanoDays report, institutions that applied for the NanoDays kit, and all Network partners, by organization type, involvement tier, and region

	NanoDays Report (n = 147)	NanoDays kit ¹ (n = 187)	NISE Network ² (n = 354)
<i>Organization type</i>			
Museum/Science Center	60%	57%	46%
University	31%	25%	35%
Other	9%	18%	19%
<i>Involvement tier</i>			
Tier 1	8%	7%	5%
Tier 2	41%	36%	31%
Tier 3	51%	57%	65%
<i>Regional hub</i>			
DC ³	1%	0%	3%
East	10%	9%	10%
Midwest	18%	15%	16%
Northeast	18%	20%	19%
South	9%	10%	9%
Southeast	20%	21%	16%
Southwest	12%	11%	12%
West	13%	15%	11%

¹ Based on the data available for the initial kit application analysis, April 2010. ² Based on data from the NISE Network database as of August 2010. Involvement tiers four through six and individuals only were excluded from the analysis. Regional hubs excluded international, no node, and unknown. ³ For years six through ten, the DC hub will be combined with the East hub.

Museums and science centers made up the majority of reporting institutions (60%), followed by colleges and universities (31%) and other institutions (9%). Half of reporting institutions (51%) were classified as Tier 3. Reporting institutions were well distributed across the Network regional hubs. Three-quarters of institutions (76%) indicated that they had participated in NanoDays 2009. In general, the sample of respondents reflected the NanoDays kit applicant pool and the Network as a whole. Museums and science centers were overrepresented in the NanoDays kit applications and reports, while other types of institutions were underrepresented in the NanoDays reports. Tier 2 institutions were slightly overrepresented in the NanoDays report compared to the kit applications and the Network as a whole, while Tier 3 institutions were underrepresented.

Museums and science centers that participated in NanoDays 2010 were further classified by size, based on self-reported annual budget (Table 3). When annual budget information was not available, we used square footage of exhibit space, as reported in the ASTC 2008 sourcebook (ASTC, 2008).

Table 3. Museum size classification

Museum size	Annual budget	Interior exhibit space (ft. ²)
Large	>\$6.5 million	>50,000
Medium	\$2.5 million-\$6.5 million	25,000-50,000
Small	\$1 million-\$2.5 million	12,000-25,000
Very small	<\$1 million	<12,000

Note. Categories from 2008 ASTC sourcebook (ASTC, 2008).

The majority of reporting institutions (70%) were either small or very small museums (Table 4). The sample of reporting institutions was a good representation of the kit applicant pool. For subsequent analyses, reporting institutions were classified by “organization category” according to whether they were large museums (including medium-sized museums), small museums (including very small museums), or universities and other types of institutions. This facilitated more robust analyses by increasing the sample size in comparison categories.

Table 4. Museums and science centers by size

Museum size	NanoDays report (<i>n</i> = 82) ¹	NanoDays kit application (<i>n</i> = 103)
Large	16%	20%
Medium	15%	14%
Small	32%	29%
Very small	38%	37%

¹ Six museums could not be classified by size because annual budget and exhibits square footage information was not available.

To explore the types of audiences being reached by NanoDays, respondents were asked to self-report whether or not they noticed family groups, school groups, or adult-only groups at their institutions during the event (Table 5).

Table 5. Types of visitor groups reported by institutions

Visitor group	Universities and other			Total (<i>n</i> = 147)
	Large museums (<i>n</i> = 25)	Small museums (<i>n</i> = 57)	(<i>n</i> = 59)	
Family groups**	100%	95%	60%	84%
School groups	60%	46%	64%	56%
Adult-only groups	52%	28%	41%	37%

Note. Respondents reported whether or not they saw any groups of each type during the NanoDays event.

p* < 0.05. *p* < 0.01.

Although these results represent a very crude measure of audience participation, they do reveal interesting differences, or at least perceptions of differences, in the types of

audiences being served at different institutions. Overall, the most frequently reported audience was family groups (84%), followed by school groups (56%) and adult-only groups (37%). Large and small museums were much more likely to report having noticed family groups compared to universities and other types of institutions. Differences in the number of institutions reporting school and adult-only groups were not statistically significant.

How did institutions collaborate during NanoDays?

Survey respondents were asked to describe the involvement of internal and external staff in planning for and implementing their NanoDays events. Respondents listed the names and the job titles of staff and volunteers from their institutions who played a significant role in organizing NanoDays and the total number of staff and volunteers who participated in or helped organize the event. They also listed institutions with which they collaborated for NanoDays, including universities and colleges, and indicated whether or not the relationships had begun with NanoDays 2010. Finally, they indicated the number of college or university staff members or students that participated in the event.

Table 6 shows the mean and median number of internal staff and volunteers and university staff and students that participated in or helped organize the event. Most institutions reported that a substantial number of internal staff and volunteers were involved in the event (median = 10). Very few institutions, on the other hand, involved a substantial number of university staff and students. Although the average number of university staff and students for all institutions was 7.5, the median was only 0.5, indicating that only a few institutions collaborated with a large number of university staff and students. Differences by organization category were not statistically significant (Kruskal-Wallis test). This result suggests that small museums and universities at these institutions may involve a greater proportion of staff resources in NanoDays compared to large museums.

Table 6. Average and median number of staff involved in planning and implementing NanoDays events

Staff members	Total (n = 147)	
	Mean	Median
Internal staff and volunteers	14.8	10.0
University staff and students	7.5	0.5

In general, collaboration was an important part of NanoDays 2010 for many institutions (Table 7). Seventy percent of institutions reported collaborating with another institution for the event and 53% reported specifically collaborating with a university or college. All institutions that reported collaborating indicated that at least one collaboration began with NanoDays 2010. Differences by organization category were not statistically significant.

Table 7. Collaboration with other institutions for Nanodays 2010

Collaboration	Percent of total
Collaborated with another institution (<i>n</i> = 147)	70%
Collaborated with a university (<i>n</i> = 143)	53%
Collaboration began with NanoDays (<i>n</i> = 104)	100% ¹

¹ Of the institutions that reported collaborating for NanoDays.

How did institutions market NanoDays 2010?

Institutions reported using a variety of strategies to market NanoDays 2010 (Table 8). Almost all institutions reported marketing NanoDays 2010. Only 5% of respondents indicated that they did not use any of the marketing strategies listed in the survey. In particular, institutions relied on electronic forms of marketing. The most frequently reported strategies were websites (71%), e-mail (63%), and word of mouth (63%). The least common were TV (11%), radio (16%), and newspapers (33%). There were several statistically significant differences in the strategies reported by organization category. Small and large museums were much more likely to report using newsletters and social media compared to universities. The data suggest that in general universities and other institutions marketed NanoDays 2010 less compared to museums.

Table 8. Frequency of reported marketing strategies, by organization category

Marketing strategies	Large museums (<i>n</i> = 25)	Small museums (<i>n</i> = 57)	Universities and other (<i>n</i> = 59)	Total (<i>n</i> = 141)
Website*	84%	79%	58%	71%
E-mail	60%	74%	54%	63%
Word of mouth	52%	63%	68%	63%
Newsletters***	64%	74%	32%	54%
Pamphlets	36%	60%	59%	54%
Social media***	48%	65%	25%	44%
Newspapers*	20%	46%	27%	33%
Other	20%	14%	32%	22%
Radio	16%	18%	14%	16%
TV	16%	9%	12%	11%
None	8%	4%	4%	5%

Note. For the statistical analysis of "none," large and small museums were combined because of low expected cell counts. Differences were not statistically significant between museums and universities and other institutions.

p* < 0.05. *p* < 0.01. ****p* < 0.001.

Almost a quarter of institutions (22%) reported using a different marketing strategy not mentioned in the survey. Examples included press releases, marketing in conjunction with other events, targeted marketing to specific audiences (e.g., schools, homeschool networks), listservs, community calendars, marketing to internal staff, and marketing through other organizations (e.g., museums or schools). Universities were slightly more likely than large and small museums to report using other types of marketing strategies. The NanoDays 2010 kit included a variety of marketing materials. Survey respondents were asked which, if any, of the materials they used to market their events (Table 9). The

NISE Network logo was the only marketing material used by over half of institutions (68%). Almost none of the institutions used the letterhead (7%), T-shirt art (5%), or envelope (1%). Differences by organization category were not significant.

Table 9. *Type of materials used to market NanoDays*

Type of material	Percent of total (n = 147)
Logo	68%
Clipart	40%
Labels	23%
Banner	22%
Press release	20%
Poster	19%
Letterhead	7%
T-shirt	5%
Envelope	1%
None	21%

Which activities were delivered during NanoDays?

Survey respondents reported whether or not they had used each element from the NanoDays 2010 kit, including the exploring activities, zoom interactive media, forums, DECIDE nano game, science cafés, or the museum theater presentation (Table 10). By far the most commonly used elements were the exploring activities (99%). In contrast, every other element of the NanoDays kit was used by less than 10% of responding institutions. Science cafés and theater presentations were each used by only 2% of institutions. Differences by organization category and involvement tier were not statistically significant.

Table 10. *Frequency of use of NanoDays kit elements by organization type*

Kit elements	Percent of total (n = 147)
Exploring activities	99%
Zoom interactive media	9%
Forums	8%
Decide nano game	8%
Science cafés	3%
Theater presentation	2%
None	1%

Respondents also provided information on which specific kit exploring activities they used and how many hours each was available to visitors (Table 11). In general, most of the exploring activities were well used across all institutions. Ten of the 12 activities were used by at least 60% of institutions. The most frequently used were *nano fabric* (86%), *ferrofluid* (84%), and *buckyballs* (83%). *Stretchability* was used by less than half of institutions (45%), while only a third of institutions (33%) used the *self-assembly* activity.

Both of *stretchability* and *self-assembly* are unique activity formats which may not be appropriate for all settings. Qualitative responses noted that these were often left out due to a lack of space. There were very few statistically significant differences in use of the NanoDays kits by organization category or by involvement tier. Tier 2 institutions were most likely to use the *liquid crystal activity* (82%), followed by Tier 3 (69%) and Tier 1 (50%)¹.

Table 11. Proportion of institutions using specific NanoDays exploring activities

Exploring activities	Respondents (n = 147)
Nano fabric	86%
Ferrofluid	84%
Buckyballs	83%
Gravity	77%
Surface area	74%
Liquid crystal	73%
Scanning probe microscope (SPM)	73%
Human body	71%
Ruler	65%
Molecules	61%
Stretchability	45%
Self-assembly	33%

The most frequently used exploring activities were not necessarily the ones that were available to visitors for the most hours (Table 12).

Table 12. Median reported hours for NanoDays exploring kit activities, by organization category

Activity	Large museums	Small museums	Universities and other	Total
Buckyballs	6.0	6.0	4.1	6.0
Human body*	6.0	6.0	4.0	6.0
SPM	6.0	5.5	5.0	5.0
Ferrofluid	6.0	5.0	4.0	5.0
Nano fabric*	7.0	5.0	4.0	5.0
Gravity	5.5	5.0	4.0	5.0
Stretchability	6.0	4.0	4.0	4.5
Ruler*	6.0	5.0	3.5	4.5
Molecules	6.0	4.0	4.0	4.0
Liquid crystals	6.0	4.0	4.0	4.0
Self-assembly	5.0	4.0	4.0	4.0
Surface area	4.0	4.0	4.0	4.0

Note. Sample size varied by activity and institution type. Significance calculated using a Kruskal-Wallis test.

* $p < 0.05$.

¹ $\chi^2(2) = 5.986, p = 0.05$.

Based on median reported hours², *buckyballs* were available the longest (six hours). *Gravity*, *nano fabric*, *ferrofluid*, *human body*, and the *scanning probe microscope (SPM)* activities were all available to visitors for a median of five hours. A comparison of delivery frequency and reported hours suggests possible ways that different activities are being used. For example, *ferrofluid* and *buckyballs* are popular choices for many institutions and are also left out for visitors for longer times. The *SPM activity*, while not the most frequently used, was available to visitors for longer at those institutions that chose to deliver it. The *self-assembly activity* is neither frequently used nor is it available to visitors for very long, possibly because, as indicated by partner feedback, it required more space than other activities. However, for the few institutions that did use the *stretchability activity*, it was available to visitors for a substantial amount of time. Institutions may be balancing trade-offs between popular, highly engaging activities and those that take fewer resources to maintain on the floor.

Differences by organization category were statistically significant for the *ruler*, *human body*, and *nano fabric activities*. Based on post-hoc tests³, small museums reported significantly more hours of the *ruler activity* (median = 5.5) compared to universities (median = 3.5). Large museums reported significantly more hours of the *nano fabric activity* (median = 7.0) compared to universities and other organizations (median = 4.0). Similarly, the number of hours reported for the *nano fabric activity* was significantly different between large museums and universities and other organizations. Post-hoc tests showed no statistically significant differences for the *human body activity*.

Only 10% of institutions reported delivering either science cafés or forums from the NanoDays kit. Differences by organization category and involvement tier were not statistically significant.

Table 13. Proportion of institutions that delivered specific types of activities from the Network online catalog, by organization type

Catalog activity	Museums and science centers (n = 88)	Universities and other (n = 59)	Total (n = 147)
Cart demonstrations and facilitated activities **	49%	25%	40%
Displays	16%	27%	20%
Media	15%	12%	14%
Classroom activities	9%	10%	10%
Exhibits	8%	9%	8%
Stage presentations	6%	7%	6%
Forums	3%	5%	4%
Museum theater	3%	0%	2%
None*	36%	56%	44%

Note. Because of low expected cell counts, a Fisher's Exact Test was used for stage presentations, museum theater, exhibits, and forums.

* $p < 0.05$. ** $p < 0.01$.

² The median is reported because of the highly skewed nature of the data.

³ Mann-Whitney, using a Bonferroni-corrected critical value of 0.0167 (0.05 / 3 = 0.0167) (Field, 2009).

In addition to reporting activities from the NanoDays kit, survey respondents also indicated the types of activities they had used from the online nisenet.org catalog (Table 13). The catalog was used much less frequently than the NanoDays kit activities. Forty-four percent of institutions reported that they had not used activities from the online catalog. Cart demonstrations and facilitated activities were the most frequently reported activity type (40%), followed by displays (20%), media (14%), and classroom activities (10%). All other types of catalog activities were used by less than 10% of institutions. Museums and science centers were much more likely to report using cart demonstrations or facilitated activities from the online catalog (49%) compared to universities and other organizations (25%). Universities and other organizations, on the other hand, were much more likely to report not having used any of the online catalog activities (56%) compared to museums and science centers (36%). These differences may indicate that universities and other types of organizations are less aware of the online resources. Museums were not broken out by size because of low expected cell counts.

Why did institutions choose to deliver certain activities and not others?

Respondents were asked to describe some of the reasons that they chose to deliver certain activities and programs from the NanoDays kit or online catalog and not others. Open-ended responses were coded and analyzed as described above. Interrater reliability on the first 50 responses was at least 80%. Table 14 shows the frequency of each code category. The five most frequent categories are described below (see Appendix C for detailed descriptions of code categories). Responses could be assigned multiple codes.

Table 14. *Coded reasons institutions chose some NISE Network activities and not others*

Reasons	Respondents (n = 145)
Audience appropriate: age	32%
Engaging activities	25%
Ease of implementation	21%
Low staffing needs	19%
Staff favorites	17%
Other	15%
Space considerations	15%
Quick activities	14%
Ease of understanding	11%
Low cost	11%
Related nano to the real world	3%

Note. Responses could be assigned multiple codes.

The most commonly cited reason (32%) for choosing particular NanoDays activities was age appropriateness, including appropriateness for a specific audience or a wide range of ages. These responses were coded as “audience appropriate: age.” Representative responses included:

- *The [museum] choose kid friendly activities and tried to match them with specific grade levels. The majority of the activities could be adapted for very young children but were also interesting to adults.*

- *We were also addressing primarily high school kids, so we needed things interesting to/age appropriate for them.*
- *The age range of our patrons is young (very young at times). Some of the activities in the NanoDays kit required more attention span than most of our participants would be willing to provide...Exploring Measurement–Ruler would only have become an activity to practice fine motor skills (scissor skills) for most.*

The next most frequent response code (25%), “engaging activities,” included organizations that chose activities because they were the most engaging or hands-on. These responses emphasized activities that were showy, interactive, and fun. Representative examples included:

- *We tried to use those that were more interactive and “showy.”*
- *We chose the activities that were the most hands-on and engaging.*
- *“Fun Factor.”*

“Ease of implementation” was another common response category (21%). These institutions desired activities that were easy to set up and clean up and required little staff training. Representative examples included:

- *I wanted to do something that I knew my volunteers could pick up very quickly.*
- *Ease of implementation. Availability of supplies. Level of training required of instructors.*
- *Love the kit and used it because it was easy to understand and quick to use.*

The 19% of responses coded as “low staffing needs” reflected a need to have activities that could be conducted safely with few staff resources. These institutions preferred activities that were self-directed and required little staff supervision. Representative examples included:

- *We needed things that were interactive without requiring too much supervision.*
- *Our NanoDays event featured activities out of the kit. The activities we selected to use were easy for the public to do without much assistance or supervision.*
- *Level of involvement required from visitors. Activities that were easy as “do-it-yourself stations” and did not need to be facilitated 100% of the time.*

For the next most common code (17%), “staff favorites,” respondents chose activities from the kit that were similar to their own research interests or that appealed to other staff or volunteer educators. Some respondents stated that they let staff and volunteers choose the activities that were most appealing to them. Representative responses included:

- *Preference and relevance to our own research activities.*
- *Relevance to scientist’s activities.*
- *My volunteers came in for a training day and were shown all of the kits from this year and last. At the end of their training, they chose which materials they wanted to present.*

There were very few statistically significant differences in reported reasons for choosing some activities and not others by organization category or involvement tier. Universities and other organizations were less likely to list low staffing needs as a reason for choosing

specific activities (9%) compared to small museums (25%) and large museums (28%)⁴. Universities and other organizations were more likely to list reasons that fell into the “other” category (21%) compared to small museums (5%) and large museums (12%)⁵. Tier 1 institutions were much more likely to choose activities based on staff preferences (50%) compared to Tier 2 (13%) and Tier 3 (15%)⁶.

What did institutions report were successes of NanoDays 2010?

Respondents were asked to describe the goals they successfully met for NanoDays 2010. Responses were coded as described above. Table 15 shows the frequency of code categories for these responses. Interrater reliability was 73% for the first 50 responses and 88% for the second 50. The five most frequent categories are described below (see Appendix D for detailed descriptions of code categories). Responses could be assigned multiple codes.

Table 15. Coded successes institutions reported for NanoDays 2010

Successes	Respondents (n = 147)
Introduced nano	48%
Reached children/family audiences	39%
Created fun experiences	29%
Collaboration	20%
Increased visitors	16%
Related nano to real world	14%
Involved experts	12%
Taught others to teach	12%
Other	40%

Note. Responses could be assigned multiple codes.

The most frequently reported success (48%) was introducing nanotechnology to the public. This code, “introduced nano,” included responses related to introducing the general public to nanotechnology, educating visitors who had never heard of nanotechnology, and increasing awareness or interest in nanotechnology. Representative examples included:

- *We successfully introduced many visitors to the topic of nanotechnology.*
- *Lots of great feedback that people understood nanotechnology better.*
- *One of our main goals is to introduce the concept of nanotechnology to those who have never heard of it, and broaden the knowledge of those who have. I think we definitely met this goal, in a fun and interactive manner.*

⁴ $\chi^2 (2) = 6.40, p < 0.05.$

⁵ $\chi^2 (2) = 6.33, p < 0.05.$

⁶ $\chi^2 (2) = 9.91, p < 0.01.$

Another success often cited by respondents (39%), coded as “reached children,” was engaging young children and families. Many organizations felt they had successfully introduced nano to young children or that they had made nanotechnology understandable to visitors of all ages. Representative examples included:

- *NanoDays is run as a family science-style program: the focus is on children and their caregivers learning together. The activities that we selected were sometimes modified to be more hands-on (less of a demonstration-style) so that we can meet our goal of providing a high level of adult/child interaction.*
- *We effectively engaged children of different ages, approaching the demonstration differently depending on what interested the child.*
- *We actually engaged kids this time! Thanks to the NISE kits, we really held everyone’s attention at once. Because my background isn’t Nanoscience, the kits helped me tremendously to present information to kids K–12 in an engaging way. Our content was much more focused, and we could engage several at once.*

Respondents were also very pleased with the nature of the activities included in NanoDays. Coded as “created fun experiences,” these responses (29%) focused on delivering fun, hands-on, interactive exhibits and activities for visitors. Representative examples included:

- *I think our primary goal was to introduce nanoscience to the public in a fun and entertaining fashion. I think that we accomplished that goal.*
- *Provided an engaging and accessible introduction into nano.*
- *We were able to provide interesting, engaging activities for visitors to do themselves. Visitors were enthusiastic and several families returned later in the month to try other activities.*

“Collaboration” was the next most frequently cited success (20%). Responses indicated that, overall, collaboration with partner universities, museums, or organizations was important and allowed institutions to do more during NanoDays than they would have been able to on their own. Representative examples included:

- *We also were happy to find a new partner in... a monthly science cafe in [our city]. This partnership brought new people to [a museum] event, as we noticed that a large percentage of respondents responded to the [monthly science café program] email, are not affiliated with the [museum], but are interested in our newsletter.*
- *The partnership with the [university] allowed us to expand beyond the scope of our usual capacity.*
- *Made excellent connections with [university] professors about continuing programs such as this on a yearly basis.*

Many respondents (16%) indicated that NanoDays helped increase attendance. This code, “increased visitors,” indicated that attendance was an important goal of NanoDays for these institutions. Representative examples included:

- *Special events such as NanoDays create increased visitor returns because they offer something different. This is particularly true among members who visit more frequently.*
- *We met our goal of making Nanodays bigger and better this year. We more than doubled our visitation and expanded the range of activities offered so that there were activities suited to everyone.*

- *We wanted to achieve 300 visitors. We were able to get 450 people. This was our first effort with NanoDays and we felt it was a huge success.*

There were several significant differences in reported successes by involvement tier (Table 16). Tier 1 organizations were less likely to list “introducing nano” as a success compared to Tiers 2 or 3. Tier 1 institutions were more likely to indicate that “collaboration” and “involving experts” were successes compared to Tiers 2 and 3. There was only one significant difference in reported successes by organization category. Small museums were more likely to have listed “creating fun experiences” as a success⁷. Thirty-nine percent of small museums reported this as a success of NanoDays, compared to 16% of large museums and 22% of universities and other organizations.

