NISE network
NANOSCALE INFORMAL SCIENCE EDUCATION

Summative Study of NanoDays 2014 Events

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Table of Contents

Executive Summary

In the spring of 2014, the Nanoscale Informal Science Education Network (NISE Net) Public Impacts evaluation team conducted a summative study of NanoDays, a nationwide festival of educational programs about nanoscale science, engineering, and technology. In 2014, NanoDays took place from March 29th – April 6th, 2014. The Network's goals for NanoDays events led to the following summative evaluation questions:

1. What is the projected public reach of NanoDays events in 2014?
2. Are 'mature' NanoDays events successful in providing an engaging experience and promoting learning of nano concepts for public audiences, including event attendees and event volunteers?
3. Does volunteering at NanoDays events have other impacts on volunteers, including increased interest in STEM activities/careers and confidence around engaging the public in nano?

These questions were answered primarily through in-person survey and interview methods at nine NanoDays events around the country as well as a national, online survey of event volunteers.

Findings

1. The estimated public reach of NanoDays 2014 is over 458,000 encounters for event attendees, and nearly 5,000 volunteers, across all events.

Using rigorously developed encounter estimation factors from 2010, the updated number of public encounters with nano during NanoDays events in 2014 is 458,887. This conservative estimate reflects the 250 kits distributed in the spring of 2014. In addition, the NanoDays reports submitted by Network partners indicate that there were 4,992 volunteers at 210 institutions.

2. NanoDays events are successful in providing event attendees with an engaging experience and in promoting learning of nano concepts.

Event attendee data across all study sites demonstrate that attendees found NanoDays interesting and enjoyable. In addition, event attendees report statistically significant gains in confidence around talking about and describing different aspects of nano concepts aligned with the NISE Net Content map.

3. NanoDays events are also successful in providing event volunteers with an engaging experience and in promoting learning of nano concepts.

Event volunteer data demonstrate that volunteers found their NanoDays experience engaging. Event volunteers also report statistically significant gains in confidence around talking about and describing different aspects of nano concepts aligned with the NISE Net Content map. These gains are larger than those reported by event attendees.

4. Volunteering at NanoDays positively impacts interest in STEM activities/careers and confidence around engaging the public in nano.

Volunteer data indicates that volunteers report higher levels of interest in STEM. High school and undecided college students also report slightly higher levels of interest in STEM careers after their NanoDays experience. Event volunteers also report statistically significant gains in confidence around engaging the public in nano, despite nano being perceived as a potentially difficult topic to communicate to public audiences.

Introduction to the Summative Study of NanoDays Events

In the spring of 2012, the Nanoscale Informal Science Education Network (NISE Net) Public Impacts Evaluation group embarked on a three-year study to explore the public impacts of the most resource-intensive educational products developed by the Network.

During this second year of the study, the Public Impacts Evaluation focused on conducting a summative evaluation of NanoDays, a nationwide festival of educational programs about nanoscale science and engineering and its potential impact on the future. NanoDays events are organized by partners in the NISE Net and take place at over 250 science museums, research centers, and universities across the country from Puerto Rico to Hawaii. NanoDays engages people of all ages in learning about this emerging field of science, which holds the promise of developing revolutionary materials and technologies. In 2014, NanoDays took place from March 29th – April 6th, 2014.

The Network's goals related to public audiences at NanoDays events are to:

1. Provide engaging programming experiences for public audiences related to nanoscale science, engineering, and technology (NSET).

2. Engage the public in content learning related to NSET, as more specifically defined in the NISE Net Content Map, which includes the following learning goals:

    A. Nanometer-sized things are very small, and often behave differently than larger things do.

    B. Scientists and engineers have formed the interdisciplinary field of nanotechnology by investigating properties and manipulating matter at the nanoscale.