Table 16. Coded successes institutions reported for NanoDays 2010, by involvement tier

Successes	Tier 1 (n = 12)	Tier 2 (n = 60)	Tier 3 (n = 75)	Total (n = 147)
Introduced nano*	8%	53%	49%	48%
Reached children/family audiences	17%	38%	43%	39%
Created fun experiences	17%	28%	31%	29%
Collaboration***	58%	25%	9%	20%
Increased visitors	33%	17%	13%	16%
Related nano to real world	17%	10%	16%	14%
Involved experts*	25%	17%	5%	12%
Taught others to teach	0%	13%	12%	12%
Other	33%	40%	35%	37%

* $p < .05$, ** $p < .01$, *** $p < .001$.

How did partner institutions support the NISE Network goals during NanoDays 2010?

Respondents were asked to describe in what ways, if any, they supported each of the three public impact goals for the NISE Network during their NanoDays events. These goals were

1. *increase awareness of nanoscale science, engineering, and technology (NSET) and its multiple, potential benefits and impacts on lives and communities;*
2. *increase understanding of the structure of matter and the forces at work on the nanoscale; and*
3. *increase understanding of societal issues, including risk assessment and abatement, and the importance of broad citizen participation in discussions about responsible research and development of new technology.*

Responses to the questions about each of these three impacts were coded as a group, as described above. Interrater reliability was 92% for the first 50 responses. Table 17 shows the frequency of code categories (see Appendix E for detailed descriptions of code categories). Responses could be assigned multiple codes.

⁷ $\chi^2(2) = 6.04, p < 0.05$.

Table 17. Coded ways institutions reported NISE Network goals

NISE goal responses	Total (n = 147)
Types of activities used	81%
Benefits for visitors	62%
Goal deemed inapplicable	44%
Topics covered	43%
Need age adaptation	29%
Age barriers	16%
Organizational barriers	10%
Other	7%

Note. Responses could be assigned multiple codes.

The majority of respondents felt that by delivering kit activities, they were supporting the first two NISE Network goals. Their responses to these questions were often a description of what activities they chose. Responses described which activities they chose, the topics covered, and benefits to visitors. These answers were captured in the codes “types of activities used” (81%), “topics covered” (43%), and “benefits for visitors” (62%). Representative examples included:

- *Most of our activities focused on simply understanding what nanoscience is and what new products it is creating. Nearly 200 children plus their parents visited all 8 stations and many more visited at least one station. All these visitors came away with some awareness of nanoscience that they may not have had before.*
- *I'm pretty sure every activity, poster, thing that had the word “nano” on it, etc. that we had supported this goal.*
- *Most guests who participated in the ferrofluid, Gravity, and surface area activities considered the activities informative and were able to infer that the structure of matter at the nanoscale, and the forces that act upon it, differ compared to other scales of matter.*

Almost half of respondents (44%) reported difficulty meeting the third overall Network goal related to societal and ethical implications of NSET. Some felt that the topic was inappropriate for their event or target audience. This was captured in the code “goal deemed inapplicable.” It is important to note that although societal and ethical implications of NSET is a growing focus of the Network, the majority of NanoDays 2010 kit activities and programs were not designed with this goal in mind. Representative examples included:

- *Those issues were not really a goal or agenda of our NanoDays event.*
- *Social issues, risk assessment and related discussion was not part of our forum.*
- *Really didn't approach this topic much due to the age and type of general visitors we had.*

Another reported challenge to reaching the third goal was visitor age. Some organizations (16%) felt that messages about social implications were too difficult for young children to grasp. This was captured in the code “age barriers.” Representative examples included:

- *These topics are a little complex for our young and transient audience so we did not focus on this goal.*

- *Ours did not address this as much, because we were focused primarily on younger children.*
- *Because of our population, families with young children, we didn't stress this particular goal. This was a bit over the head of the average second-grader.*

Some organizations (29%) chose to support the third goal through adult-only forums, while others expressed a desire to learn how to present this topic to a young audience. These age adaptations or desire to learn how to adapt to different ages, were coded as “age adaptation.” Representative examples included:

- *Provide tools to explain the 3rd goal to a much younger audience.*
- *We address this in some of our workshops that involve older students/adults. We often times don't get into this with our younger audiences. This is something that we as an institution need to work on.*
- *This part of the world is heavily agricultural. In several adult-only presentations I fielded a number of questions about nanotechnology and its impact on bioengineering.*

There were very few significant differences in how institutions reported supporting Network public impact goals by organization category or involvement tier. Tier 2 organizations were more likely to have “other” ways of supporting Network goals (13%) compared to Tier 1 (0%) or Tier 3 organizations (3%)⁸. Small museums were most likely to support Network goals via “benefits to visitors” (77%), followed by large museums (60%) and universities and other organizations (49%)⁹.

What challenges did partner institutions face in implementing NanoDays 2010?

Respondents mentioned challenges faced when implementing NanoDays 2010, as well as suggestions for how the Network could provide more support, in their responses to the following three questions:

1. *Which of your goals were you less successful at meeting? If possible, please elaborate on why you think you were less successful.*
2. *Is there anything the NISE Network could have done to help you better meet these goals?*
3. *How could the NISE Network help you support these goals [NISE Network public impact goals] in the future?”*

Responses to these three questions were coded as a group, as described above. Table 18 shows the frequency of each code category (see Appendix F for detailed descriptions of code categories). Interrater reliability was 92% for the first 50 responses. Responses could be assigned multiple codes.

⁸ $\chi^2 (2) = 6.94, p < 0.05.$

⁹ $\chi^2 (2) = 9.79, p < 0.01.$

Table 18. Coded challenges and suggestions from partner institutions related to NanoDays 2010

Suggestions	Total (n = 147)
No suggestions	60%
Low attendance	23%
Limited resources	21%
NISE net goal 3	17%
Publicity	12%
Age issues	12%
Change of date	11%
Collaboration	10%
Other	40%

Note. Responses could be assigned multiple codes.

The majority of respondents (60%) loved the kit and had no suggestions to make other than to continue the good work. These responses were coded as “no suggestions.”

Representative examples included:

- *No! The kits were fantastic.*
- *None. A great day, great experiences and wonderful results.*
- *Keep producing and providing fantastic supplies at no charge!! Thank you.*

The most common (23%) problem that respondents noted was the issue of low attendance. This was captured in the “low attendance” code (other code categories suggest reasons why attendance may have been low). Representative examples included:

- *Our school group attendance was lower this year but fieldtrips have been cut from our school district’s budget.*
- *We did not meet our attendance goal. This year, NanoDays week was the week before Easter, and there are so many other activities to compete with our events.*
- *Attendance was particularly low. We normally host 250–300 guests for a family science-style event like NanoDays and have had better attendance in the past. We’re not sure if the beautiful weather or concurrent events at [specific exhibition] kept people from coming to [the museum]. There were also pre-Easter and Passover events happening on March 27th that could be considered as “competing.”*

Many organizations (21%) had responses that fell under the “limited resources” category. These organizations struggled with space, time, staffing, and budgetary shortfalls, which prevented their event from reaching its full potential. Representative examples included:

- *The network was great! We just have limited resources (people, time and money) here, and these were a lot more difficult to deal with than expected.*
- *Perhaps if NISEnet could provide some funding to go towards extra hours to part-time education staff it would allow us to provide more Nano education opportunities to the public.*
- *We would have liked to have offered more activities (from the catalog) in addition to the ones found in the kit. But time (to organize and train staff) got away from us.*

Again, a number of organizations (17%) had trouble reaching NISE Network’s third goal related to societal implications or requested assistance addressing this goal. These responses fell into the category “assistance with NISE Network goal 3.” Representative examples included:

- *More suggestions on how to present the “riskier” side of nano without scaring visitors. I saw the nanosilver/socks activity but the sensor is expensive for limited uses. Something along those lines, though, would be incredibly interesting.*
- *Provide tools to explain the 3rd goal to a much younger audience.*
- *Have activities specifically focused on societal issues.*

Over a third of respondents (40%) had suggestions that did not fall neatly into one of the previous code categories and were coded as “other.” It is interesting to note that a large number of suggestions were very institution specific. Representative examples included:

- *One issue that seems to have come up regards the Nanopants activity. The non-nanopants, and even the nanopants, get really wet after so many hours of demos. To have a second pair to use while the first one dries, or another brilliant solution, would be nice.*
- *Not really. Feedback from my surveys suggest the girls really loved activities where they were doing something hands-on and also when they could take something home with them. Therefore, more take-home items would be great!*
- *A list of websites kids can visit about nanotechnology would be a nice take away to extend the visit and learning opportunity.*

Table 19 compares the frequency of coded challenges and suggestions, by organization category.

Table 19. Coded challenges and suggestions, by organization category

Suggestions	Large museums (n = 25)	Small museums (n = 57)	Universities and other (n = 59)	Total (n = 141)
No suggestions	52%	56%	61%	60%
Org specific	40%	37%	42%	40%
Low attendance*	4%	30%	22%	22%
Limited resources	20%	23%	19%	21%
NISE net goal 3	32%	12%	17%	18%
Publicity	16%	9%	15%	13%
Age issues	8%	18%	8%	12%
Change of date	0%	16%	10%	11%
Collaboration**	24%	7%	2%	10%

* $p < .05$. ** $p < .01$.

The data suggest that small museums struggled with low attendance more than large museums and universities and other institutions. Large museums were more likely than small museums, universities, or other organizations to discuss issues with their collaboration efforts and to request help with those collaboration efforts. Tier 2

organizations were more likely to request assistance from NISE Network with their collaboration efforts compared to Tier 1 or Tier 3 organizations¹⁰. Eighteen percent of Tier 2 institutions mentioned this issue, compared to 8% and 4% for Tier 1 and Tier 3 institutions, respectively.

How many visitors participated in NanoDays 2010?

By combining data from the NanoDays reports with findings from the public encounter estimates, it was possible to generate an estimate of the number of visitors impacted by NanoDays 2010. Because these estimates likely included duplicate counts of visitors participating in multiple activities, the numbers are reported as encounters rather than unique visitors.

In total, 44 institutions agreed to count participants. Of these, five were either not able to count as planned during their NanoDays events or did not return their reporting forms. Table 20 describes the 39 institutions that participated in the counting and how these compared with the overall NanoDays 2010 kit recipients.

Table 20. *Types of institutions that participated in the NanoDays 2010 public encounter estimates*

	Count participants (n = 39)	NanoDays kit applicants (n = 187 ¹)
Organization type		
Large museum	23%	12%
Medium museum	13%	8%
Small museum	21%	16%
Very small museum	21%	21%
University and other	23%	44%
Involvement tier		
Tier 1	21%	7%
Tier 2	51%	36%
Tier 3	28%	57%
Regional hub		
Northeast	23%	20%
East (mid-Atlantic)	15%	9%
DC ²	0%	0%
Southeast	10%	21%
South	3%	9%
Midwest	13%	15%
West	18%	15%
Southwest	18%	11%

Note. Numbers for NanoDays kit applicants were based on analysis of the 187 institutions that had received the kit by March 2010. Institutions that received kits after this date were excluded.

¹ Four museums could not be classified by size because annual budget information and exhibit space square footage were not available. The sample size for organization category was 184. ² For years six through ten, the DC hub will be combined with the East hub.

¹⁰ $\chi^2(2) = 7.52, p < 0.05$.

Despite using target quotas in the solicitation phone calls, the group of participating institutions differed from NanoDays kit applicants in a variety of ways. Museums, especially large museums, were overrepresented in the study, while universities and other types of institutions were underrepresented. Tier 1 and Tier 2 institutions were overrepresented compared to Tier 3 institutions. Institutions in the south and southeast Network hubs were substantially underrepresented, while institutions in the mid-Atlantic hub were slightly overrepresented.

Following the 2009 year four summative evaluation protocol, large and medium museums, small and very small museums, and universities and other institutions were grouped for subsequent analysis. Six museums that completed the NanoDays report could not be classified by size and were excluded from the encounter estimates. Because of the variety of limitations (discussed in more detail below), the number of encounters reported below should be considered as only a rough estimate of NanoDays 2010 public participation.

Table 21 shows the number of activities counted for each organization type. For the majority of activity types, counts were available for all three organization categories. None of the small museums or universities participating in the study planned to deliver forums. The number of institutions delivering lectures during NanoDays 2010 was also very small. An effort was made to distribute counting assignments evenly across institutions. Therefore, participating institutions were assigned to count visitors for only one activity for each program type that they planned to deliver. Every institution that participated in the study delivered at least one hands-on activity, while only three of the participating institutions delivered a forum.

Table 21. *Number of activities counted, by program type and institution type*

Activity type	Large museums	Small museums	Universities/other
Exhibit	8	4	4
Forum	3	0	0
Hands-on	14	16	9
Stage	6	5	2
Classroom	3	3	4
Lecture	3	1	2
TOTAL	37	29	21

Table 22 shows the participation estimates by program type and institution type based on the 2010 counting results. For all program types, these estimates represent the median count for each institution type. The median was used instead of the mean as a measure of central tendency because of the skewed distribution of count data. In all but two cases (classroom programs at large museums and small museums), the median was lower than the mean. Only three institutions participating in the counting conducted forums and all of these were large museums. The median count for these institutions, therefore, was used to estimate forum participation at both small museums and universities.

Table 22. Median estimated encounter rates, by organization type and activity type

Program type	Large museums	Small museums	Universities/ other
Lecture	48	16	36
Hands-on	46	26	35
Forum	41	41	41
Stage	41	21	51
Classroom	26	32	33
Exhibit	19	32	60

Note. Participation estimates based on median count for each institution type. Estimates for forum participation based on large museum forum participation.

In the majority of cases, the estimates derived from the 2010 study data were either the same as or lower than the estimates used in year four (Table 23). This may be partly due to the fact that the 2010 study included more institutions and, in particular, more smaller museums and universities. The estimates may, therefore, be a more realistic reflection of participation rates for these institution types. Year five participation estimates were substantially higher for exhibits and stage programs at universities compared to year four. Year four data did not include stage presentations or exhibits delivered at universities and may have underestimated participation at universities for these program types. Because only two universities in the 2010 study counted lecture participation, these estimates should be interpreted cautiously.

Table 23. Encounter estimates, by organization category and activity type, for years four and five

	Year 5	Year 4
Large museums		
Exhibit	19	137
Forum	41	32
Hands-on	46	65
Stage	41	73
Classroom	26	31
Lecture	48	48
Small museums		
Exhibit	32	35
Forum	41	32
Hands-on	26	35
Stage	21	25
Classroom	32	31
Lecture	16	48
Universities/other		
Exhibit	60	37
Forum	41	32
Hands-on	35	37
Stage	51	25
Classroom	33	31
Lecture	36	48

The difference between year four and year five estimates was particularly pronounced for exhibits at large museums. The median participation count at exhibits in the 2010 study was 19, compared to the average participation rate of 137 in the year four study. This difference may partially be due to the method for calculating the central tendency. However, because the year four study included exhibit counts at only two institutions, compared to eight institutions in the 2010 study, it may be that the previous year greatly overestimated exhibit participation during NanoDays. The year four study report noted that counts were often done during peak times and probably did not reflect participation rates at slower times of the day. In general, there are likely many periods of time at a museum when exhibits are not heavily used, especially at large institutions.

The number of activities and programs delivered during NanoDays 2010 was derived from responses to the NanoDays reports. If data were not available for an institution for a specific activity type, that institution was assumed to have not delivered any activities or programs of that type. This assumption resulted in a conservative estimate of participation rates by activity type. One outlier was eliminated from the classroom activity data because the total number of classroom activities delivered was reported as 600 (probably because of a typo when completing the survey). The NanoDays report included an open-ended question asking respondents to “describe any other nanotechnology programs or activities delivered at your institution during NanoDays that you have not already reported in the survey.” However, because respondents did not consistently report the frequency and duration of these activities, they were not included in the overall reach and delivery estimates.

There was some ambiguity in the survey questions related to the number of forums and science cafés that institutions conducted during NanoDays. In the NanoDays report, the first set of questions related to the NanoDays kit asked respondents “how many forums did you conduct during NanoDays” and “how many science cafés did you conduct during NanoDays.” Later in the survey, respondents could also report forums and science cafés as part of any non-NISE programs that they delivered. Because the data indicated that respondents did distinguish the difference between these two sets of questions, responses from all the questions were added together to get a total number of forums and science cafés delivered by each institution. This number may be an over report for the few institutions that listed the same forum or science cafés in both places. There was no place to report delivery of lectures in the NanoDays report. Respondents were also not asked to report hours of delivery for NISE Network online catalog displays, exhibits, or media. Table 24 shows the total delivery hours and number of programs delivered at partner institutions during NanoDays 2010, based on the NanoDays reports.

Table 24. Total number of activities delivered or number of hours activities were available to visitors for all reporting institutions, by program type and institution type

Program type	Large museums (n = 25)	Small museums (n = 57)	Universities and other (n = 59) ¹
Exhibit (hrs)	88	282	173
Forum (#)	16	14	15
Hands-on (hrs)	3124	4739	4021
Stage (#)*	35	21	28
Classroom (#)	11	18	21
Lecture (#)	--	--	--

Note. Because respondents did not have an opportunity in the survey to report the number of hours for NanoDays kit or online catalog exhibits, displays, or media, the results likely greatly underestimate the total number of exhibit hours.

¹ For classroom activities reported by universities and other types of institutions, the sample size was 58.

Table 25. Estimated total encounters for reporting institutions, by organization category

Museum size/ organization type	Total delivered	Estimated participation rate (per hour or per activity)	Total encounters
Large museums			
Exhibit (hrs)	88	19	1663
Forum (#)	16	41	656
Hands-on (hrs)	3124	46	143693
Stage (#)*	35	41	1435
Classroom (#)	11	26	286
Lecture (#)	--	48	--
		Subtotal	147,732
Small museums			
Exhibit (hrs)	282	32	9024
Forum (#)	14	41	574
Hands-on (hrs)	4739	26	123208
Stage (#)*	21	21	441
Classroom (#)	18	32	576
Lecture (#)	--	16	--
		Subtotal	133823
Universities and other			
Exhibit (hrs)	173	60	10395
Forum (#)	15	41	615
Hands-on (hrs)	4021	35	140721
Stage (#)*	28	51	1428
Classroom (#)	21	33	693
Lecture (#)	--	36	--
		Subtotal	153852
		TOTAL	435,407

Note. Results were rounded to the nearest whole number after the total was calculated.

* $p < .05$.

By multiplying the total number of programs delivered or hours of delivery (Table 24) by the encounter rate for each activity type (Table 23), we estimated that the total number of encounters for reporting institutions was 435,407 (Table 25). However, there were several institutions that reported encounter numbers much higher than other organizations of similar types and sizes. To compensate for these outliers, we capped the maximum total number of encounters per institution as the mean number of encounters plus two standard deviations, calculated for large museums, small museums, and universities and other organizations. For example, the mean total encounters for large museums was 5,909, with a standard deviation of 7,763. Any large museum that reported a total number of encounters greater than 21,435 ($5909 + 2 \times 7763$) was instead considered to have total encounters of exactly 21,435. We adjusted the total encounters for seven institutions based on these criteria. Table 26 shows the revised total number of encounters for institutions that submitted NanoDays reports.

Table 26. Total encounters and revised total encounters for reporting institutions, by organization type

Organization type	Total encounters	Revised total encounters
Large museums	147,732	134,579
Small museums	133,823	118,613
Universities and other	153,852	135,455
TOTAL	435,407	388,647

Note. Revised total encounters capped the total number of encounters per institution as the mean number of encounters plus two standard deviations, calculated for large museums, small museums, and universities and other organizations. Results rounded to the nearest whole number after the total was calculated.

Forty-nine institutions applied for and received the NanoDays 2010 kit but did not complete the NanoDays report as of May 25, 2010. Nine of these institutions were classified as large museums (18%), 14 as small museums (29%), and 26 as universities or other types of institutions (53%). To estimate the total number of encounters for these institutions, we used the median number of total encounters calculated for institutions that completed the NanoDays report, by organization category. Based on this estimated encounter rate, the total number of encounters for non-reporting institutions was 84,188 (Table 27).

Table 27. Estimated number of encounters for reporting and non-reporting institutions

Institution type	No. non-reporting institutions	Estimated encounters (per institution)	Total encounters
Large museums	9	3,496	31,464
Small museums	14	1,231	17,234
Universities and other	26	1,365	35,490
		TOTAL non-reporting	84,188
		TOTAL reporting	388,647
		ESTIMATED GRAND TOTAL	472,835

Note. Estimated encounters based on the median number of encounters for reporting institutions by organization category.

The total estimated number of encounters for all institutions, including both reporting and non-reporting institutions, for NanoDays 2010 was 472,835. By comparison, the year four evaluation study reported that NISE Network institutions reached between 371,917 and 425,107 participants during NanoDays 2009.

Part II: DELIVERY AND REACH OF YEAR FIVE PARTNERS

The 2010 NISE Network partner survey was conducted in June 2010 to inform the year five Delivery and Reach summative evaluation report. While the NanoDays reports were limited to partner activity during the weeks of NanoDays 2010, the partner survey asked participants to provide information more broadly about the nano education activities and programs they had delivered throughout the grant year, from July 1, 2009, through June 30, 2010. The survey was developed around three primary evaluation questions:

1. *What nano education activities were delivered by NISE Network institutions in year five?*
2. *How frequently did Network institutions deliver nano education programs and activities?*
3. *When did Network institutions deliver nano education programs and activities?*

In addition to these questions, we also explored the factors that influenced the delivery of nano education activities. Factors addressed in the survey included Network involvement tier, organization type and size, participation in NanoDays, reasons reported for choosing activities, staff resources, and involvement in other nano education projects outside of the NISE Network. The survey did not provide information on the types of audiences being reached by Network institutions, although respondents did describe their interest in and experience with Spanish translations of nano education programs and activities (see Appendix K). The reach of partner institutions will be an important focus for years six through ten of the project.

Key findings included:

- **The Network is serving a broad range of organizations.** In addition to science centers, important groups of partner institutions included universities and colleges, small and very small museums, and children's museums.
- **The overwhelming majority of partner institutions are delivering nano education programs and activities.** Almost every survey respondent (98%) indicated that their institutions had delivered some type of nano education program or activity during the year. This represents a substantial improvement over findings from the year four summative evaluation studies.
- **Many institutions are delivering nano education activities and programs both during and outside of NanoDays.** For example, 65% of institutions that reported timing data indicated they delivered cart demonstrations or facilitated activities both during and outside of NanoDays. This represents a substantial improvement over year four findings.
- **Common sources of nano activities are the NanoDays kit and activities developed by individual institutions.** Universities were much less likely to report

having used activities from the nisenet.org online catalog compared to other organization categories.

- **Partners are primarily delivering cart demonstrations and facilitated activities.** A portion of institutions also delivered exhibits, including displays or media, and classroom activities. This pattern aligns well with the reasons that institutions reported choosing certain activities and not others.
- **Institutions are frequently modifying NISE Network activities.** Respondents reported modifying activities by incorporating them into existing programs, adapting them for different audiences, or combining two or more activities into a longer program.
- **Most partners are delivering nano education activities no more than a couple times per year.** Cart demonstrations and facilitated activities were delivered more frequently than other activity types. Some groups of institutions delivered cart demonstrations and facilitated activities at a higher frequency than others. For example, 50% of large museums delivered these types of activities at least once a month. Forty percent and 51% of Tier 1 and 2 institutions, respectively, delivered these types of activities at least once a month.
- **Tier 1 and 2 institutions are delivering nano education at a higher level than Tier 3 institutions.** Tier 1 and 2 institutions were more likely to: deliver cart demonstrations, facilitated activities, stage presentations, and museum theater shows; deliver cart demonstrations and facilitated activities at higher frequency; modify Network activities; use nano education activities from a variety of sources beyond the NanoDays kit, including the online catalog; and deliver activities both during and outside of NanoDays.
- **NanoDays may be a strong catalyst for further involvement in nano education.** For example, institutions that hosted NanoDays events in 2010 were more likely to deliver activities more often and from a variety of sources, including from the online catalog and developed by their own institutions.
- **Organizations of all types and sizes are contributing to the efforts of the Network.** There were very few differences in the delivery of nano education activities and programs between small museums, large museums, universities, and other types of institutions. Findings did suggest a few important subgroups of organizations. Universities were clearly focused on delivering K–12 programming and were also much more likely to be involved in other nano education projects outside of the Network. Classroom activities were a major focus of other types of organizations, such as schools and government and policy organizations.

Methods

The 2010 NISE Network partner survey was administered online through Survey Gizmo and delivered to all NISE Network member institutions classified as involvement Tier 1–3 in the Network database. The sampling strategy was census, with a target response rate of 50%. On April 30, 2010, we downloaded the list of individuals from the NISE Network

database associated with Tier 1–3 partner institutions. We then asked Network project leaders to identify one individual from each institution on that list that was in the best position to provide information about nano education activities and events and would be the most likely to respond to the survey. Project leaders identified 335 contacts, each representing a unique institution. Due to missing or incorrect contact information, the survey was sent to only 332 of these contacts.

The survey consisted of 28 questions focused on the types of nano education activities delivered, as well as the frequency, timing, and source of those activities, modifications institutions made to those activities, the reasons certain activities were chosen over others, involvement in nano education projects outside of the Network, staff resources, and interest in the translation of nano education products. Respondents also had the opportunity to provide general feedback to the NISE Network project team. A copy of the final survey is included in Appendix G.

On June 8, 2010, we sent participants a pre-contact e-mail notifying them that they would be receiving the survey in the next several days and inviting them to contact us if there was a more appropriate individual at their institution to respond to the survey. A link to the final survey was sent on June 10, followed by one e-mail reminder on June 17. Between June 23 and 25, we made targeted phone calls to individuals who had not yet completed the survey. The survey was closed on June 28 with 152 completed responses representing 151 unique institutions. Responses from the two individuals from the same institution were combined for the final analysis. Although the overall response rate of 45% was just below the target, it was high compared to the mean response rate of 39.6% reported in a meta-analysis of Internet surveys by Cook, Heath, and Thompson (2000).

As with the NanoDays report, findings from the partner survey were supplemented by information from the Network database.

Data analysis

Responses were downloaded from Survey Gizmo and analyzed using SPSS 17. Data relevant to *evaluation question 1* were analyzed using descriptive statistics. Data relevant to *evaluation questions 2-4* were analyzed through a combination of descriptive statistics, bivariate analysis, and multivariate analysis. All statistical analyses were performed using Pearson's chi-square unless otherwise noted. Appropriate to the census sampling strategy, inferential statistics were used to strengthen the interpretation of findings, rather than generalize to a larger population. Open-ended responses were coded inductively as described above for the NanoDays reports.

Findings

Which institutions participated in the survey?

Table 34 outlines the characteristics of the institutions that participated in the partner survey. Information was downloaded from the Network database and linked to individual survey responses. For a few international Network partners, information was not

available on the Network database. In these cases, we worked with the regional hub leaders and project team leads to classify institutions.

Table 28. *Description of institutions that participated in the partner survey*

	Survey participants (n = 151)	All network partners (n = 354)
Network regional hub		
DC	2.0%	2.5%
East (mid-Atlantic)	10.6%	10.2%
International	2.6%	5.4%
Midwest	17.2%	15.5%
Northeast	16.6%	18.9%
South	7.3%	9.3%
Southeast	19.9%	15.8%
Southwest	10.6%	11.9%
West	13.2%	10.5%
Involvement tier		
1 Core partners	6.6%	4.8%
2 Nano-infused partners	40.4%	30.5%
3 Broad reach partners	53.0%	64.7%
Organization type		
Museum/science center	56.3%	46.0%
Nanoscience college/university	31.8%	35.0%
K–12 school	4.0%	7.3%
Other ISE	3.3%	3.7%
Government and policy organization	2.0%	2.8%
Library	2.0%	1.7%
Other	0.7%	3.4%

Note. ISE = informal science education. Frequencies for all network partners based on data downloaded from Quickbase in August 2010, Tiers 1-3 only.

To determine how representative survey participants were of the larger Network, we compared participating institutions to data downloaded from the Network database on August 2, 2010 (Table 28). Participants were representative of the overall Network based on regional hub. By involvement tier, Tier 2 institutions were overrepresented in the sample (40% compared to 31% in the Network as a whole), while Tier 3 were underrepresented (53% compared to 65% in the Network as a whole). By organization type, museums and science centers were overrepresented in the sample (56% compared to 46% in the network as a whole).

To further explore the potential of nonresponse bias, the evaluation team randomly selected 18 nonresponders (representing 10% of the 180 nonresponders from the partner survey) for a brief follow-up interview. The primary goal of these interviews was to determine whether responders were more likely to deliver nano education activities and programs compared to nonresponders. The random sample was stratified by involvement tier to be representative of the overall Network, Tiers 2 and 3. Only individuals who lived in the United States and had a phone number listed in the NISE Network database were

selected. If, after three phone calls, the individual could not be contacted, or if the phone number was determined to be incorrect, a new individual was selected. If the phone number was correct but the original individual had left the institution, no further attempts were made to contact the institution.

Of the 18 individuals selected, 11 completed the follow-up interview, six could not be reached because they no longer worked at the institution, and one stated that he had already completed the survey and did not wish to answer additional questions. The 11 individuals who completed the interviews represented Tier 2 and Tier 3 institutions, including museums, universities, and one library. Eight of the 11 reported that their institutions had done some type of nano education programming since July 1, 2009. Reported activity types included, among others, facilitated activities and cart demonstrations, classroom programs, and exhibits. These results provide evidence that nonresponders also delivered at least a minimal number of nano education activities during year five.

Table 29 shows the types and sizes of museums that participated in the partner survey, classified as above for the NanoDays reports.

Table 29. Description of participating museums and science centers

	Respondents
Museum size (<i>n</i> = 80)	
Large	18.8%
Medium	18.8%
Small	22.5%
Very small	40.0%
Museum type	
Art or history museum (<i>n</i> = 84)	6.0%
Children's museum (<i>n</i> = 84)	41.7%
Emerging museum (<i>n</i> = 84)	1.2%
Nature or natural history museum (<i>n</i> = 84)	16.7%
Science and technology center (<i>n</i> = 85)	82.4%
Other (<i>n</i> = 84)	2.4%

Note. Data from Quickbase. Sixty-six participating institutions were not classified as museums. Information was not available to categorize the size of five museums. Each institution could report multiple museum types.

Small and very small organizations made up the majority of participating museums (67%). Over 80% of participating museums classified themselves as science and technology centers. Other common types of museums were children's museums (42%) and nature or natural history museums (17%). These findings are an important reminder that the Network's professional audience extends well beyond science and technology centers.

For subsequent analyses, museum size and organization type were combined to create a single "organization category" variable with four groups: large museums (including medium museums), small museums (including very small museums), universities

(including colleges), and other types of organizations. This approach was based on analyses from the year four summative studies. When low expected cell counts made comparisons unreliable, universities and other types of organizations were combined. In a few cases, large and small museums were also combined.

What nano education activities were delivered by NISE Network institutions in year five?

Respondents were first asked to indicate which sources of nano education programs or activities their institutions had used (NanoDays kit, nisenet.org online catalog, other NISE Network materials, developed by their own institution, or other sources) (Table 30). Almost all institutions delivered activities from the NanoDays kit (93%). The majority also delivered activities developed by their institutions (75%) and from other sources (64%). Although respondents did not describe these other sources, they might have included other nano education projects or activities adapted from other content areas.

Table 30. *Proportion of institutions delivering nano education activities or programs from specific sources*

Activity source	Respondents
NanoDays kit (<i>n</i> = 148)	93.2%
Nisenet.org online catalog (<i>n</i> = 101)	46.5%
Other NISE Network materials (<i>n</i> = 114)	50.0%
Developed by your institution (<i>n</i> = 130)	74.6%
Other source(s) (<i>n</i> = 107)	63.6%

Note. Institutions could report multiple sources.

Only four institutions indicated that they did not deliver nano education activities or programs from any of the listed sources. One of these, however, indicated later in the survey that the institution had delivered non-NISE Network nano education activities as well as K–12 nano education teacher outreach. The other three institutions clearly stated in the open-ended responses that they had been unable to deliver any nano education during the year. One organization mentioned that they received a NanoDays kit but had not received any training to present it. The other two institutions cited staffing and budget constraints.

Tier 1 and 2 institutions were significantly more likely to use some sources compared to Tier 3 (Table 31), including the nisenet.org online catalog and other NISE Network materials. These institutions may, by being more involved in the Network, be more aware of other resources or they may be more motivated to go beyond resources freely provided by the Network (i.e., the NanoDays kit). Differences by organization category were only statistically significant for the nisenet.org online catalog¹¹. Large museums were the most likely to report having delivered activities from the online catalog (64%), followed by small museums (55%), universities (28%), and other types of organizations (42%). It is notable that institutions from all involvement tiers and all organization categories were equally likely to develop their own nano education activities.

¹¹ $\chi^2(3) = 7.921, p < 0.05$

Table 31. Proportion of institutions delivering nano education activities from specific sources, by involvement tier

Activity source	Tiers 1 and 2	Tier 3
NanoDays kit	95.7% (n = 70)	91.0% (n = 78)
Nisenet.org online catalog***	64.2% (n = 53)	27.1% (n = 48)
Other NISE Network materials**	65.5% (n = 58)	33.9% (n = 56)
Developed by your institution	74.6% (n = 63)	74.6% (n = 67)
Other source(s)	67.9% (n = 53)	59.3% (n = 54)

Note. Because of low expected cell counts, Tiers 1 and 2 were combined.

* $p < 0.05$. ** $p < 0.01$. *** $p < .001$.

Survey participants were next asked to indicate which types of NISE Network activities and programs from any source their institutions had delivered throughout the year. Table 32 outlines the types of activities and the percentage of institutions that reported delivering each type. The activity categories were based on the organization of the online Network catalog. In the online catalog, several activities are included under multiple categories. Because of this ambiguity, we combined several of the categories. Cart demonstrations were combined with facilitated activities, stage presentations were combined with museum theater, and displays and media were combined with exhibits.

Table 32. Proportion of institutions that reported delivering NISE Network activities

Activity type	Respondents (n = 151)
Cart demonstrations and facilitated activities	80.8%
Exhibits, displays, and media	43.7%
Classroom activities	34.4%
Stage presentations and museum theater	13.9%
Forums	5.3%
None	11.3%

Note. Respondents indicated directly whether or not their institution had delivered any activities or programs of each type. Activity types were later combined for analysis.

The overwhelming majority (81%) of institutions indicated they had delivered at least one cart demonstration or facilitated activity during the year. The next most commonly reported activity types were exhibits, displays, and media (44%) and classroom activities (34%). Very few institutions delivered stage presentations and museum theater (14%) or forums (5.3%). A surprisingly high number of institutions (11%) reported that they had not delivered any of the listed types of NISE Network activities, suggesting that some institutions are delivering nano education activities and programs solely from other sources outside the NISE Network.

Because a surprisingly high number of institutions reported delivering exhibits, displays, or media, we further investigated which specific activities in these types were delivered. Only a few activities of this type were delivered by at least 10% of institutions (Table 33). The intro to nanotechnology video was the most frequently reported (19%), followed by the intro to nanomedicine video (16%), giant hanging balloon nanotube model (15%), and *Is that Robot Real?* Children's book (12%). For some partners, there may have been confusion about classifying the giant hanging balloon nanotube model as an exhibit. Anecdotally, project team members have reported that partner institutions often have staff facilitating and building the carbon nanotube model with visitors. Similar issues may exist with how partners are using the children's book.

Table 33. Exhibit, display, and media activities delivered by at least 10% of institutions

Activity	Respondents (n = 151)
Intro to nanotechnology video	19.2%
Intro to nanomedicine video	15.9%
Giant hanging balloon nanotube model	14.6%
<i>Is that Robot Real?</i> Children's book	11.9%

Table 34 compares the delivery of NISE Network activities by involvement tier. Differences in the delivery of cart demonstrations and facilitated activities, as well as stage presentations and museum theater, were statistically significant. Tier 1 institutions were the most likely to deliver cart demonstrations and facilitated activities (100%), followed by Tier 2 (89%) and Tier 3 (73%). Tier 1 institutions were also the most likely to deliver stage presentations and museum theater shows (40%) compared to Tier 2 (23%). Almost no Tier 3 institutions delivered stage presentations or museum theater shows (4%).

Table 34. Proportion of institutions that reported delivering NISE Network-produced activities, by involvement tier

Activity type	Tier 1 (n = 10)	Tier 2 (n = 61)	Tier 3 (n = 80)
Cart demonstrations and facilitated activities*	100%	88.5%	72.5%
Stage presentations and museum theater***	40.0%	23.0%	3.8%
Exhibits, displays, and media	60.0%	41.0%	43.8%
Classroom activities	30.0%	39.3%	31.3%
Forums ¹	20.0%	6.6%	2.5%
None	0.0%	8.2%	15.0%

¹ Fisher's exact test, with Tier 1 and 2 institutions combined because of low expected cell counts.

* $p < 0.05$. ** $p < 0.01$. *** $p < 0.001$.

By organization type, only differences in the delivery of classroom activities were statistically significant. Other types of institutions were much more likely to report

delivering classroom activities (67%) compared to large museums (22%), small museums (36%), and universities (27%)¹². In particular, schools, government and policy organizations, and other types of ISE institutions besides libraries frequently delivered classroom activities.

For each activity type that institutions reported delivering, the survey also prompted respondents to indicate specifically which activities of that type from the NISE Network catalog had been delivered. Surprisingly, some respondents reported that their institutions had delivered an activity type but subsequently indicated that none of the activities of that type listed in the survey had been delivered. Table 35 compares the percentage of institutions that delivered each activity type based on the first general question and on the activity-specific questions.

Table 35. Comparison of proportion of institutions that reported delivering NISE Network activities, by activity type, between general and activity-specific survey questions

Activity type	Question 3 (n = 151)	Activity specific questions (n = 151)
Cart demonstrations and facilitated activities	80.8%	79.5%
Stage presentations and museum theater	13.9%	9.9%
Exhibits, displays, and media	43.7%	37.7%
Classroom activities	34.4%	7.9%
Forums	5.3%	2.0%
None	11.3%	--

Note. Question 3 asked respondents to indicate which activity types were delivered at their institutions throughout the year. If they selected an activity type, they were directed to another set of questions asking about the specific activities of that type that were delivered. Although not all respondents completed the activity specific questions, results are reported out of the entire sample. Some differences, therefore, may be due to nonresponse bias.

In all cases, percentages based on the activity-specific questions were lower. The percentages were consistent only for cart demonstrations and facilitated activities (81% versus 80%). Some of these differences may be due to confusion with the survey question or lack of familiarity with the names of the listed activities. However, the pronounced differences for classroom activities suggest a different story. Although 34% of respondents indicated that NISE Network-produced classroom activities had been delivered at their institution during the year, only 8% reported that one of the listed classroom activities had been delivered. As discussed below, over half of institutions reported modifying NISE Network activities by combining two or more activities into a longer program. Institutions may be creating classroom programs from other Network activities rather than using the provided classroom-specific program curriculum.

How frequently did Network institutions deliver nano education programs and activities?

Respondents were asked to report the frequency that they delivered each activity or program (a couple times per year, at least once a month, at least once a week, several

¹² $\chi^2(3)=12.358, p < 0.01$

times per week, or once a day). For exhibits, displays, and media, respondents could also indicate that the activities were always available to visitors. Table 36 shows the maximum frequency that institutions reported delivering NISE Network-produced activities, by activity type. Even for cart demonstrations and facilitated activities, which were delivered by most institutions, the frequency of delivery was relatively low. Only about a third of institutions (35%) reported delivering cart demonstrations or facilitated activities at least once a month or more.

Table 43. Maximum frequency that institutions delivered NISE Network activities, by activity type

Activity type	Frequency level						
	Never	A couple times per year	At least once a month	At least once a week	Several times per week	Once a day	Always available ¹
Cart demonstrations and facilitated activities	21.9%	43.0%	12.6%	7.3%	11.9%	3.3%	--
Stage presentations and museum theater	90.7%	4.6%	2.0%	0.7%	0.7%	1.3%	--
Exhibits, displays, and media	64.2%	23.8%	3.3%	0.7%	0.7%	0.7%	6.6%
Classroom activities	92.7%	7.3%	0%	0%	0%	0%	--
Forums	98.7%	1.3%	0%	0%	0%	0%	--

Note. N = 151. Institutions that did not report frequency were assumed to not have delivered the activity type.

¹ This option was only available for exhibits, displays, and media.

To compare the frequency delivery of cart demonstrations and facilitated activities by organization type and involvement tier, we collapsed maximum delivery frequency into two categories: (1) “high,” corresponding to at least once a month or more, and (2) “low,” corresponding to never or only a couple times per year. Differences by involvement tier were highly significant (Table 37). Tier 2 institutions were the most likely to deliver at a high frequency (51%), closely followed by Tier 1 (40%). Tier 3 institutions rarely delivered this activity type at least once a month or more (23%). The differences in delivery frequency were significant even after controlling for a variety of other factors, including organization category. Tier 1 and 2 institutions were 2.3 times more likely to deliver cart demonstrations or facilitated activities at least once a month compared to Tier 3 institutions (see Appendix H for details of multivariate analyses). Differences by organization category were not statistically significant.

Table 37. Proportion of institutions delivering cart demonstrations and facilitated activities at a high frequency, by involvement tier

Delivery frequency	Tier 1 (n = 10)	Tier 2 (n = 61)	Tier 3 (n = 80)
High**	40.0%	50.8%	22.5%

Note. High frequency corresponded to at least once a month or more. Other institutions delivered cart demonstrations and facilitated activities never or only a couple times per year.

** $p < 0.05$. ** $p < 0.01$.

When during the year did Network institutions deliver nano education programs and activities?

For each activity, respondents also had the opportunity to indicate whether their institutions had delivered the activity during NanoDays 2010 only (3/27/10–4/4/10), outside of NanoDays only, or both. For each activity type, we noted whether an institution had delivered any of the NISE Network activities during each time period (Table 38). For both cart demonstrations and facilitated activities and stage presentations and museum theater, over half of respondents reported delivering activities during and outside of NanoDays. Institutions were less likely to deliver classroom activities or exhibits, displays, and media during both these time periods. No institution reported delivering a forum outside of NanoDays. Because so few institutions provided timing data for many of the activity types, these data should be interpreted cautiously. However, they do suggest that, in contrast to results from year four evaluation studies, partner institutions are frequently delivering NISE Network activities outside of the official NanoDays dates.

Table 38. Proportion of institutions that reported delivering NISE Network-produced activities during NanoDays 2010, outside of NanoDays, or both

Activity type	During NanoDays 2010 only	Outside NanoDays only	Both
Cart demonstrations and facilitated activities (n = 114)	17.5%	17.5%	64.9%
Stage presentations and museum theater (n = 14)	14.3%	35.7%	50.0%
Exhibits, displays, and media (n = 51)	29.4%	27.5%	43.1%
Classroom activities (n = 10)	30.0%	50.0%	20.0%
Forums (n = 2)	1.3%	0.0%	0.0%

Note. Data only shown for those institutions that delivered the activity type and reported delivery timing. The dates of NanoDays 2010 were specified as 3/27/10–4/4/10.

Differences in the timing and delivery of cart demonstrations and facilitated activities were statistically significant by involvement tier¹³ but not by organization category. Tier 1 and 2 institutions were more likely (77%) to report delivering these types of activities both

¹³ Mann-Whitney U = 1238, $p < .05$

during and outside of NanoDays compared to Tier 3 institutions (52%). The proportions of institutions by involvement tier that delivered during NanoDays only and outside of NanoDays only were similar. For Tier 1 and 2 institutions, 13% of institutions delivered these types of activities only during NanoDays and 10% delivered them only outside of NanoDays. The proportions for Tier 3 institutions were 22% and 26%, respectively. Differences for the other activity types were not analyzed because of the low number of institutions reporting timing data for these activities.

Respondents next indicated the types of modifications their institutions had made to any of the NISE Network activities throughout the year (Table 39). Six modification categories were provided in the survey (incorporated into an existing program, adapted for a different audience, combined two or more activities into a longer program, adapted for different staffing needs, changed the format or activity type, and changed the educational messages). An open-ended question also allowed respondents to describe any other types of modifications their institutions have made. In general, the majority of institutions made several types of modifications to NISE Network activities. The most common modification was incorporating activities into existing programs (67%), followed by adapting for different audiences (61%) and combining two or more activities into a longer program (53%). Only one modification type, changing educational messages, was relatively uncommon (16%).

Table 39. *Proportion of respondents indicating their institutions had modified Network activities*

Modification type	Respondents
Incorporated into an existing program (<i>n</i> = 141)	66.7%
Adapted for a different audience (<i>n</i> = 137)	60.6%
Combined two or more activities into a longer program (<i>n</i> = 133)	53.4%
Adapted for different staffing needs (<i>n</i> = 133)	45.1%
Changed the format or activity type (<i>n</i> = 135)	41.5%
Changed the educational messages (<i>n</i> = 127)	15.7%

There were significant differences in the proportion of institutions that reported making different activity modifications by involvement tier (Table 40). Tier 1 and 2 institutions were more likely to incorporate activities into existing programs (77%) compared to Tier 3 institutions (58%). Tier 1 and 2 institutions were also more likely to report adapting activities for different staffing needs (59%) compared to Tier 3 institutions (34%). Overall, the data suggest that Tier 1 and 2 institutions are making more modifications to NISE Network activities. Differences by organization category were not statistically significant.

Table 40. *Types of activity modifications reported by institutions, by involvement tier*

Modification type	Tier 1 and 2	Tier 3
Incorporated into an existing program*	76.9% (<i>n</i> = 65)	57.9% (<i>n</i> = 76)
Adapted for a different audience	68.2% (<i>n</i> = 66)	53.5% (<i>n</i> = 71)
Combined two or more activities into a longer program	60.3% (<i>n</i> = 63)	47.1% (<i>n</i> = 70)
Adapted for different staffing needs**	58.7% (<i>n</i> = 63)	32.9% (<i>n</i> = 70)
Changed the format or activity type	50.0% (<i>n</i> = 64)	33.8% (<i>n</i> = 71)
Changed the educational messages	19.7% (<i>n</i> = 61)	12.1% (<i>n</i> = 66)

Note. Sample size in parentheses. Because of low expected cell counts, Tiers 1 and 2 were combined.

* $p < 0.05$. ** $p < 0.01$.

Seventy-seven respondents completed the question, “briefly describe any other types of modifications your institution made to NISE Network-produced programs or activities during this time period.” The majority used this open-ended question to provide examples of the previously listed six modification categories. These examples are provided in Appendix I.

Institutions also reported the types of K–12 nano education activities and programs they delivered throughout the year (outreach programs delivered in the classroom, school programs delivered at your institution, curriculum or classroom activities, or teacher professional development) (Table 41). Responses suggest that K–12 programming is an important part of the nano education efforts at many institutions. The most common activity type was school group programs (62%), followed by outreach programs (52%), curriculum or classroom activities (41%), and teacher professional development (36%).

Table 41. *Proportion of institutions that delivered K–12 nano education activities*

Activity type	Respondents
Outreach programs delivered in the classroom (<i>n</i> = 141)	51.8%
School group programs delivered at your institution (<i>n</i> = 147)	61.9%
Curriculum or classroom activities (<i>n</i> = 138)	40.6%
Teacher professional development (<i>n</i> = 136)	36.0%

Differences by organization category were significant (Table 42). Universities and colleges delivered more K–12 programming than other types of institutions across all four activity types. The differences were particularly pronounced for school group programs and teacher professional development. The vast majority of universities delivered school group programs (89%), compared to less than half of other types of institutions. Similarly, almost two thirds of universities (62%) delivered teacher professional development

compared to less than a third (31%) for other types of organizations. There were no statistically significant differences by involvement tier.

Table 42. Proportion of institutions that delivered K–12 nano education activities, by organization category

Activity type	Large museums	Small museums	Universities	Other
Outreach programs delivered in the classroom*	33.3% (n = 27)	44.7% (n = 47)	69.6% (n = 46)	52.9% (n = 17)
School group programs delivered at your institution***	46.7% (n = 30)	49.0% (n = 49)	89.4% (n = 47)	43.8% (n = 16)
Curriculum or classroom activities	25.9% (n = 27)	37.0% (n = 46)	54.5% (n = 44)	47.1% (n = 17)
Teacher professional development***	25.9% (n = 27)	21.3% (n = 47)	61.9% (n = 42)	31.3% (n = 16)

* $p < 0.05$. ** $p < 0.01$. *** $p < .001$.

Why did institutions choose to deliver some activities and not others?

One hundred and forty-three respondents answered the open-ended question, “what are some of the reasons your institution chose to deliver certain NISE Network-produced activities and not others since July 1, 2009?” In coding these responses, we began with the “reason” codes developed through analysis of the NanoDays reports. These categories were used in the initial coding of partner survey responses. This coding scheme was then revised, however, to reflect differences in responses to the NanoDays report and the partner survey. Responses could be assigned multiple codes.

Table 43. Reasons that institutions reported choosing to deliver some NISE Network activities

Reasons	Proportion of respondents (n = 143)
Fit with existing programs	33%
General audience characteristics	24%
Ease of implementation	24%
Staff resources	22%
Appropriate for audience age	20%
Supply cost and availability	19%
Length of activity	14%
Problems delivering nano activities	13%
Engaging activities	10%
Staff preference	10%
Space requirements	7%
Real-world connections	3%
Other	16%

Note. Responses could be assigned multiple codes.

The reasons that institutions reported choosing to deliver some NISE Network activities and not others were similar to findings from the NanoDays report. Three new code categories emerged from the partner survey responses: “fit with existing programs,”

“general audience characteristics,” and “problems delivering nano activities.” “Fit with existing programs” was the most commonly cited reason in the partner survey that institutions chose certain activities over others (33%). This may indicate that beyond the context of the NanoDays event, fit with existing institutional programs becomes a much more important factor in determining which nano education activities are implemented. In both the partner survey and the NanoDays report, “audience appropriateness” was one of the most important reasons institutions chose to deliver certain activities. In the partner survey, some respondents talked about audience appropriateness in general (24%), while other respondents were specific about the age of audiences (20%). In both surveys, “ease of implementation” and “staff resources” were critical considerations. In the partner survey, some respondents (13%) used the question as an opportunity to explain why they had encountered problems delivering nano education activities during the year. The most common partner survey code categories are described below (see Appendix J for the full analysis, including descriptions of code categories).

Most commonly (33%), institutions expressed concerns about the fit with their existing programs, content focus, or mission. They also chose activities based on the needs and goals of others, such as their collaboration partners. In some cases, institutions chose not to include activities because they were similar to existing programs. Representative examples included:

- *We mostly incorporated Nano into current programming.*
- *Energy and climate change was a big focus for our department this past year and in the coming year. We especially focused on nano programs that covered these themes.*
- *Our lab is focused on natural science, so we choose activities that fit with that theme.*
- *The activities did not seem to fit our program.*
- *Meeting our organization’s program priorities.*

Many organizations (24%) were also interested in choosing activities based on the perceived interests and abilities of their target audiences in general. Activities that seemed appealing to those audiences, or that were anticipated to stimulate audience interest, were chosen over other activities. Representative examples included:

- *I picked the ones that seemed the most appropriate for audience.*
- *Anticipated level of interest by our target audience.*
- *Activities delivered were those popular with audience based on evaluation from previous years.*
- *I guess mainly tried to use those things that had concepts that were easy to grasp for my audience.*
- *My audience was Technology and Pre-Engineering teachers, 6–12th grade. My goal was to help each teacher incorporate a Nano Technology unit of instruction in their curriculum. I was showcasing classroom oriented activities which would explain nano concepts and emphasize the commercial application of nano research. Some of the Nano Days activities were not applicable for classroom delivery, or did not fit the curricular area. I also chose activities which were easy to replicate in the classroom without specialized equipment or supplies.*

Institutions desired activities that did not require too much time or effort to set up or deliver. This included activities that were simple for facilitators to set up, use, and put

away. Just under one quarter (24%) of respondents reported choosing activities based on their “ease of implementation”. Representative examples included:

- *Kits were easy to use and easy to train volunteers to use...Stringing together a number of kits was easy to do.*
- *Those that pack and travel easy and are easy for people to explore on their own.*
- *I chose activities that were easy to teach volunteers, or easy to use in the after-school environment. I avoided activities that were a pain to set up or clean up.*
- *Ease of presentation & set up (sometimes the ones with water were too messy for the situation).*
- *Ease of use, mobility of kits/activities.*
- *The products we chose are easier to demonstrate and useful in explaining principles of nanotechnology. The chosen products don't use liquids so chances of making mess are reduced.*

Many organizations (22%) had limited staff resources and, therefore, tended to choose activities that could be conducted with few or no staff facilitators. Representative samples included:

- *We chose the activities...that were the easiest for us to run (based on materials availability, cost, and staffing availability).*
- *Because we are so small in floorspace and staff sizes, the ones I thought could be handled just by me and a couple volunteers in the space we had available.*
- *Tried to choose a variety of activities to compensate for our Center's staffing limitations. Some simple, low-consumables activities chosen for unstaffed stations. More complicated or messy activities reserved for staffed stations.*
- *We have used things that are easily reproducible with a very small staff and limited supplies budget.*

Some organizations (20%) discussed activity appropriateness specifically in terms of audience age. Sometimes this meant choosing activities that were appropriate for young children, while other times organizations targeted older children or a wide range of ages. Representative samples included:

- *The more basic principles stayed and some of the more complex ones were left out since our audience was very young.*
- *Some of the materials are for an older audience than we serve. Our primary audience is preschool to 5th grade. We occasionally work with adults and teachers.*
- *We chose to do the cart demos that work best with a variety of age groups over a short period of time.*
- *Providing hands-on experience to broadest possible audience (i.e., young-elderly, motor-skills challenges).*
- *Our primary audience is family groups with children between 3-12 years of age, so we select kits based on that reason.*

Institutions also had a limited budget and sought out activities that were low cost or required very few consumable supplies. Activities were chosen that included all needed supplies or required only inexpensive materials. Nineteen percent of respondents indicated that availability and cost of supplies was a factor in their choice of activities. Representative samples included:

- *[The activities] use simple/household materials.*
- *We have used things that are easily reproducible with a very small staff and limited supplies budget.*
- *Materials at hand.*
- *Since we had to ship some materials to Italy, shipping costs were a factor (or available materials in Italy).*

Other less frequent reasons that partners report choosing to deliver certain activities and not others are described in Appendix J.

Were partner institutions involved in NanoDays?

Respondents to the partner survey were asked to indicate whether or not their institutions had participated in NanoDays 2010. The Network database also provided information about which institutions hosted a NanoDays 2010 event, based on NanoDays kit applications and NanoDays reports submitted to the Network. Table 44 shows the percentage of institutions that participated in NanoDays 2010, according to each source. Although 80% of partner survey respondents self-reported that their institutions had participated in NanoDays 2010, only 66% were listed in the Network database as having hosted a NanoDays 2010 event. This is not surprising, since institutions can host an event without applying for and receiving the NanoDays kit. Because participation based on the Network database was a stronger predictor of the delivery of nano education activities and programs, it was used for all subsequent analyses. The stronger relationship may suggest that having a physical NanoDays kit promotes more frequent delivery of nano education activities throughout the year.

Table 44. *Participation in NanoDays 2009 and 2010*

	Respondents
NanoDays, Quickbase (<i>n</i> = 149)	65.8%
NanoDays, survey (<i>n</i> = 146)	79.5%

Note. For partner survey, “not sure” responses were coded as missing.

Participation in NanoDays, as defined by the Network database, was significantly related to a variety of other factors, including the types of activities delivered, activity sources used, and the frequency and timing of activity delivery. Table 45 shows the proportion of institutions that delivered specific types of nano education activities based on whether or not they participated in NanoDays 2010. Differences were statistically significant for cart demonstrations and facilitated activities, as well as the stage presentations and museum theater. Institutions that participated in NanoDays 2010, were more likely to deliver cart demonstrations and facilitated activities (94%) compared to those institutions that did not participate (57%). Similarly, institutions that participated in NanoDays were more likely to deliver stage presentations and museum theater programs (18%) compared to those that did not (6%). Finally, institutions that participated in NanoDays were much less likely to report having delivered none of the listed types of nano education activities during the year compared to institutions that did participate. Only 3% of institutions that

participated in NanoDays 2010 reported delivering none of the listed activity types, compared to over a quarter (26%) of nonparticipating institutions.

Table 45. Proportion of institutions delivering specific types of nano education activities, by participation in NanoDays 2010

Activity type	NanoDays 2010 (Database) ¹	
	Yes (n = 98)	No (n = 51)
Cart demonstrations and facilitated activities	93.9%***	56.9%***
Stage presentations and museum theater ²	18.4%*	5.9%*
Exhibits, displays, and media	46.9%	37.3%
Classroom activities	38.8%	27.5%
Forums ²	7.1%	2.0%
None ²	3.1%***	25.5%***

¹ Based on Network database. ² Fisher's exact test.

* $p < 0.05$. ** $p < 0.01$. *** $p < 0.001$.

NanoDays participation was also related to the different activity sources reported by institutions (Table 46). As would be expected, institutions that participated in NanoDays 2010 were more likely to report using activities from the NanoDays kit compared to nonparticipating institutions. Participating institutions were also more likely to develop their own nano education activities (82%) compared to nonparticipating institutions (64%). Overall, the data suggest that those institutions that hold NanoDays events represent a particularly invested group that is using a broader variety of activity resources. Although the causal direction is not clear, NanoDays may be an important engagement point for involving new institutions and increasing the depth of engagement for others.

Table 46. Proportion of institutions delivering nano education activities from specific sources, by participation in NanoDays 2010

Activity type	NanoDays 2010 ¹	
	Yes	No
NanoDays kit ²	100.0%*** (n = 98)	81.3%*** (n = 48)
Nisenet.org online catalog	53.8% (n = 65)	35.3% (n = 34)
Other NISE Network materials	52.0% (n = 75)	48.6% (n = 37)
Developed by your institution	82.1%* (n = 84)	63.6%* (n = 44)
Other source(s)	62.3% (n = 69)	66.7% (n = 36)

¹ Based on Network database. ² Fisher's exact test.

* $p < 0.05$. ** $p < 0.01$. *** $p < 0.001$.

In other words, institutions that participated in NanoDays were more likely to deliver cart demonstrations and facilitated activities at least once a month (45%) compared to other institutions (18%). This relationship was statistically significant even after controlling for organization category, involvement tier, staff preparedness, and involvement in other nano projects (see Appendix H for more details on multivariate analyses).

Table 47. Proportion of institutions delivering cart demonstrations and facilitated activities at a high frequency, by participation in NanoDays 2010

Delivery frequency	NanoDays 2010	
	Yes (n = 98)	No (n = 51)
High**	44.9%**	17.6%**

Note. High frequency corresponded to at least once a month or more. Low frequency corresponded to never or only a couple times per year.

* $p < 0.05$. ** $p < 0.01$.

Institutions that participated in NanoDays were also more likely to deliver cart demonstrations and facilitated activities both during and outside of NanoDays compared to other institutions¹⁴. Almost three-quarters (73%) of institutions that hosted a NanoDays event in 2010, according to the Network database, delivered cart demonstrations or facilitated activities both during and outside of NanoDays. In contrast, only 41% of institutions that did not host a 2010 NanoDays event delivered these types of activities both during and outside of NanoDays.

What level of staff resources did partner institutions dedicate towards nano education?

Respondents provided information on the number of full-time, paid staff members currently working at their institutions, as well as the number of those staff members who worked at least 10% of their time during the year on nano education programs and activities, including the NISE Network. Table 48 shows the mean and median staff resources reported by institutions. The average number of full-time, paid staff was 360, while the median was 18. On average, only three of the staff members worked at least 10% of their time on nano education. The median number of staff who worked 10% of their time on nano education was one. Calculating the ratio of nano education staff to full-time, paid staff provided an estimate of the proportion of staff resources dedicated to nano education. On average, institutions put 18% of their paid staff resources towards nano education. The median percentage was much lower, at 3%, indicating that a few institutions are dedicating a much higher level of paid staff resources towards nano education compared to others. For example, a few institutions reported that 100% of their full-time, paid staff worked at least 10% of their time on nano education programs and activities. The majority of these had only one to two full-time, paid staff members. Almost two thirds (62%) of institutions reported dedicating less than 5% of their paid staff resources to nano education.

¹⁴ $\chi^2(1) = 9.612, p < 0.01$

Table 48. *Descriptive statistics for institutional staff resources*

	Mean	Median	<i>n</i>
Full-time, paid staff	359.5	18.0	138
Nano education staff	3.0	1.0	136
Proportion nano education staff	0.18	0.03	129

Note. Nano education staff was reported as the number of full-time, paid staff at each institution that worked at least 10% of their time on nano education programs and activities. Proportion of nano education staff was calculated as the ratio of nano education staff to full-time, paid staff, excluding institutions with no full-time, paid staff.

There were statistically significant differences in both the number of full-time, paid staff in general and the number of full-time, paid staff dedicated to nano education by involvement tier and organization category. However, there were no statistically significant differences in the *proportion* of staff dedicated to nano education by involvement tier or organization category (Kruskal-Wallis test). This indicates that after accounting for different levels of staff resources, Network partner organizations of all types and sizes are committing similar amounts of staff resources to nano education.

Staff preparedness was also a variable of interest to the project team. Survey participants indicated, on a five-point scale, how well prepared they felt staff members at their institutions were to deliver nano education programs and activities during the year (Table 49). Eighty percent of respondents felt that staff members were very well prepared or well prepared to deliver nano education programs and activities. Because this question was highly subjective, results should be interpreted cautiously. Depending on a respondent's job responsibilities and connection with program delivery staff, the data may or may not be an accurate reflection of staff preparedness. Recoding staff preparedness as a two-level, categorical variable (well or very well-prepared and neutral, not very well, or not at all prepared), there were no statistically significant differences by involvement tier or organization category.

Table 49. *Reported levels of staff preparedness*

	Respondents (<i>n</i> = 147)
Very well prepared	30.6%
Well prepared	49.0%
Neutral	17.7%
Not very well prepared	1.4%
Not at all prepared	1.4%

The project team hypothesized that staff resources and staff preparedness would be related to delivery of nano education activities and programs. Because so many partner survey respondents did not provide information about staff resources, this could not be included as a variable in the multivariate analyses. Staff preparedness was included but was not a statistically significant predictor of the frequency that partner institutions

delivered cart demonstrations or facilitated activities after controlling for other variables (see Appendix H for details on multivariate analyses).

Were partner institutions involved in other nano education projects outside the NISE Network?

The survey asked participants whether or not their institutions were involved in other nano education projects outside of the NISE Network. The project team hypothesized that responses might indicate a level of commitment to the topics of NSET. As outlined in Table 50, just over a third of respondents (36%) indicated that their institutions were involved in other nano projects. Almost two-thirds (64%) of respondents reported that their institutions were not involved or that they were not sure.

Table 57. *Proportion of institutions involved in other nano projects outside of the NISE Network*

Involved in other nano projects	Respondents (n = 151)
No	50.3%
Yes	36.4%
Not sure	13.2%

Comparing institutions by organization category, universities were significantly more likely to be involved in other nano projects (67%) compared to other types of institutions (Table 51). Small museums were, by far, the least likely to be involved in other projects (12%). There were no significant differences by involvement tier. After controlling for other variables, involvement in other nano education projects outside of the NISE Network was not a statistically significant predictor of the frequency that organizations delivered cart demonstrations or facilitated activities (see Appendix H).

Table 51. *Proportion of institutions involved in other nano education projects, by organization category*

Organization category	Involved in other nano projects	n
Large museums	30.0%	30
Small museums	12.0%	50
Universities/colleges	66.7%	48
Other types of organizations	33.3%	18
TOTAL	36.3%	146

Note. Institutions that were “not sure” were considered to have not been involved in other nano education projects. Differences by organization category were statistically significant, $\chi^2(3) = 32.49$, $p < 0.001$.

Part III: DISCUSSION

In this section of the report, we discuss key findings across the Delivery and Reach study, including findings specific to NanoDays and those that apply broadly throughout year five. To illustrate and clarify findings, we also draw on examples from the partner site visits. Overall, the study provided strong evidence that the Network has been successful in connecting with a range of institutions across the country and supporting these institutions in the delivery of nano education programs and activities. The evaluation also highlighted the diversity of institutions participating in the network, as well as potential future directions and ways that the Network could increase its impact. Throughout the discussion, we relate study findings to the Network's planning tools, including the public engagement pyramid (Figure 1) and the year six through ten logic model (Appendix L).

The Network has been highly successful connecting with a variety of institutions and supporting the delivery of nano education programs and activities.

The Network has succeeded in reaching a large number of institutions across the country. Early in the project, the project team set the goal of bringing nano education to 100 museums, science centers, and universities. As of June 2010, the Network database included over 330 Tier 1 through 3 institutions, including museums, science centers, nanoscience colleges and universities, schools, government and policy organizations, libraries, and other types of organizations. These institutions were well distributed across the country. Specifically, all regional hubs (East, Midwest, Northeast, South, Southeast, Southwest, and West) were each represented by at least 9% of partner institutions. In addition, 2.5% of partner institutions represented the DC area and 5.4% represented international partners. Comments from staff at partner institutions were overwhelmingly positive about the Network, both in the Delivery and Reach study and during the site visits. Open-ended comments in the NanoDays reports included numerous examples of positive feedback about the NanoDays kit and the support of the Network in general.

The Network has connected with a large number of institutions and has supported the delivery of nano education programs and activities across these institutions. The overwhelming majority of partner institutions are delivering nano education programs and activities. Ninety-eight percent of partner survey respondents (148 out of 151) indicated that their institutions had delivered some type of nano education program or activity during year five of the project. Furthermore, the majority of institutions are delivering nano education activities and programs both during and outside of NanoDays. For example, 65% of institutions reported delivering cart demonstrations or facilitated activities both during and outside of NanoDays. Similarly, 50% of institutions reported delivering stage presentations or museum theater programs both during and outside of NanoDays. Looking at only Tier 1 and 2 institutions, 77% delivered cart demonstrations or facilitated activities both during and outside of NanoDays. Overall, of the institutions that reported delivery timing data, 65% delivered at least one activity type both during and outside of NanoDays. During the site visits, 19 out of the 26 partner institutions reported using the NanoDays kit outside of NanoDays. Museums reported incorporating

kit activities into teacher trainings, school and homeschool programs, and museum floor activities.

Institutions are using nano education activities and programs from a variety of sources and modifying those activities to suit their own audiences and contexts. Respondents to the partner survey frequently reported delivering activities from the NanoDays kit (93%), other NISE Network materials (50%), the online catalog (47%), and other sources (60%). Three quarters of respondents (75%) also indicated their institutions had developed their own nano education activities or programs. Overall, 83% of institutions delivered activities from at least two sources according to the partner survey responses. These activities are frequently being modified. Eighty-two percent of institutions indicated they made at least one type of modification to Network activities or programs, according to the partner survey, and 67% made at least two types of modifications. The most commonly reported types of modifications were incorporating activities into an existing program, adapting activities for a different audience, and combining two or more activities into a longer program. This last type of modification may be a common way that institutions create their own classroom programs.

Combining Network activities to create longer programs was also frequently mentioned during the site visits. For example, one museum worked to develop a two-hour nanoscience lesson that incorporated hands-on activities from the NISE Network catalog, as well as other resources from scientists and teachers. Drawing primarily on the NanoDays kit, another partner institution strung together activities to create the Problem-Based Learning Program (PBL). This program was designed to train K–12 teachers in nanoscale science, engineering, and technology (NSET) and brain awareness programming. Teachers who participated in PBL were provided with NanoDays kits and encouraged to use the activities to create their own PBL modules. When combining programs, institutions often used both Network and non-Network resources. For example, one institution created a large exhibition featuring the videogame, NanoQuest, a comedic nano video produced by Washington University, a nano-themed Podcast, and several NISE Network activities. Several institutions also described ways that they had incorporated NISE Network activities into existing programs or modified activities to make them more accessible to younger audiences.

Overall, these findings highlight the importance of activity modifications in shaping how Network educational products reach the public through partner institutions. Although the Network has actively encouraged partners to modify activities and programs, it is still unclear how these modifications influence public and professional impacts. Moving forward, the Network should continue to investigate how partner institutions are modifying NISE Network activities and programs and how these modifications are influencing the impact of the Network. In addition, project leaders should consider adding activity modification as an explicit element in the Network logic model.

This study provided less information about the types of audiences that partner institutions reached. Based on data from the NanoDays reports and the participation counts, the total estimated number of encounters for all institutions, including both reporting and non-reporting institutions, for NanoDays 2010 was 472,800. Respondents to the NanoDays report indicated whether or not their institutions had reached family groups, school groups, or adult-only groups during NanoDays. Overall, the most

frequently reported audience group was families (84%), followed by school groups (56%), and adult-only groups (37%). Family groups were an especially important audience for museums. All large museums and 95% of small museums reported reaching family groups during NanoDays, compared to only 60% of universities and other types of organizations. Universities and other types of organizations most frequently reported serving school groups (64%), followed by family groups (60%) and adults only (41%).

Although not a direct measure of audiences reached, 43% of institutions indicated in the partner survey that they would be interested or very interested in Spanish translations of NISE Network materials. There was less interest for translations in other languages. Only 17% of respondents indicated that they would be interested or very interested in translations of NISE Network activities, programs, or exhibits in other languages besides Spanish. During the site visits, some institutions reported making efforts to reach underserved audiences with nano education activities. Strategies included outreach to Title 1 schools with high minority populations and hosting free admission days. Learning more about the public audiences that the partner institutions are reaching and impacting will be an important focus of evaluation during years six through ten.

The reach and impact of the Network may be increasing

Comparisons between year five and year four evaluation findings suggest that the impact of the Network may be increasing. According to the year four evaluations (Reich & Goss, 2009), 83% of individuals from Tier 2 institutions that attended regional workshops delivered nano education programs or exhibits within six months following their workshop participation. In a survey of Network members who had not attended the regional workshops, 59% of individuals from Tier 3 institutions stated that they had delivered nano-related programs and or exhibits to the public. In contrast, based on the 2010 partner survey, 98% of Tier 2 institutions and 96% of Tier 3 institutions delivered some type of nano education program or activity during year five of the project. Similarly, during year four evaluations, 64% of individuals from Tier 3 institutions stated that they had conducted or planned to conduct NISE Network programs and or exhibits with the public. Based on the 2010 partner survey, 89% of partner institutions delivered NISE Network programs or activities of any type during year five, including 92% of Tier 2 institutions and 85% of Tier 3 institutions. Year four evaluation found that very few institutions were delivering nano programming outside of NanoDays. During year five, 65% of institutions reported delivering cart demonstrations or facilitated activities both during and outside of NanoDays. This potential increase is promising given the Network's broader focus beyond NanoDays for years six through ten (see Appendix L). Because evaluation methods and questions differed between years four and five, these comparisons should be interpreted cautiously.

A number of mechanisms, including Network professional development opportunities, recruitment efforts, and NanoDays, have supported the Network's success.

The recruitment of a broad range of institutions has increased the delivery and reach of the Network.

The Network has used a variety of mechanisms to recruit partner institutions, such as establishing local connections through regional hub leaders and presenting at national conferences. As a testament to the success of these efforts, findings from the NanoDays reports and the partner survey highlighted the diversity of institutions that make up the Network. Respondents to the partner survey included museums and science centers of all sizes, nanoscience universities and colleges, schools, government and policy organizations, libraries, and other types of institutions. Museums ranged from large to very small and included science and technology centers, children's museums, art and history museums, and nature and natural history museums. The most common type of organization was museums and science centers (56%), followed by nanoscience universities and colleges (32%). About a third of all institutions were classified as small or very small museums (33%), compared to only 20% for large and medium-sized museums. Almost half of museums (46%) classified themselves as science centers and 23% of organizations classified themselves as children's museums.

Based on the partner survey, the diversity of Tier 3 institutions was much higher than for Tier 1 and 2 institutions. Tiers 1 and 2 were dominated by museums and science centers (75%), with both large and medium-sized museums (33%) and small and very small museums (40%) well represented. Only 20% of Tier 1 and 2 institutions were universities or colleges. Of Tier 3 institutions, on the other hand, 40% were museums and science centers and 43% were universities and colleges. Very few Tier 3 institutions were large or medium museums (10%). There was a much higher proportion of "other" types of organizations in Tier 3 (18%) compared to Tiers 1 and 2 (6%).

Not only is the Network diverse, but all types of partner organizations are contributing substantially to the Network's efforts. Surprisingly, there were very few significant differences in the delivery of nano education activities and programs, including number, type, and frequency of activities, between different types of organizations. After controlling for a variety of factors, organization category was not a statistically significant predictor of the frequency that organizations delivered cart demonstrations or facilitated activities. In other words, small museums, universities, and other types of institutions delivered activities and programs at a comparable level to large museums. This is encouraging since these types of organizations represent the majority of the Network. These findings also suggest that smaller institutions, such as small museums, may be dedicating a disproportionate level of resources to nano education compared to larger institutions. Based on the NanoDays reports, there were no significant differences in the number of internal staff and volunteers involved in planning for or implementing NanoDays among large museums, small museums, universities, and other types of organizations.

Professional development efforts targeted at Tier 1 and 2 institutions have led to greater nano education delivery at these institutions.

During year four of the NISE Network project, the Network developed the concept of “involvement tier” to categorize the range of involvement levels for different partner institutions. The project team prioritized Network resources and professional development efforts towards Tier 1 and 2 institutions, with the goal of increasing the capacity of these institutions to deliver nano education experiences sustainably, on an ongoing basis. Findings from the Reach and Delivery study suggest that these organizations, compared to Tier 3 institutions, are indeed providing a greater number, variety, and depth of nano education experiences for their audiences. Although it is not possible with the current data to say that Network professional development efforts have caused this difference, it is clear that the Network has succeeded in identifying and mobilizing a group of institutions that are more deeply engaged in the topics of NSET.

Across a range of measures, Tier 1 and 2 institutions delivered nano education activities and programs at a higher level than Tier 3. Based on the partner survey results, compared to Tier 3, Tier 1 and 2 institutions were more likely to: deliver cart demonstrations, facilitated activities, stage presentations, and museum theater shows; deliver cart demonstrations and facilitated activities at a high frequency; modify NISE Network activities; use nano education activities from a variety of sources beyond the NanoDays kit, including the online catalog; and deliver activities both during and outside of NanoDays. The differences in delivery frequency were significant even after controlling for a variety of other factors, including museum size and organization type. Tier 1 and 2 institutions were over two times more likely to deliver cart demonstrations or facilitated activities at least a couple times per month compared to Tier 3 institutions.

NanoDays has been a popular focus for many partner institutions and may be a catalyst for further involvement in nano education

This study provided strong evidence that NanoDays is an important entry point to nano education for many institutions and a pathway to further involvement in the Network. Most Network partner institutions have participated in NanoDays and 80% of respondents to the partner survey indicated that their institutions participated in NanoDays 2010. As described above, NanoDays activities are potentially impacting a large number of visitors across the country. Furthermore, evaluation findings suggest that many institutions are investing substantial resources into NanoDays events. For example, based on the NanoDays reports, a median of 10 internal staff and volunteers participated in or helped organize the events. Differences by museum size and organizational type were not statistically significant, suggesting that small museums and universities may have involved a larger proportion of staff resources in the NanoDays event compared to large museums. Organizations are also taking advantage of NanoDays to establish new collaborations and partnerships. In the NanoDays reports, 70% of institutions reported collaborating with another organization for the event. Of these, 100% indicated that at least one collaboration began with NanoDays 2010. Organizations listed collaboration as one of the most important successes of NanoDays 2010 and also as an area where they desired more assistance from the Network.

Participation in NanoDays, as defined by the Network database, was related to which activities institutions delivered, the sources of those activities, and the timing and frequency of activity delivery. For example, after controlling for a variety of other factors, institutions that participated in NanoDays 2010 were three times more likely to deliver cart demonstrations or facilitated activities at least once a month compared to those institutions that did not participate. According to the site visit data, most of the nano cart demonstrations and facilitated activities partner institutions implemented on the museum floor were taken directly from the NanoDays kit. These findings suggest that receiving a physical NanoDays kit may be a catalyst for further involvement in the Network and increased investment in nano education. It is important to note that receiving a NanoDays kit provides a common route through which partner institutions deliver Network activities without participating in Network professional development. Although this pathway to public impact was not highlighted in the Network's early program theory models (e.g., see Reich & Goss, 2009), the Network logic model for years six through ten (Appendix L) does imply that professionals could obtain and deliver Network products without participating in professional development activities.

Findings from the Delivery and Reach studies suggest possible directions for years six through ten.

As the Network has learned more about engaging a broad group of institutions across the country in the topics of NSET, it has continually set new goals and worked to challenge itself in new ways. Findings from years four and five summative evaluations have provided baseline measurements for the delivery and reach of the Network. Based on these measurements, the Network can strive to increase its institutional and public reach in a number of ways. These include increasing the types of activities that institutions are delivering or the frequency that institutions are engaging visitors with nano education, supporting institutions in addressing societal implications related to NSET, or better meeting the specific needs of a broad range of partner institutions.

Broaden the types of activities that institutions are delivering

The Network has the potential to increase the types of activities that institutions are delivering and supporting institutions in delivering more in-depth experiences. Currently, institutions are primarily delivering facilitated activities and cart demonstrations (e.g., "exploring" NanoDays kit activities). Almost all of respondents (99%) to the NanoDays report indicated using the exploring activities from the NanoDays kit. Every other element from the NanoDays kit was used by less than 10% of institutions. Based on the partner survey, cart demonstrations and facilitated activities were the most frequently delivered activity types (81%), followed by exhibits (44%), and classroom activities (34%). In-depth experiences, such as science cafés and forums, were rarely delivered. The Network could explore ways to support and encourage institutions in delivering a broader range of activity types.

Looking closely at the reasons that institutions reported delivering some activities and not others, as well as the modifications that institutions are making to Network activities, will help to identify barriers that organizations face to delivering more in-depth nano

education programming. One opportunity for the network is to help institutions combine multiple smaller activities into longer programs. Based on the partner survey, this may have been a common way that partner institutions developed classroom programs. During the site visits, institutions also reported combining multiple nano education activities to create or supplement summer camps, teacher trainings, school programs, science curriculum, and museum floor programming. One important step that the Network has already taken is differentiating activity types by depth of engagement and the number of individuals reached (Figure 1). Based on this engagement pyramid, fewer institutions would deliver in-depth experiences, such as forums and classroom programs. These activities, however, would engage the public more deeply in the topics of NSET. The engagement pyramid acknowledges that these types of programs require more resources and a higher level of investment in the topic.

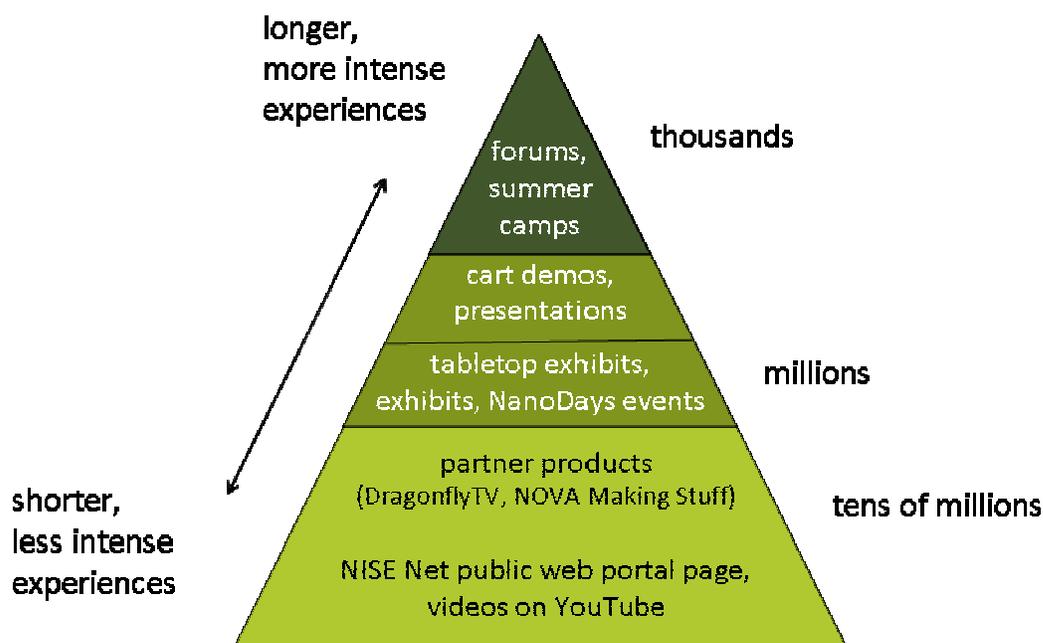


Figure 1. NISE Network years six through ten public impacts engagement

Increase the frequency that institutions are delivering nano education activities and programs

The Network could also choose to focus on increasing the frequency with which institutions are delivering nano education activities and programs. The majority of respondents to the partner survey indicated that their institutions had delivered nano education activities and programs no more than a couple times per year. Delivery frequency was highest for cart demonstrations or facilitated activities. However, less than a quarter of institutions (23%) delivered these types of activities at least once a week. Involvement tier and participation in NanoDays were both important predictors of whether or not institutions delivered cart demonstrations or facilitated activities at a higher frequency. The Network could investigate further what aspects of Network involvement or NanoDays participation motivate institutions to deliver programs and

activities more often. One promising strategy is supporting institutions in integrating NISE Network activities into existing programs, which, based on the partner survey and site visit data, was one of the most common reasons partners chose specific NISE Network activities. According to the partner survey, fit with existing programs was the most common reason partners chose to deliver some Network activities and not others. Already, over two thirds (67%) of institutions reported incorporating NISE Network activities into existing programs. In the coming years, the Network is planning to issue “mini-grants” to encourage partners to further integrate NISE Network activities into existing programming.

Support institutions in addressing societal ethical issues related to NSET

One of the goals of the Network during years one through five of the project was to increase public understanding of societal and ethical issues, including risk assessment and abatement, and the importance of broad citizen participation in discussions about responsible research and development of new technology. However, feedback from the NanoDays reports indicates many institutions struggled to address this goal. Of the 142 respondents that answered at least one of the open-ended questions on the NanoDays report, 58% indicated either that their institutions struggled with addressing goal three or that they felt that the goal was inappropriate for their audiences and contexts. Forty-two percent of respondents said that they did not focus on this goal during their NanoDays events. Some organizations (15%) did not address the goal specifically because they felt it was inappropriate for younger audiences. Others (28%) felt they needed to make age adaptations to programs and activities to communicate messages about societal implications. These results suggest two challenges for the Network: (1) supporting some institutions in engaging visitors with societal issues related to NSET and (2) convincing other institutions that this goal is important and can be addressed in an informal learning environment. However, because these findings are primarily based on open-ended feedback from the NanoDays reports, the evaluation team may want to further investigate the challenges and barriers partner institutions face in addressing public understanding of societal issues related to NSET. It is important to note that although societal and ethical implications of NSET is a growing focus of the Network, the majority of NanoDays 2010 kit activities and programs were not designed with this goal in mind.

Meet the needs of a broad range of partner institutions

As discussed above, the Network is serving a broad range of partner institutions and organizations. Although there is much that these institutions share in common, there are also important differences in the types of audiences they serve, the activity formats that they typically select, and the ways they modify NISE Network activities and programs to fit with their existing programs and organizational goals. An important challenge for the Network will be to continue to meet the diverse needs and interests of different partner organizations. The Network could choose to develop programs and resources that work well for a variety of contexts or focus on the specific needs of particular groups of organizations.

Not surprisingly, different partner institutions focused on different types of audiences. For example, in the NanoDays reports, large and small museums were significantly more likely to report serving family groups (100% and 95% respectively) during NanoDays

2010 compared to universities and other types of organizations (60%). Universities and other types of organizations most frequently reported serving school groups (64%), followed by family groups (60%) and adults only (41%). Tailoring activities and programs to audiences was a critical issue to many partner organizations. Almost one-third (30%) of respondents to the NanoDays report indicated that age appropriateness was one of the primary reasons they chose to deliver certain activities and not others. In the partner survey, 24% of respondents said that general audience concerns was an important reason and 22% said that age appropriateness specifically was a primary reason for choosing certain activities. Almost two-thirds (61%) of institutions participating in the partner survey reported adapting NISE Network activities for different audiences.

Many organizations focused on younger children when discussing issues of age appropriateness. However, respondents to both surveys also mentioned a variety of other audiences, including teachers, college students, adults, and seniors. As discussed above, universities and colleges were more focused on teacher professional development and programs for schoolchildren. Over half (62%) of universities and colleges indicated they delivered teacher professional development related to NSET, compared to 26%, 21%, and 31% of large museums, small museums, and other types of organizations respectively. Universities were also much more likely to be involved in other nano education projects outside of the Network.

Partner institutions are modifying NISE Network activities and developing their own activities to meet their organizational goals and support existing programming. Based on the partner survey, as well as site visit data, the most commonly reported modification (67%) that institutions made to Network activities and programs was incorporating those activities into existing programs. Fit with existing programs was also the most commonly reported reason (33%) that partner institutions chose certain activities over others. As emphasized above, these findings highlight the importance of activity modifications in shaping the Network's public impacts. Based on this, the Network might consider balancing its focus on new development with efforts to support partner institutions in modifying, adapting, and combining existing activities to most effectively engage their target audiences and achieve their institution-specific goals. By supporting partners in this way, the Network may be able to more effectively achieve its intended public audience impact goals across a broader range of institutions.

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Appendices

Appendix A: Copy of NanoDays 2010 kit application

Appendix B: Copy of NanoDays 2010 report

Appendix C: Codebook for reasons that institutions chose to deliver Network activities (NanoDays report)

Appendix D: Codebook for successes institutions reported for NanoDays 2010 (NanoDays report)

Appendix E: Codebook for how institutions reported supporting Network goals during NanoDays 2010 (NanoDays report)

Appendix F: Codebook for challenges institutions reported related to NanoDays 2010 (NanoDays report)

Appendix G: Copy of partner survey

Appendix H: Partner survey multivariate analyses

Appendix I: Modifications institutions reported making to Network activities (partner survey)

Appendix J: Codebook for reasons that institutions chose to deliver Network activities (partner survey)

Appendix K: Partner institution use of and interest in NISE Network language resources (partner survey)

Appendix L: NISE Network logic model, years six through ten

Appendix A: NanoDays 2010 kit application

(Note: the formatting of the survey is slightly altered from the original online version. Survey logic, such as hidden questions and page skips, are not represented.)

NanoDays 2010 physical kit application

1. Contact Information

NanoDays is March 27 through April 4, 2010!

Please fill out this application to be considered for a 2010 NanoDays physical kit. Applications for physical kits will be accepted from October 28, 2009 through December 15, 2009. A total of 200 kits are available for distribution. Kits will be shipped beginning in mid- January, 2010.

NISE Net also offers a digital download version of the NanoDays kit, complete with instructions, supply lists, marketing materials, and multimedia files. Consider this option if you are affiliated with an organization that does not hold public events, would like to preview the contents, are located outside the United States, or want to create multiple copies of print resources. Digital kits will be available for download after December 15, 2009 at www.nisenet.org/nanodays/.

*** 1. Please enter the name of a contact person and a shipping address for your kit (No PO boxes please).**

Name:

Job Title:

Institution:

Institution website:

Address 1:

Address 2:

City/Town:

State:

Country:

Zip Code:

Email Address:

Phone Number:

*** 2. Have you participated in NanoDays activities in the past?**

Yes

No

Don't know/not sure

If Yes, please describe where and when

NanoDays 2010 physical kit application

*** 3. Which best describes your organization?**

- Museum/Science Center
- K-12 School
- Library
- Nanoscale Science and Engineering College/University
- Nanoscale Science and Engineering Industry
- Government or Policy Organization
- Social Science Organization
- Other (please describe)

2. Museum Type

4. If your organization is a museum, check boxes for all types that apply

- Science or Technology Museum
- Children's Museum
- Art or History Museum
- Natural History or Nature Museum
- Emerging or Developing Museum
- Other (please specify)

3. Information about your museum or organization

NanoDays 2010 physical kit application

5. Estimated annual number of visitors for your museum or organization:

- under 10,000
- 10,000 - 50,000
- 50,000 - 100,000
- 100,000 - 200,000
- 200,000 - 500,000
- over 500,000
- Comment about visitorship (if needed)

**6. What kind of population(s) are served by your museum or organization?
Check all that apply.**

- Urban (large city): population over 250,000
- Urban (medium-sized city): pop. 100,000 - 250,000
- Urban (small city): pop. less than 100,000
- Suburban
- Rural
- Comment about demographic setting (if needed)

7. What is the annual operating budget of your museum or organization?

- under \$250,000
- 250,000 - \$500,000
- \$500,000 - \$1 million
- \$1 - \$2.5 million
- \$2.5 - \$6.5 million
- over \$6.5 million
- Comment about annual operating budget (if needed)

NanoDays 2010 physical kit application

*** 8. NISE Net uses a series of regional hubs to facilitate communication, share materials, and organize events. Please identify the NISE Net regional hub that is appropriate for you. If you are not sure, see the [NISE Net Community map](#).**

- Northeast (New England & NY)
- MidAtlantic (PA, NJ, MD, DC, DE, OH)
- Washington DC (e.g. non museum/agency partners)
- Southeast and Puerto Rico (VA, NC, KY, TN, LA, MS, AL, GA, FL)
- South (TX, AR, OK)
- Midwest (ND, SD, NE, KS, MN, IA, MO, WI, IL, MI, IN)
- West (AK, WA, OR, ID, MT, WY, CO, UT, NM)
- Southwest (CA, NV, AZ, HI)
- International

4. Information about your NanoDays event

Please answer the questions below to let us know how you plan to use the NanoDays kit.

*** 9. In what type(s) of programs will you use NanoDays activities?**

- Family Program/Workshop
- School Programs
- Summer Camp
- Program for General Public
- After School Programs

Other (please describe)

NanoDays 2010 physical kit application

*** 10. Briefly describe your plans for organizing events or activities during the official NanoDays period from March 27 through April 4, 2010. Please include event target date, type of event, location, intended audience, and any other details you feel are important.**

11. Describe how you might use the kit or activities in other contexts (i.e. instead of or in addition to the NanoDays period described above).

*** 12. If you are selected to receive a NanoDays kit, you will be expected to:**

- * hold (or collaborate in) at least one event during NanoDays 2010;**
- * submit a NanoDays event report by April 30, 2010**

NISE Net will provide a template for the event report. If you find that you cannot use the kit materials, you may be asked to return them or distribute them to another user.

Do you agree to these terms?

- Yes
 No

NanoDays 2010 physical kit application

13. The NISE Net research and evaluation team conducts studies to count participation in NanoDays and growth in public awareness of nanotechnology. The team will contact institutions in February and March, 2010 with requests for data collection support during NanoDays. What is your level of interest in supporting data collection? [Support is appreciated, but not required to receive a NanoDays Kit.]

- Yes, please send me information and I will decide whether or not to participate.
- I'm not sure, but you may contact me if needed and I will decide whether or not to participate.
- I prefer not to be contacted.

If yes, please provide a daytime telephone number and/or email address

5. Thank you!

Your application for a 2010 NanoDays physical kit is now complete. You will only be contacted by a NISE Network representative if there are additional questions about your application.

If your status changes or you have any additional questions about NanoDays, feel free to contact Margaret Glass, [mglass \[at\] astc dot org](mailto:mglass@astc.org).

Appendix B: NanoDays 2010 report

(Note: the formatting of the survey is slightly altered from the original online version. Survey logic, such as hidden questions and page skips, are not represented.)

SurveyGizmo - Project: Editor

https://app.squizmo.com/survey_editor.php?id=258585

Survey: NanoDays Report 2010

Status: **Launched**

1. NanoDays Report

Congratulations on participating in NanoDays 2010!

Please fill out this report to tell us how you used your kit materials during NanoDays, March 27 through April 4, 2010. This information is important for evaluating the success of the Nanoscale Informal Science Education (NISE) Network project and reporting back to NSF.

The report should take no more than 15 minutes to complete.

If you need to exit before finishing, you MUST use the "save and continue report later" button or your progress will not be saved.

Please complete this online report by May 1, 2010.

If you have any questions regarding the report, please e-mail visitorstudies@ornl.edu.

2. Contact Information

1. Please enter your first and last name and contact information.

Name:

Job title:

Institution:

E-mail address:

Phone number:

3. Staff and Volunteers

2. Please list the names and job titles of staff and volunteers at your institution who played a significant role in organizing the NanoDays event or delivering activities.

3. How many staff and volunteers total from your institution participated in or helped organize the NanoDays event?

4. Who did you collaborate with outside your institution for NanoDays 2010?

	Institution	Primary contact	Relationship began with NanoDays?	
			Yes	No
1.	<input type="text"/>	<input type="text"/>	<input type="radio"/>	<input type="radio"/>
2.	<input type="text"/>	<input type="text"/>	<input type="radio"/>	<input type="radio"/>
3.	<input type="text"/>	<input type="text"/>	<input type="radio"/>	<input type="radio"/>
4.	<input type="text"/>	<input type="text"/>	<input type="radio"/>	<input type="radio"/>
5.	<input type="text"/>	<input type="text"/>	<input type="radio"/>	<input type="radio"/>

5. Did you collaborate with a college or university?

- Yes
- No

6. Please indicate the types of college or university staff, including students, that participated in the event and the total number of individuals of each type.

	Participated?		Number of individuals?
	Yes	No	
Faculty or professors	<input type="radio"/>	<input type="radio"/>	<input type="text"/>
Science research staff	<input type="radio"/>	<input type="radio"/>	<input type="text"/>
Education/outreach professionals	<input type="radio"/>	<input type="radio"/>	<input type="text"/>
Students or post-docs	<input type="radio"/>	<input type="radio"/>	<input type="text"/>

5. Marketing

7. How did you advertise or market your NanoDays 2010 event?

- Local newspaper
- Organizational newsletter
- Organizational website
- Local TV/cable station
- Radio
- E-mail blasts
- Social networking media (e.g., Twitter, Facebook, etc.)
- Pamphlets, flyers, or posters
- Word of mouth
- There was no marketing or advertising
- Other (please specify)

8. Did you use any of the following marketing materials from the NanoDays kit in preparation for the event?

- News release
- Nano clipart
- NanoDays logo
- Ready-to-print poster
- Ready-to-print banner
- Ready-to-print T-shirt art
- Labels for nametags and business cards
- Letterhead
- Envelope
- None of the marketing materials from the NanoDays kit were used

6. Programs and Activities (NanoDays Kit)

9. This question asks about the activities and programs delivered at your institution during NanoDays using the materials included in the NanoDays kit. Please refer to pages 56–57 in your NanoDays planning guide for a list of kit contents.

Which of the following types of programs did you deliver during NanoDays using kit materials?

- "Exploring" hands-on activities
- Public forums
- Science cafés
- "Zoom" interactive media
- DECIDE nanotechnology game
- 10-minute societal implications plays
- None of the activities or programs used NanoDays kit materials

10. Please indicate which "exploring" hands-on activities you delivered and how many hours total each activity was available to visitors during NanoDays. Consult with other staff as needed to help answer this question.

	Delivered during NanoDays?		Total hours?
	Yes	No	
Exploring Measurement—Ruler	<input type="radio"/>	<input type="radio"/>	<input type="text"/>
Exploring Measurement—Human Body	<input type="radio"/>	<input type="radio"/>	<input type="text"/>
Exploring Tools—SPM	<input type="radio"/>	<input type="radio"/>	<input type="text"/>
Exploring Forces—Gravity	<input type="radio"/>	<input type="radio"/>	<input type="text"/>
Exploring Properties—Surface Area	<input type="radio"/>	<input type="radio"/>	<input type="text"/>
Exploring Materials—Liquid Crystal	<input type="radio"/>	<input type="radio"/>	<input type="text"/>
Exploring Materials—Ferrofluid	<input type="radio"/>	<input type="radio"/>	<input type="text"/>
Exploring Structures—Bucky balls	<input type="radio"/>	<input type="radio"/>	<input type="text"/>
Exploring Measurement—Molecules	<input type="radio"/>	<input type="radio"/>	<input type="text"/>
Exploring Fabrication—Self-Assembly	<input type="radio"/>	<input type="radio"/>	<input type="text"/>
Exploring Measurement—Stretchability	<input type="radio"/>	<input type="radio"/>	<input type="text"/>
Exploring Materials—Nano Fabric	<input type="radio"/>	<input type="radio"/>	<input type="text"/>

11. How many forums did you conduct during NanoDays?

- 1 2 3 4 5+

12. How many science cafés did you conduct during NanoDays?

- 1 2 3 4 5+

7. Programs and Activities (Online Catalog)

SurveyGizmo - Project: Editor

https://app.sgzmo.com/survey_editor.php?id=258585

13. This question asks about the programs and activities you delivered during NanoDays that were not part of the NanoDays kit but instead came from the [nisenet.org](http://www.nisenet.org) website. Please refer to the website for a complete list of catalog activities:
<http://www.nisenet.org/catalog>

Other than activities that were part of the NanoDays kit, which of the following activities and programs from the online catalog did you deliver during NanoDays ?

- Cart demonstrations
- Stage presentations
- Facilitated activities
- Museum theater
- Displays
- Classroom activities
- NISE Net exhibits
- Forums
- NISE Net media
- None of the activities or programs came from nisenet.org

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14. Please indicate which cart demonstrations or facilitated activities from the online catalog you delivered and how many hours they were available to visitors during NanoDays. Consult with other staff as needed to answer this question.

	Delivered during NanoDays?		Total hours?
	Yes	No	
Forms of Carbon	<input type="radio"/>	<input type="radio"/>	<input type="text"/>
Surface Area	<input type="radio"/>	<input type="radio"/>	<input type="text"/>
Tiny Particles, Big Trouble!	<input type="radio"/>	<input type="radio"/>	<input type="text"/>
Magic Sand / Nanosurfaces	<input type="radio"/>	<input type="radio"/>	<input type="text"/>
Lotus Leaf Effect	<input type="radio"/>	<input type="radio"/>	<input type="text"/>
Aerogel	<input type="radio"/>	<input type="radio"/>	<input type="text"/>
Invisible Sunblock	<input type="radio"/>	<input type="radio"/>	<input type="text"/>
Sizing Things Down	<input type="radio"/>	<input type="radio"/>	<input type="text"/>
Intro to Nano Cart Demo	<input type="radio"/>	<input type="radio"/>	<input type="text"/>
Biobarcode s: Antibodies and nanosensors	<input type="radio"/>	<input type="radio"/>	<input type="text"/>
Cutting It Down to Nano	<input type="radio"/>	<input type="radio"/>	<input type="text"/>
DNA Nanotechnology	<input type="radio"/>	<input type="radio"/>	<input type="text"/>
Nanoparticle Stained Glass	<input type="radio"/>	<input type="radio"/>	<input type="text"/>
Inkjet Printer	<input type="radio"/>	<input type="radio"/>	<input type="text"/>
Exploring Measurement—Solutions (NanoDays 2008)	<input type="radio"/>	<input type="radio"/>	<input type="text"/>
Balloon Nanotubes Tabletop	<input type="radio"/>	<input type="radio"/>	<input type="text"/>
Macro, Micro, and Nano Stretch Ability	<input type="radio"/>	<input type="radio"/>	<input type="text"/>
Ready, Set, Self-Assemble	<input type="radio"/>	<input type="radio"/>	<input type="text"/>
Shrinking Robots!	<input type="radio"/>	<input type="radio"/>	<input type="text"/>
The Electric Squeeze	<input type="radio"/>	<input type="radio"/>	<input type="text"/>

15. Please indicate which of the stage presentations from the online catalog you delivered during NanoDays and how many times each was delivered. Consult with other staff as needed to answer this question.

	Delivered?		How many times?
	Yes	No	
Treating Tumors with Gold	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/>
Energy & Nanotechnology	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/>
Intro to Nano—Stage	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/>
Shrinking Robots!	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/>
Flying Cars	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/>
Snowflakes: Nano at Its Coolest	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/>
World of Carbon Nanotubes	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/>

16. Please indicate which of the museum theater shows from the online catalog you delivered during NanoDays and how many times each was delivered. Consult with other staff as needed to answer this question.

	Delivered?		How many times?
	Yes	No	
Wheel of the Future	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/>
Nano Dreams and Nano Nightmares	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/>
Attack of the Nanoscientist	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/>

17. Please indicate which of the classroom activities from the online catalog you delivered during NanoDays and how many times each was delivered. Consult with other staff as necessary to answer this question.

	Delivered?		Number of times?
	Yes	No	
Theatre School Program	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/>
Nanoparticle Stained Glass	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/>

8. Programs and Activities (Other Sources)

18. Did you deliver any of the following types of nanotechnology programs or activities that were not part of the NanoDays kit or the nisenet.org online catalog?

- Hands-on activities, including cart demonstrations, tabletop activities, and facilitated activities
- Exhibits, including stand-alone displays, media, and computer stations

- Yes
 No

19. Did you deliver any of the following types of nanotechnology programs or activities that were not part of the NanoDays kit or the nisenet.org online catalog?

- Stage presentations, including museum theater
- Forums, including science cafés
- Classroom activities

- Yes
- No

20. Please list the nanotechnology hands-on activities or exhibits you delivered during NanoDays that were not part of the NanoDays kit or online catalog and how many hours total each was available to visitors.

	Activity name	Activity type?		Total hours?
		Hands-on activity	Exhibit	
1.	<input type="text"/>	<input type="radio"/>	<input type="radio"/>	<input type="text"/>
2.	<input type="text"/>	<input type="radio"/>	<input type="radio"/>	<input type="text"/>
3.	<input type="text"/>	<input type="radio"/>	<input type="radio"/>	<input type="text"/>
4.	<input type="text"/>	<input type="radio"/>	<input type="radio"/>	<input type="text"/>
5.	<input type="text"/>	<input type="radio"/>	<input type="radio"/>	<input type="text"/>
6.	<input type="text"/>	<input type="radio"/>	<input type="radio"/>	<input type="text"/>
7.	<input type="text"/>	<input type="radio"/>	<input type="radio"/>	<input type="text"/>
8.	<input type="text"/>	<input type="radio"/>	<input type="radio"/>	<input type="text"/>

21. Please list the nanotechnology stage or theater presentations, forums or science cafés, or classroom activities you delivered during NanoDays that were not part of the NanoDays kit or online catalog and how many times each was delivered.

	Activity name	Activity type?			How many times?
		Stage	Forum	Classroom	
1.	<input type="text"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="text"/>
2.	<input type="text"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="text"/>
3.	<input type="text"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="text"/>
4.	<input type="text"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="text"/>
5.	<input type="text"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="text"/>
6.	<input type="text"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="text"/>
7.	<input type="text"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="text"/>
8.	<input type="text"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="text"/>

22. Please describe any other nanotechnology programs or activities delivered at your institution during NanoDays that you have not already reported in this survey.

9. Programs and Activities

23. What are some of the reasons you chose to deliver certain activities and programs from the NanoDays kit or online catalog and not others?

10. Public Audiences

24. Please indicate if you noticed any of the following audiences participating in NanoDays between March 27 and April 4 at your institution.

- Family groups (adults with children)
- School groups
- Adult only groups

11. NanoDays Overall

For the next three questions, think about the goals you and your institution had for your NanoDays 2010.

25. Which of your goals did you successfully meet? If possible, please elaborate on why you think you were successful.

26. Which of your goals were you less successful at meeting? If possible, please elaborate on why you think you were less successful.

27. Is there anything the NISE Network could have done to help you better meet these goals?

12. NanoDays Overall

For the next three questions, think about the public impact goals for the NISE Network.

28. The first goal is: Increase awareness of nanoscale science, engineering, and technology and its multiple, potential benefits and impacts on lives and communities.

In what ways, if any, did your event support this goal?

29. The second goal is: Increase understanding of the structure of matter and the forces at work on the nanoscale.

In what ways, if any, did your event support this goal?

30. The third goal is: Increase understanding of societal issues, including risk assessment and abatement, and the importance of broad citizen participation in discussions about responsible research and development of new technologies.

In what ways, if any, did your event support this goal?

31. How could the NISE Network help you support these goals in the future?

'Thank You'/Redirect Page

Thank you for completing the NanoDays report.

Appendix C: Codebook for reasons that institutions chose to deliver certain activities (NanoDays report)

Code	Description
Age appropriate: adaptable	Chose exhibits that are adaptable to a range of ages, materials that are relevant to a wide range of ages. Includes descriptions of youth-oriented exhibits, exhibits oriented to specific children's age groups, appropriate for the motor skills of a children's age group.
Ease of implementation	Description of the exhibit being easy to put on or implement, easy to train the volunteers, easy to set up, not messy, easy for the staff and volunteers to understand, being familiar with the kit.
Ease of understanding	Any mention of the exhibit being easy for the audience to understand, easy for the audience to do, easy for the volunteers to teach the audience.
Engaging activities	Activities that are described as interactive, hands-on, active, visual, fun, interesting, appealing, engaging, attention-grabbing, showy. Activities that are related to audiences' existing knowledge or expertise, that make real-world connections.
Low cost	NanoDays activities were chosen that were low cost to implement, lack of funding. Descriptions of all necessary supplies being included in the kit, there being a lot included in the kit, a low need for other consumables outside the kit, choosing activities based on a low need for other consumables/supplies that are not included in the kit.
Low staffing needs	Any mention of needing exhibits that only take a few staff members/volunteers to run, not having enough staff members/volunteers, preferring exhibits that do not take many staff members/volunteers, selecting activities that are independent or self-directed and do not need supervision or staffing.
Other	Other topics that do not fall into these categories but may be important, including portability, safety, activities that provide take home materials, activities that allow visitors to feel like a scientist or to associate with scientists, etc. This includes descriptions of the kit being conducive to small audiences, easy to use in large audiences, needing a large number of people to participate in the activities, not needing a large number of people to conduct the demonstrations, allowing for high volume of visitors, adaptable for both large and small groups, useful for both large and small groups.
Quick activities	Includes any mention of needing quick activities, activities that can be joined and left at any time, activities that can have a rapid pass-through, a lack of time for lengthy exhibits, ability to adapt activities based on the amount of time available on-the-spot, short attention spans, lack of time to present more Nano material.
Space considerations	Descriptions of choosing NanoDays due to the fact that it contained exhibits that could be done in a small space, a lack of available space, exhibits being appropriate for the space available, the small amount of space needed, or the need for more space.

Staff favorites	Choosing to include or not include activities based on staff or volunteer favorites, staff or volunteer knowledge, applicability of activities with current staff and volunteer research, familiarity and comfort of staff and volunteers with the subject matter, previous experience of presenters with the material.
Real-world connections	Activities that were chosen to show a real-world connection between nanotechnology and visitors' lives, built on everyday knowledge, or applied to visitors' outside lives.

Appendix D: Codebook for successes institutions reported for NanoDays (NanoDays report)

Code	Description
Built on NanoDays	Building on last year's NanoDays successes, visitors who already know something about nano due to visiting NanoDays last year, visitors inquiring about the dates of the next NanoDays, return visitors to the NanoDays exhibit, ease of putting on NanoDays due to familiarity.
Collaborated	Collaborating on NanoDays with other museums, companies, universities, experts, and other organizations.
Communicated nano=small	The concept that nano is incredibly small and that things that happen on nanoscale occur differently than macro scale, grasping the concept of the true size of nano, the difference that is caused by the size of nano.
Created fun exhibits	Making the nano exhibits interactive, hands-on, creative, engaging, fun, exciting.
Discussed social implications	Discussion of the social implications of nano, controversies that arise as a result of nanotechnology, pros and cons to using nano, multiple sides to the concept.
Increased outreach	Taking the exhibits to other venues, outreach to schools and underserved communities.
Increased visitors	NanoDays resulted in an increased number of visitors, a longer length of stay, surprisingly good attendance, repeat visitors, increases in attendance due to marketing or advertising or new collaborations, reached desired target audience that does not fall into one of the other audience categories, reaching a wide range of desired audience members.
Increased volunteerism	An increased number of volunteers, volunteers especially for NanoDays, volunteers prompted by a specific event, training new volunteers to provide NanoDays exhibits, attempting to reach many high school volunteers, increased excitement in volunteers due to NanoDays, enthusiasm in volunteers due to NanoDays.
Introduced nano	Introducing the concept of nano to audiences, increasing understanding, raising awareness, familiarizing with the concept, grasping the concept, stimulating interest, piquing curiosity, exciting audiences. Increased public awareness of nano, increase of general knowledge.
Involved experts	Involving experts such as scientists and graduate students in the field, connecting the public to scientists, making science and scientists and universities approachable to individuals who ordinarily would not venture there.
Reached diverse audiences	Reaching out to diverse, underrepresented audiences, having a diverse attendance, inclusion of women and minorities.
Reached expert audience	The intended audience includes scientists, experts, policymakers, teachers.
Reached children	The intended audience includes children of specific ages, youth in general, family groups, all ages, intergenerational, broad spectrum audiences.

Related nano to the real world	Relating nano to other fields and other phenomena, doing real-world experiments with nano with visitors, showing the breadth of the applications of nanotechnology. Relating nano to current research, new technology, and recent happenings.
Suggested career paths	Suggesting career paths to students, attracting students to STEM fields, attracting students to research, helping students to realize they are scientists.
Taught others to teach	The program allowed volunteers to learn and then teach the material to others. Also included any mention of the materials being easy for the volunteers to learn or convey, teaching the permanent staff information about nano so that the topic can be permanently included in the organization's exhibits.

Appendix E: Codebook for how institutions reported supporting Network goals during NanoDays 2010 (NanoDays report)

Code	Description
Age adaptation	Any mention of how the organization adapted or would like to adapt the content to be appropriate for different age ranges. Examples include discussion of tailoring content to fit ages, having adult-only forums, leaving out certain goals because of age of target audience, workshops for adults. Also descriptions of creating programming that was successful for integrating learning about nano for both children and adults at the same time.
Barriers: NISE net	Details of why goals were not met due to issues on the part of the NISE Network. This includes being unclear that the goal was a part of NanoDays or not having enough activities in the kit to support a particular goal. This also includes when organizations did not present the information due to lack of knowledge of how to present risks of nanotechnology without causing fear and distrust in the audience.
Barriers: Age	Details of why goals were not met because of age issues. This includes if the information was deemed not applicable to the age range of the audience, inability of children to grasp the concepts related to the goal, and decisions not to approach a goal due to the young age of the audience.
Barriers: Organization	Details of why goals were not met due to issues at the organizational level. This includes things like if the goal did not fit with the NanoDays experience currently provided by the organization, time limitations, choosing to focus on other aspects of NanoDays such as the physical properties, or needing a different forum in order to present ideas (i.e., less frenetic).
Benefits for visitors	Benefits that visitors receive on parallel with the goals of NISE Net. Includes being engaged in hands-on activities, participating, increasing knowledge, being introduced to nanotechnology for the first time, having volunteers explain complex ideas, raising awareness, giving takeaways, participating in kit activities, getting children to understand nano structure, seeing real-life application of nanotechnology, sparking interest, appeasing fears, addressing common misconceptions, drawing parallels between nanotechnology and technology that older adults can understand, use of experts to explain nanotechnology,
Continued learning	Opportunities where visitors indicated they wanted to know more information on the topic or resources to examine the topic in depth at their leisure. This includes visitors asking for more information to inform others, organizations giving out relevant websites, expressing a desire to continue to learn on their own, to do research. Also included are instances when parents want more information on nano to inform their children's school curriculum.
Goal deemed inapplicable	Declaration that the goal is inapplicable to the target audience, due to age, venue, or other reasons.

Methods	Description of methods used to satisfy the NISE Net goal and impart nano information. Includes posters, table top experiments, demonstrations, presentations, stimulating conversations, booths at other venues, movies, workshops, nano forum café, video clips, PowerPoint, guest lectures, stage shows, advertising in local papers about nano facts, pre-lab assignments, increasing the number of nano-focused days at the organization, etc.
Topics covered	Topics covered during NanoDays. Includes responsible research, ethics, positive impact on society, how technology impacts our lives, kit activities, social context of nanotechnology, risk/benefit ratio of nanotechnology, health implications, everyday application, the broad spectrum of nanotechnology, the multiple benefits, pros and cons of nano, long-term effects, career and educational aspects of nano, solar energy, etc.

Appendix F: Codebook for challenges institutions reported related to NanoDays (NanoDays report)

Code	Code description
Assistance with collaboration	Hurdles resulting from lack of a community partner, difficulties in finding a willing community partner, community partners that fell through, unsuccessful collaborations, desire for assistance from NISE Net in connecting community partners, difficulty in putting on NanoDays without a community partner, the need for assistance in making long-term collaborations work. Also the desire for NISE Net to provide guest lecturers, help in going to conferences, and the desire for face-to-face regional hub meetings.
Assistance with NISE Net goal 3	The need for more guidance/materials/ideas on how to meet NISE Net's third goal. This includes informing participating institutions on what has been found to be most effective in this regard, table-top activities that don't require much manpower, tips on how to inform visitors about the "riskier" side of nano without scaring them, a societal implications activity that is not too involved, activities focused on societal issues, reports of known hazards, data on the lack of regulation in nano, and tips on how to frame the societal issues for younger children.
Change of date	Change the length or timing of NanoDays. Suggestions include making NanoDays two weeks instead of just one, making it one full month, holding it at a different time of year that is less susceptible to fantastic weather competition, making the focus more on year-round nano, not just NanoDays.
Child specific	Need to provide materials for very young children or provide guidance for how to adapt the activities for very young children.
Limited resources	Problems of low budgets (museum or schools that visit the museums), limited time, limited number of staff, too few volunteers, limited space.
Low attendance	Problems of low attendance, the inability to attract specific groups such as college students, high school students, diverse individuals, individuals new to nanotechnology, non-members. The desire to broaden the scope of the audience and the participation. Low attendance due to competing events such as school holidays, mandatory exams, competing exhibits, great weather.
Organization specific suggestions	Suggestions made by only one or two organizations that do not fall into one of the other categories. This includes the need for certain things, such as take-homes, examples of everyday nano, physical examples, websites for kids to visit after they view the exhibit, more nanopants, etc. It also includes additional assistance needed from NISE Net, such as more reminders, better website service, the ability to order a la carte kit items, etc. Desire for NanoDays kit to include more inquiry-based activities, making materials easily

	adaptable for a wide range of ages.
No suggestions	No suggestions were made, the kits were great, nothing needs to change, materials were very complete, keep up the good work.
Publicity	Need to provide publicity and advertising competently, far before event, nationally, locally.

Appendix G: Copy of partner survey

(Note: the formatting of the survey is slightly altered from the original online version. Survey logic, such as hidden questions and page skips, are not represented.)

NISE Network Member Survey

Introduction

This survey is designed to document the nano education activities and programs that Nanoscale Informal Science Education (NISE) Network partner institutions delivered during the last year (July 1, 2009, through June 30, 2010). This includes activities already reported in the NanoDays 2010 survey. We will use this information to evaluate the success of the Network and report back to NSF.

The survey should take no more than 15 minutes to complete.

Please complete this survey by Friday, June 25. Individuals who submit the survey on behalf of their organizations by this deadline will be entered into a drawing to win a FREE registration and travel stipend to a major professional development conference.

Thank you for your willingness to participate and for all your efforts over the past five years to improve the NISE Network!

If you have any questions regarding the survey, please e-mail visitorstudies@omsi.edu.

Respondent information

1.) Please enter your name and contact information.

Survey responses will not be associated with individual names in the final evaluation report.

Activity source

2.) Please indicate if your institution delivered nano education programs or activities from any of the following sources since July 1, 2009.

	Yes	No
NanoDays kit	()	()
Nisenet.org online catalog	()	()
Other NISE Network materials	()	()
Developed by your institution	()	()
Other source(s)	()	()

NISE Network nano education activities delivered in year 5

Please tell us about the NISE Network-produced activities, including activities from the nisenet.org online catalog or the NanoDays kit, delivered at your institution since July 1, 2009. Include activities already reported in the NanoDays 2010 survey. Refer to the website for a complete list of activities and activity types:

<http://www.nisenet.org/catalog>

Consult with other staff as needed to answer this question.

3.) Which of the following NISE Network-produced activities and programs did your institution deliver during this time period?

- Cart demonstrations
- Stage presentations
- Facilitated activities

- Museum theater
 Displays
 Classroom activities
 Exhibits
 Forums
 Media
 None of the above

) Please indicate which cart demonstrations or facilitated activities your institution delivered during this time period, including how often and when they were available to visitors.

	Delivered?		If YES, how often on average?					If YES, when?		
	Yes	No	A couple times per year	At least once a month	At least once a week	Several times per week	Once a day	NanoDays (3/27-4/4)	Outside of NanoDays	Both
Aerogel	()	()	—	—	—	—	—	—	—	—
Balloon nanotubes tabletop	()	()	—	—	—	—	—	—	—	—
Biobarcodes: antibodies and nanosensors	()	()	—	—	—	—	—	—	—	—
Cutting it down to nano	()	()	—	—	—	—	—	—	—	—
DNA nanotechnology	()	()	—	—	—	—	—	—	—	—
Exploring fabrication—self-assembly	()	()	—	—	—	—	—	—	—	—
Exploring forces—gravity	()	()	—	—	—	—	—	—	—	—
Exploring materials—ferrofluid	()	()	—	—	—	—	—	—	—	—
Exploring materials—	()	()	—	—	—	—	—	—	—	—

liquid crystals										
Exploring materials—nano fabrics	()	()	—	—	—	—	—	—	—	—
Exploring measurement—human body	()	()	—	—	—	—	—	—	—	—
Exploring measurement—molecules	()	()	—	—	—	—	—	—	—	—
Exploring measurement—ruler	()	()	—	—	—	—	—	—	—	—
Exploring measurement—solutions	()	()	—	—	—	—	—	—	—	—
Exploring measurement—stretchability	()	()	—	—	—	—	—	—	—	—
Exploring properties—surface area	()	()	—	—	—	—	—	—	—	—
Exploring structures—buckyballs	()	()	—	—	—	—	—	—	—	—
Exploring tools—SPMs	()	()	—	—	—	—	—	—	—	—
Forms of carbon	()	()	—	—	—	—	—	—	—	—
Inkjet printer	()	()	—	—	—	—	—	—	—	—
Intro to nano cart demo	()	()	—	—	—	—	—	—	—	—
Invisible sunblock	()	()	—	—	—	—	—	—	—	—
Lotus leaf effect	()	()	—	—	—	—	—	—	—	—
Macro, micro, and nano stretchability	()	()	—	—	—	—	—	—	—	—
Magic sand / nanosurfaces	()	()	—	—	—	—	—	—	—	—

Nanoparticle stained glass (cart program)	()	()	—	—	—	—	—	—	—	—
Ready, set, self assemble	()	()	—	—	—	—	—	—	—	—
Shrinking robots!	()	()	—	—	—	—	—	—	—	—
Sizing things down	()	()	—	—	—	—	—	—	—	—
Surface area	()	()	—	—	—	—	—	—	—	—
The electric squeeze	()	()	—	—	—	—	—	—	—	—
Tiny particles, big trouble!	()	()	—	—	—	—	—	—	—	—

) Please indicate which **stage presentations** your institution delivered during this time period, including how often and when they were available to visitors.

	Delivered?		If YES, how often on average?					If YES, when?		
	Yes	No	A couple times per year	At least once a month	At least once a week	Several times per week	Once a day	NanoDays (3/27-4/4)	Outside of NanoDays	Both
Energy and nanotechnology	()	()	—	—	—	—	—	—	—	—
Flying cars	()	()	—	—	—	—	—	—	—	—
Intro to nano—stage	()	()	—	—	—	—	—	—	—	—
Nanosilver: breakthrough or biohazard?	()	()	—	—	—	—	—	—	—	—
Shrinking robots!	()	()	—	—	—	—	—	—	—	—
Snowflakes: nano at its coolest	()	()	—	—	—	—	—	—	—	—

Treating tumors with gold	()	()	—	—	—	—	—	—	—	—
World of carbon nanotubes	()	()	—	—	—	—	—	—	—	—

) Please indicate which **museum theater shows** your institution delivered during this time period, including how often and when they were available to visitors.

	Delivered?		If YES, how often on average?					If YES, when?		
	Yes	No	A couple times per year	At least once a month	At least once a week	Several times per week	Once a day	NanoDays (3/27-4/4)	Outside of NanoDays	Both
Attack of the nano scientists	()	()	—	—	—	—	—	—	—	—
Nano dreams and nano nightmares	()	()	—	—	—	—	—	—	—	—
Wheel of the future	()	()	—	—	—	—	—	—	—	—

) Please indicate which **exhibits or displays** your institution delivered during this time period, including how often and when they were available to visitors.

	Delivered?		If YES, how often on average?						If YES, when?		
	Yes	No	A couple times per year	At least once a month	At least once a week	Several times per week	Once a day	Always available	NanoDays (3/27-4/4)	Outside of NanoDays	Both
At the nanoscale	()	()	—	—	—	—	—	—	—	—	—
Balloon nanotubes (giant hanging model)	()	()	—	—	—	—	—	—	—	—	—
Balloon nanotubes	()	()	—	—	—	—	—	—	—	—	—

tabletop											
Bump and roll	()	()	—	—	—	—	—	—	—	—	—
Changing colors	()	()	—	—	—	—	—	—	—	—	—
Creating nanomaterials	()	()	—	—	—	—	—	—	—	—	—
Detecting disease	()	()	—	—	—	—	—	—	—	—	—
Fact or fiction?	()	()	—	—	—	—	—	—	—	—	—
Intro to nanomedicine video	()	()	—	—	—	—	—	—	—	—	—
Intro to nanotechnology video	()	()	—	—	—	—	—	—	—	—	—
Mixing molecules simulation	()	()	—	—	—	—	—	—	—	—	—
Nano buzz current science	()	()	—	—	—	—	—	—	—	—	—
NanoLab	()	()	—	—	—	—	—	—	—	—	—
Nanomedicine explorer interactive software	()	()	—	—	—	—	—	—	—	—	—
Regenerating tissues	()	()	—	—	—	—	—	—	—	—	—
Three drops simulation	()	()	—	—	—	—	—	—	—	—	—
Treating disease	()	()	—	—	—	—	—	—	—	—	—
Unexpected properties	()	()	—	—	—	—	—	—	—	—	—

) Please indicate which **classroom activities** your institution delivered during this time period, including how often and when they were available to visitors.

	Delivered?		If YES, how often on average?					If YES, when?		
	Yes	No	A couple times	At least once a	At least once	Several times per	Once a	NanoDays (3/27-4/4)	Outside of	Both

			per year	month	a week	week	day		NanoDays	
Nanoparticle stained glass (classroom program)	()	()	—	—	—	—	—	—	—	—
Theater school program	()	()	—	—	—	—	—	—	—	—

) Please indicate which **media** your institution delivered during this time period, including how often and when they were available to visitors.

	Delivered?		If YES, how often on average?						If YES, when?		
	Yes	No	A couple times per year	At least once a month	At least once a week	Several times per week	Once a day	Always available	NanoDays (3/27-4/4)	Outside of NanoDays	Both
Everything is made of atoms poster	()	()	—	—	—	—	—	—	—	—	—
How small is nano: measuring different things	()	()	—	—	—	—	—	—	—	—	—
Intro to nanomedicine video	()	()	—	—	—	—	—	—	—	—	—
Intro to nanotechnology video	()	()	—	—	—	—	—	—	—	—	—
<i>Is that Robot Real?</i> children's book	()	()	—	—	—	—	—	—	—	—	—
Multimedia zoom into a human hand	()	()	—	—	—	—	—	—	—	—	—
Multimedia zoom into a nasturtium leaf	()	()	—	—	—	—	—	—	—	—	—
Nanomedicine explorer interactive	()	()	—	—	—	—	—	—	—	—	—

software											
Scale ladder illustration	()	()	—	—	—	—	—	—	—	—	—
SmallTalk podcasts	()	()	—	—	—	—	—	—	—	—	—
Talking nano (6-DVD video set)	()	()	—	—	—	—	—	—	—	—	—
Zoom into a butterfly wing poster	()	()	—	—	—	—	—	—	—	—	—
Zoom into a computer chip poster	()	()	—	—	—	—	—	—	—	—	—
Zoom into the human bloodstream poster	()	()	—	—	—	—	—	—	—	—	—
Zoom into the human bloodstream poster	()	()	—	—	—	—	—	—	—	—	—

) Please indicate which [forums](#) your institution delivered during this time period, including how often and when they were available to visitors.

	Delivered?		If YES, how often on average?					If YES, when?		
	Yes	No	A couple times per year	At least once a month	At least once a week	Several times per week	Once a day	NanoDays (3/27-4/4)	Outside of NanoDays	Both
Energy challenges, nanotech solutions?	()	()	—	—	—	—	—	—	—	—
Nanomedicine in healthcare	()	()	—	—	—	—	—	—	—	—
Risks, benefits, and who decides?	()	()	—	—	—	—	—	—	—	—

Untitled Page

4.) Please indicate if your institution made any of the following modifications to any of the NISE Network-produced activities delivered since July 1, 2009.

	Yes	No
Incorporated into an existing program	<input type="checkbox"/>	<input type="checkbox"/>
Combined two or more activities into a longer program	<input type="checkbox"/>	<input type="checkbox"/>
Changed the educational messages	<input type="checkbox"/>	<input type="checkbox"/>
Adapted for a different audience	<input type="checkbox"/>	<input type="checkbox"/>
Adapted for different staffing needs	<input type="checkbox"/>	<input type="checkbox"/>
Changed the format or activity type	<input type="checkbox"/>	<input type="checkbox"/>

5.) Briefly describe any other types of modifications your institution made to NISE Network-produced programs or activities during this time period.

Why delivered?

6.) What are some of the reasons your institution chose to deliver certain NISE Network-produced activities and not others since July 1, 2009?

Non-NISE Network activities 2

7.) Please describe any non-NISE Network nano education activities or programs your institution delivered since July 1, 2009. Include activities already reported in the NanoDays 2010 survey.

Consult with other staff as needed to answer this question.

Brief description

: _____

Activity type?

- Facilitated activity
- Exhibit or display
- Stage presentation
- Forum or science café
- Classroom activity

How often on average?

- A couple times per year
- At least once a month
- At least once a week
- Several times per week
- Once a day
- Always available

When?

- NanoDays (3/27-4/4)
- Outside of NanoDays
- Both

)

[] [Click here to see definitions of activity types.](#)

Facilitated activity. Hands-on activity or interactive program for small groups of visitors facilitated by a museum staff member or volunteer; typically 5–10 minutes long.

Exhibit or display. A permanent or temporary un-staffed visitor experience, including objects, graphics, interactive components, computers, or media.

Stage presentation. A public program, including theatrical plays, for a large group of visitors; often in a dedicated presentation area; typically 15–20 minutes long.

Forum or science café. A longer program, including lectures, for a large group of visitors, and especially adults; often in a dedicated presentation area; advanced registration may be required.

Classroom activity. Workshop, lab, or lesson for students; usually in a dedicated classroom or lab space; typically about 45 minutes long.

New Page

8.) Please indicate if your institution provided any of the following types of nano education activities, programs, or resources for K–12 students and teachers since July 1, 2009.

	Yes	No
Outreach programs delivered in the classroom	<input type="checkbox"/>	<input type="checkbox"/>
School group programs delivered at your institution	<input type="checkbox"/>	<input type="checkbox"/>
Curriculum or classroom activities	<input type="checkbox"/>	<input type="checkbox"/>
Teacher professional development	<input type="checkbox"/>	<input type="checkbox"/>

Other activities

9.) Did your institution participate in NanoDays 2010?

Yes

No

Not sure

10.) Please describe any other nano education programs or activities delivered at your institution since July 1, 2009, that you have not already reported in this survey.

Network information

11.) Is your institution involved in other nano education projects outside of the NISE Network?

Yes

No

Not sure

) Please briefly describe these projects.

Institution information

12.) How many full-time, paid staff members currently work at your institution?

13.) Of the full-time, paid staff at your institution, how many worked at least 10% of their time (about half a day per week) since July 1, 2009, on nano education programs and activities, including the NISE Network project?

14.) How well prepared do you feel staff members were at your institution who delivered nano education programs and activities since July 1, 2009?

- Very well prepared
- Well prepared
- Neutral
- Not very well prepared
- Not at all prepared

Spanish language resources

15.) How interested do you think your institution would be in Spanish translations of NISE Network activities, programs, or exhibits?

- Very interested
- Interested
- Neutral
- Not very interested
- Not at all interested

16.) How interested do you think your institution would be in translations of NISE Network activities, programs, or exhibits in other languages besides Spanish?

- Very interested
- Interested
- Neutral
- Not very interested

() Not at all
interested

17.) Please indicate if your institution has ever translated nano education activities, programs, or exhibits from any of the following sources.

	Yes	No
NanoDays kit	()	()
Nisenet.org online catalog	()	()
Other NISE Network materials	()	()
Developed by your institution	()	()
Other source(s)	()	()

Spanish language resources 2

18.) Please indicate how important you feel it would be to have translated materials available for the following types of programs.

	Very important	Important	Neutral	Not very important	Not at all important
Facilitated activities	()	()	()	()	()
Exhibits or displays	()	()	()	()	()
Stage presentations	()	()	()	()	()
Forums or science cafés	()	()	()	()	()
Classroom activities	()	()	()	()	()

)
 Click here to see definitions of activity types.

Facilitated activity. Hands-on activity or interactive program for small groups of visitors facilitated by a museum staff member or volunteer; typically 5–10 minutes long.

Exhibit or display. A permanent or temporary un-staffed visitor experience, including objects, graphics, interactive components, computers, or media.

Stage presentation. A public program, including theatrical plays, for a large group of visitors; often in a dedicated presentation area; typically 15–20 minutes long.

Forum or science café. A longer program, including lectures, for a large group of visitors, and especially adults; often in a dedicated presentation area; advanced registration may be required.

Classroom activity. Workshop, lab, or lesson for students; usually in a dedicated classroom or lab space; typically about 45 minutes long.

19.) What languages besides Spanish would your institution be interested in?

Spanish language resources 3

20.) Were you aware of the [Spanish materials](#) available on nisenet.org?

Yes

No

21.) Would you be willing to be contacted about the translation of NISE Network activities and programs?

Yes

No

General feedback

22.) *Please use the space below to provide any additional feedback to the NISE Network project team.*

Thank You!

Thank you for completing the NISE Network member survey.

Individuals who submit the survey by Friday, June 25, will be entered into a drawing to win FREE registration to a major professional development conference. The NISE Network will pre-pay your registration and provide a limited travel stipend (up to \$250) for one of the following national conferences:

- *Association of Science-Technology Centers (Oct. 2–5, 2010, Honolulu)*
- *Materials Research Society (Nov. 29–Dec. 3, 2010, Boston)*
- *National Science Teachers Association (March 10–13, 2011, San Francisco)*
- *Association of Children’s Museums (May 18–21, 2011, Houston)*

Two drawings will be made. Winners will be notified by July 9, and will need to accept the offer and specify a preferred conference within 30 days. This offer extends to registration fees and related travel only. Recipients are responsible for additional travel, accommodations, and other related expenses.

Appendix H: Partner survey multivariate analyses

To better understand the factors that influenced the delivery of nano education programs and activities, we conducted a logistic regression using the frequency of delivering cart demonstrations or facilitated activities as a binary, dependent variable (i.e., whether or not institutions delivered these types of activities at least once a month). The independent variables were involvement tier, staff preparedness, involvement in NanoDays 2010 (based on the Network database), organization category, and involvement in other nano education projects. Staff resources and the proportion of staff resources put towards nano education were not used as predictor variables because of the large number of missing cases. Because of the low number of tier 1 institutions, tier 1 and tier 2 were combined for the analyses. Again because of low cell counts, staff preparedness was recoded into two categories: (a) very well and well prepared and (b) neutral, not very well, or not at all prepared. Organization category was coded as three dummy variables (small museums, universities, and other types of institutions), with large museums as the reference category.

Table H1 shows the results of the logistic regression of frequency of delivering cart demonstrations or facilitated activities. As indicated by the model chi-square value, the model was significant at the 0.01 level. Based on the chi-square and -2 log likelihood ratio, the model explained approximately 12% of the variability in the dependent variable. After controlling for other factors, involvement tier and participation in NanoDays 2010 were both statistically significant predictors of the frequency of delivering cart demonstrations or facilitated activities. Tier 1 and 2 institutions were over two times more likely to deliver cart demonstrations or facilitated activities at least once a month compared to Tier 3 institutions. Similarly, institutions that hosted NanoDays events in 2010, according to the Network database, were three times more likely to deliver these types of activities at least once a month compared to non-participating institutions. All other variables were not significant predictors of delivery frequency. Diagnostics of the logistic regression did not indicate issues with multicollinearity.

A logistic regression of delivery of classroom programs (independent variables same as above) was also statistically significant. “Other types of institutions” was the only statistically significant predictor of classroom program delivery after controlling for other variables. Other types of institutions were almost 12 times more likely to report having delivered classroom programs compared to large museums.

Table H1. Logistic regression of the frequency of delivery of cart demonstrations or facilitated activities

Variable	Model (n = 140)
<i>Professional development</i>	
Involvement tier	0.823* (2.277)
Staff preparedness	0.521 (1.683)
Involvement in NanoDays 2010	1.105* (3.020)
<i>Organization type</i>	
Small museum ¹	-0.481 (0.618)
University ¹	-0.856 (0.425)
Other ¹	-0.199 (0.820)
<i>Content focus</i>	
Other nano projects	0.162 (1.175)
Constant	-1.831*
Model chi-square	20.383**
Chi-square / -2 Log Likelihood	0.1249

Note. Unstandardized logistic coefficients with odds ratios in parentheses. Delivery frequency was coded as either high (at least once a month) or low (less than once a month).

¹ Reference organization type was large museums

* p<0.05, ** p<0.01

Appendix I: Modifications institutions reported making to Network activities (partner survey)

Seventy-seven respondents completed the question, “briefly describe any other types of modifications your institution made to NISE Network-produced programs or activities during this time period”. The majority of responses served as examples of the six modification categories listed in the previous close-ended question. Examples of these responses are listed here to illustrate how partner institutions are modifying Network activities. Responses could represent several modification categories.

The first modification listed on the checklist, “incorporated into an existing program,” was well represented in the open-ended responses. **Thirty-three respondents (43%) indicated that they incorporated NISE Network activities into existing programs.** Representative examples included:

- *We have been teaching an Outreach program called Energy which has taken bits and pieces from Energy and Nano program as well as some materials from the old Nanodays kit.*
- *Ferro fluids was added to nano-scale iron activity created by [university] for museum delivery during NanoDays.*
- *Energy-related PowerPoint program with materials incorporated into a climate change family science night.*
- *Elements of Nano demos were incorporated into existing activities in scout badge programs where appropriate. For instance, a requirement for Magnetism included a short intro to ferrofluids.*
- *The materials were used during a two day K–12 teacher/student hands-on event, University Days, held each year on the University campus.*

The second modification on the checklist, “combined two or more activities into a longer program,” was mentioned nine times (12%). Institutions appear to be selecting activities that “go together,” and creating mini-programs. Representative examples included:

- *~8 of the NanoKit activities were grouped together as a GenEd Physics Lab.*
- *Combined balloon carbon nanotube with forms of carbon demo. Combined sunblock societal impact poster with invisible sunblock demo. Combined nanopants demo with our own nanofabric demo.*
- *I often string together 2 or 3 activities in a sequence and adapt the messaging to pertain to issues of education in general, science funding, or the role of museums in engaging the public in current science.*
- *We took several activities and combined them into a summer camp program.*
- *We would often combine some of the programs or deliver the nano tools program and combine it with our nano simulator activities and nanomanipulator.*

The third modification on the checklist, “changed the educational message,” was not frequently mentioned in the open-ended responses. **Only two respondents (3%) indicated that they changed the educational message or focus of the activities.** Representative examples include:

- *We culled some of the activities, and changed some of the focus.*
- *Adapted activities to reflect research at our [research lab].*

The fourth modification on the checklist, “adapted for a different audience,” was mentioned 13 times (17%). Adaptations were primarily made to accommodate young children but were also made to accommodate language differences, older adults, and specific professions. This is especially interesting, as many participants from the NanoDays survey indicated that they struggled to adapt activities for a younger audience. Representative examples included:

- *The theater show Nanodreams and nanonightmares and all items in kit were translated into Spanish and adapted to the Mexican culture.*
- *Our audience is primarily preschool-age and early elementary children. We added some additional elements to the activities to make them more hands-on and the concepts more concrete.*
- *We adapted activities for our very young audience—ages 18 months and up and their families.*
- *Adapted for teachers.*
- *Many activities have been slightly adjusted (primarily the amount/detail of background material presented) to incorporate our large visitor age range. Nanotechnology programs include those aimed at young children (Nano Days) and a nano program developed for a senior citizen group.*
- *Adapted content to be engaging and interactive for seniors and preschoolers.... Showed animated film to relay message just because you’re small doesn’t mean you are not important. Dr. Seuss Horton Hears a Who for preschoolers to help them understand the concept of nano science.*

The fifth modification on the checklist, “adapted for different staffing needs,” was mentioned seven times (9%). It appears that there is a distinct need for activities that can be conducted with fewer facilitators or with relatively untrained volunteers. Representative examples included:

- *Lessons were trimmed down so that the activities could be done by volunteers over short periods of time.*
- *During Nano Days, we combined activities with similar themes in order to pair uninitiated volunteers with staff to work with our visitors thus training the volunteers on multiple activities while serving the visitors.*
- *I did several demonstrations at a Boys & Girls Club as part of the... partnership work. The after-school environment with a very high student-adult ratio required some modification of the activities to account for minimal facilitation.*
- *We’ve taken the NanoDays kit and made it something that can be taken out by high school volunteers to demonstrate on the museum floor.*
- *We had children (the conference attendee’s children) who were going to present this to [other children].*

The last modification on the checklist, “changed the format or activity type,” was mentioned 16 times (21%). Some format modifications were very basic, such as lengthening or shortening specific activities. However, many of the format changes were more complex and were made to cater specifically to a classroom or summer camp setting. Representative examples included:

- *We also adapted some of the activities into classroom activities that could be done during summer camps.*
- *For the July 19, 2009 Nano Day here at the [museum], we opted for a three-hour program during which visitors dropped by tables with various activities led by educators.... We also felt that an open, informal format worked better for us than holding a closed workshop or class.*
- *We used inquiry-based methods to explore the information with the general public.*
- *We have developed a Nanotechnology school program for grades 6–12 using many of the materials from NISE Network (extended, with the inclusion of non-NISE Network activities). We have also shortened a version of the Treating Cancer with Gold stage presentation as the conclusion to that program to offer a vision of the potentials of nanotechnology into the future.*
- *Added classroom activities.*

Other modifications were also made. **Seventeen respondents (22% of responses) described other types of modifications that were not included on the checklist.** There were several distinct trends, although due to the small number of respondents, these trends were not supported by a high frequency of responses.

Several institutions made modifications in an effort to tie the activities more closely to real-world phenomena. Representative examples included:

- *Used the buckyballs at a statewide educational event for youth and adults.... Combined it with a demonstration of plant tissue cultures—nano in real life.*
- *We included these activities with our current science activities—current real world examples of science.*
- *I deliver programs as examples of informal science ed to a number of adult audiences throughout the year. For this purpose, I often string together 2 or 3 activities in a sequence and adapt the messaging to pertain to issues of education in general, science funding, or the role of museums in engaging the public in current science. I frequently add materials not explicitly in the instructions—e.g. I always use collard greens and lettuce with the nanofabrics and magic sand to address the concept of nanostructures in nature that are imitated in manufacturing of new materials.*

Other institutions described very specific changes that they had made to the NISE Network activities. Representative examples included:

- *For example, we modified the Exploring Measurement/Molecules activity by taping the balloons to marble columns located around the gallery space. Visitors would be invited to take a clipboard/data sheet and visit the different colored balloons around the room. We modified the data sheet so that it was completely blank (no color or smell clues). Families had a great time debating the scents and talking with our staff about their answers. Because it was so open-ended, visitors wanted to bring their results back to staff for “approval,” which allowed staff to talk with them about how the activity connected to nano. One young visitor “lit up” when he made the connection for himself: Oh! That’s why I can smell Mom’s coffee in the morning before I even see it!*
- *Addition of capillary tubes to the “defying gravity” demonstration. Use a large tube (like the large cup, put it in water, see that the water falls out) and capillary tube, same idea of sticky forces acting within the water, pulling it up the tube.*
- *Used ideas from NanoFabric to display hydrophobicity by holding an outside, post-lecture activity, having a faculty member & a student volunteer put on NanoTech lab coats & safety goggles, then have audience members use spray bottles filled with brightly*

colored water (i.e. energy drinks) onto the people in the lab coats. (Note: Great activity, but wear dark clothing. Material NOT stain resistant if the colored water stays on the fabric/in a pocket for more than 10 minutes!).

Two respondents mentioned that they adapted the activities from the kit to better conform to local school standards:

- *The major change was presenting materials as a [science teacher professional development opportunity], we adapted a lot of activities to meet [state standards].*
- *Translate into Spanish, incorporate the [state] Curriculum Standards.*

Appendix J: Codebook for reasons that institutions chose to deliver Network activities (partner survey)

Code	Description
Audience appropriate: age	Includes descriptions of youth-oriented exhibits and exhibits oriented to a specific age group or appropriate for the motor skills of young children. Chose exhibits that are adaptable to a range of ages, materials that are relevant to a wide range of ages.
Audience appropriate: general	Any mention of choosing activities based on audience characteristics, including appropriateness for the target audience, appropriateness for a range of audiences, resonance with audience, anticipated audience interest, or previously expressed audience interest. Also includes excluding activities based on the perception of audience interests, being easy for the audience to understand, or suited to their level of knowledge.
Quick activities	Includes any mention of needing quick activities, activities that can be joined and left at any time, activities that can have a rapid pass-through, a lack of time for lengthy exhibits, ability to adapt activities based on the amount of time available, short attention spans, and lack of time to present more nano material.
Engaging activities	Activities that are described as interactive, hands-on, active, visual, fun, interesting, appealing, engaging, attention-grabbing, showy.
Space considerations	Descriptions of choosing NanoDays due to the fact that it contained exhibits that could be done in a small space, a lack of available space, exhibits being appropriate for the space available, the small amount of space needed, or the need for more space. Any description of choosing activities based on the type of space available (e.g., stage versus museum floor).
Low staffing needs	Any mention of needing exhibits that take only a few staff members or volunteers to run, not having enough staff, preferring exhibits that do not take many staff, selecting activities that are independent or self-directed and do not need supervision or staffing.
Ease of implementation	Description of the exhibit being easy to put on or implement, easy to train the volunteers, easy to set up, easy for the staff and volunteers to understand, being familiar with the kit, easy to clean up afterwards, not messy. May also include description of choosing activities based on portability needs, mobility needs, or travel needs.
Low cost	Descriptions of all necessary supplies being included in the kit, there being a lot included in the kit, a low need for other consumables outside the kit, choosing activities based on a low need for other consumables/supplies that are not included in the kit. Includes descriptions of choosing activities that require supplies that are easy to access, simple to get, normal household everyday items, inexpensive items. Also includes description of the kit being "ready to go" or "complete." Also includes any discussion of choosing activities that were low cost to implement or any discussion of a lack of funding.

Staff favorites	Choosing to include or not include activities based on staff or volunteer favorites, staff or volunteer knowledge, applicability of activities with current staff and volunteer research, familiarity and comfort of staff and volunteers with the subject matter, previous experience of presenters with the material.
Real-world connections	Activities that are related to audiences' existing knowledge or expertise, that make real-world connections, or connect nano to the real world for the visitors.
Other	Other topics that do not fall into these categories but may be important, including safety, general logistics, general resource problems, versatility of kits, perceived "effectiveness" of activities, and others. Also includes issues of audience size.
Fit with program	Any mention of choosing activities that relate to other exhibits on the floor, that fit well with existing themes, or that are aligned with other initiatives. This also includes choosing activities that help organizations reach their program priorities, goals, or mission or that help others (such as teachers or collaboration partners) reach their goals. It includes selecting activities based on the usual delivery method or type of event or choosing activities that fit into a learning progression for the visitor or that combine well together. On the flip side, it also includes <i>not</i> selecting activities because they are too similar to existing activities or because they do not fit with how they traditionally present material. Also includes avoiding activities that they have already presented or choosing new and different activities based on previous exhibits.
Problems	Mention of problems that cropped up when attempting to present nano education material. This can include not having time to do nano programming, not having the kit, receiving the kit late, or needing more materials. Examples include being a new member and having very few materials to present.

Appendix K: Partner institution use of and interest in NISE Network language resources (partner survey)

In the partner survey, respondents were asked to indicate how interested they thought their institutions would be in Spanish translations of NISE Network activities, programs, or exhibits. Forty-three percent of respondents indicated that their institutions would be interested or very interested in Spanish translations (Table K1). There was less interest for translations in other languages. Only 17% of respondents indicated that they would be interested or very interested in translations of NISE Network activities, programs, or exhibits in other languages besides Spanish.

Table K1. *Level of interest in translations of NISE Network activities*

Translation language	Very interested	Interested	Neutral	Not very interested	Not at all interested
Spanish (<i>n</i> = 151)	16.6%	26.5%	31.1%	13.2%	12.6%
Other languages (<i>n</i> = 150)	4.7%	12.7%	35.3%	26.7%	20.7%

Very few institutions reported having done their own translations of nano education activities, programs, or exhibits (Table K2). Individuals were most likely to report having translated activities developed by their own institutions (8%) and least likely to report having translated nisenet.org online catalog activities (1%). Only a third of respondents (32.7%) indicated that they were aware of the Spanish materials available on nisenet.org (*n* = 150).

Table K2. *Frequency that respondents reported having translated activities from different sources*

Activity source	Translated?
NanoDays kit (<i>n</i> = 147)	7.5%
Nisenet.org online catalog (<i>n</i> = 147)	1.4%
Other NISE Network materials (<i>n</i> = 147)	2.0%
Developed by your institution (<i>n</i> = 146)	8.2%
Other source(s) (<i>n</i> = 147)	6.8%

Respondents that indicated that they were interested or very interested in either Spanish or other language translations of NISE Network materials were also asked how important they felt it would be to have translated materials available for specific types of programs (Table K3). The number of responses to these questions ranged between 68 and 66 individuals. Respondents expressed the most interest in translations of exhibits and displays. Approximately three quarters (76%) of respondents indicated that translations for these types of programs would be important or very important. Similarly, 68% and 62% of respondents indicated that translations for facilitated activities and classroom activities, respectively, were also important or very important. Less than half of

respondents felt that translations for stage presentations (33%) or forums or science cafés (39%) were important or very important.

Table K3. Importance of translating materials for specific types of programs

Program type	Very important	Important	Neutral	Not very important	Not at all important
Facilitated activities (n = 68)	35.3%	32.4%	25.0%	7.4%	0%
Exhibits or displays (n = 67)	50.7%	25.4%	17.9%	6.0%	0%
Stage presentations (n = 66)	19.7%	13.6%	43.9%	16.7%	6.1%
Forums or science cafés (n = 66)	16.7%	22.7%	33.3%	22.7%	4.5%
Classroom activities (n = 68)	36.8%	25.0%	29.4%	8.8%	0%

Individuals that responded very interested, interested, or neutral to the question about translations in other languages besides Spanish were also asked to list other languages that their institutions would be interested in (Table K4). Out of the 17 responses, Chinese (Mandarin) was the most commonly mentioned language (seven respondents).

Table K4. Translation languages other than Spanish in which respondents expressed interest

Language	Number of times mentioned (n = 17)
Chinese, Mandarin	7
Korean	3
Arabic	3
Polish	2
Vietnamese	2
Japanese	2
Russian	2
Hmong	2
English	1
Swedish	1
Finnish	1
Estonian	1
Italian	1
Asian languages (general)	1
French	1
Bengali	1
Haitian Creole	1

Note. The total number of times mentioned is more than 17 because many respondents mentioned more than one language.

Appendix L: NISE Network logic model, years six through ten

NISE Net Logic Model Years 6-10									
Overarching Network Goals									
1. In partnership with the research community, develop the necessary capacities and resources to achieve a widespread, sustainable impact on the ISE field.									
2. Engage the development and delivery power of the network community to raise the level of public awareness, engagement, and understanding of nanoscale science, engineering, and technology.									
Inputs resources	Outputs				Outcomes - Impact				
	activities	participation (activities)	participation (outcomes)	deliverables	short term learning by individuals	medium term action by individuals, organizations		long term conditions in field/society	
Network	Network community				Professional audience - informal science education field				
\$20M funding, NSF	Develop best practices to engage the public in nano	Tier 1	Tier 1	Pedagogy, practices, skills, knowledge	Most professionals report increased knowledge and skills for engaging the public in nano (Tiers 1-3). Many professionals report increased intent to participate in the network (Tiers 2-3).	Many partners engage their audiences in nano (Tiers 1-3). Some partners begin to integrate nano sustainably into their regular program (Tiers 1-2).	Overall, ISE community has capacity to engage public in nano. In some organizations, nano is fully integrated into ongoing program.		
Subawardees (Tier 1)	Develop products to engage the public in nano	Tier 1 (+ some Tier 2)	Tier 1 (+ some Tier 2)	Programs, exhibits, media (new products, adaptations, and					
Partner organizations (ISE orgs, research centers) (Tiers 2-3)	Develop resources, experiences to inform other professionals how to present nano to the public	Tier 1	Tier 1	Studies and reports, tools and guides, workshop curricula and materials (e.g. presentations)					
Partner centers (NNIN, CNS)	Deliver professional development experiences, resources to individuals in ISE field	Tier 1 (+ some Tier 2)	Tiers 1-3	Network-wide meeting; regional, national, and preconference workshops; online workshops; website	Professional audience - research science fields				
Partners' collaborations	Distribute products to organizations	Tier 1	Tiers 1-3	Website, activity and program kits, exhibits	Most professionals report increased knowledge and skills for communicating search to the public (Tiers 1-3). Many professionals report increased intent to participate in outreach efforts and/or partner with ISE organizations (Tiers 1-2).	Many partners participate in outreach efforts, independently or in partnership with local ISE organizations (Tiers 1-3). Some partners begin to integrate outreach efforts sustainably into their regular program (Tiers 1-2). Some partners begin to develop I	Participating members of the research community have the capacity to engage in outreach efforts. In some research institutions, public outreach is sustainably integrated into ongoing efforts. Some research institutions work in funded partnerships with ISE		
Professional organizations (ASTC, ACM, MRS, NSTA, AAM, VSA)	Provide funding to develop capacity to implement products	Tier 1	Tiers 1-3	Minigrants					
Wider museum, research, and educational community									
	Educational products				Public audience - informal learning environments				
	Deliver educational products to target audiences in informal settings	Tiers 1-3	Families	Cart and stage programs, activities, exhibits, media	Most visitors report increased awareness, knowledge, understanding, and engagement related to nano. Some visitors report changes in intended behavior related to nano.	Some visitors are more attentive to nano. A few visitors apply their knowledge and engagement in a social, economic, or educational context.	Overall public awareness, knowledge, and understanding of nano increases. A few individuals become very engaged in nano (e.g. by seeking careers in the field).		
		Tiers 1-3	Children in peer groups	Camp and afterschool programs					
		Tiers 1-3	Adults	Forums, science cafes					
		Tiers 1-3	K12 school groups	Classroom (field trip) programs					

Figure L1. This logic model, last updated September 2010, was developed to guide the work of the NISE Network during project years six through ten. It outlines how project outputs, including Network community outputs and educational products, will be designed to achieve public and professional outcomes.