    C. Nanoscience, nanotechnology, and nanoengineering lead to new knowledge and innovations that weren't possible before.

    D. Nanotechnologies have costs, risks, and benefits that affect our lives in ways we cannot always predict.

In addition, the NISE Net has a range of goals for NanoDays focused on professionals in the Network, including increasing the capacity of the field to engage the public in nanoscience, engineering, and technology (NSET) content. Although not the main emphasis of this Public Impacts Summative Evaluation, this study does contribute some information regarding the Network's efforts towards this goal, particularly around the ways that volunteers – who can be seen as a hybrid public-professional audience, as they often facilitate NanoDays programming for the public – have been impacted by their NanoDays event experience. A complete list of goals for NanoDays, for both public and professional audiences, can be found in Appendix A.

Given these Network goals, the following summative evaluation questions were addressed in this study:

1. What is the projected public reach of NanoDays events in 2014?

2. Are mature[1] NanoDays events successful in providing an engaging experience and promoting learning of nano concepts for public audiences, including event attendees and event volunteers?

3. Does volunteering at NanoDays events have other impacts on volunteers, including increased interest in STEM activities/careers and confidence around engaging the public in nano?

These questions were answered through a range of methods, which will be briefly summarized here. A more thorough description of the study methods will be found in Appendix B.

In order to answer Question 1, kit distribution data was used to provide an updated list of kit recipients in 2014. These recipients were sorted into "small" and "large" museums based on criteria commonly used by the Association of Science and Technology Centers (ASTC, 2008). In addition, universities and colleges were designated by a "university" category. Once the numbers of small, large, and university sites were determined, evaluation team members used the conservative encounter estimate factors developed during the 2010 Delivery and Reach study (Pattison, Benne, & LeComte-Hinely, 2011) to generate the current encounter estimate for NanoDays 2014 events around the country.

Question 2 focuses on two specific public audiences: event attendees and event volunteers. The elements of the question focused on event attendees were addressed through surveys and interviews with museum visitors attending nine different NanoDays events across the country[2]. Adults were approached and asked to complete a brief survey, which included several items from the Summative Study of the *Nano* Mini-exhibition (Svarovsky, Goss, Ostgaard, Reyes, Cahill, Auster, & Bequette, 2013). A subset of adults were also asked to participate in a three-question interview to probe for additional information based on their responses. Family groups, consisting of adults and children, were also purposefully sampled. The adults in the group were asked to complete surveys and interviews while the children were interviewed by a separate data collector.

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[1] For the purposes of this study, the Evaluation Team (in consultation with members of Network leadership) defined "mature" NanoDays events as those that were hosted by established partners who had implemented at least two previous NanoDays events prior to this year. Sites were chosen in consultation with Evaluation Team members, the Regional Hub Leaders and Network Leadership.

[2] The nine study sites included Bakken Museum, The Discovery Museums, Duluth Children's Museum, Connecticut Science Center, Future of Flight Aviation Center & Boeing Tour, KidsQuest Children's Museum, Museum of Science, Science Factory Children's Museum and Exploration Dome, and Science Museum of Minnesota. The dates of actual NanoDays events observed fell between 03/29/2014 and 04/18/2014, with some events falling outside the official range of the NanoDays 2014 festival.

The elements of Question 2 that focused on event volunteers were addressed through an online Volunteer Survey administered through Survey Gizmo. The same online survey was also used to answer Question 3. Evaluation staff worked with NanoDays team members and the NISE Net Regional Hub Leaders to communicate with Network partners about the Volunteer Survey and enlist their help in circulating and promoting the survey with their volunteers after their NanoDays event. Information about the number and types of volunteers was gathered from the NanoDays 2014 report required of partners who received a 2014 physical kit.

Lastly, information providing additional context for the study was collected through the NanoDays 2014 reporting survey, which was sent to all 250 Network partners who received a physical NanoDays kit.

Table 1 aligns the Network goals of NanoDays relevant to public impacts to the sources of evidence included in this summative evaluation.

Goal	Indicator of Success	Source of Evidence
Provide engaging NSET programming for public audiences.	Event attendees find NanoDays interesting and enjoyable.	Visitor responses to relevant survey and interview questions.
	Event volunteers find their experience meaningful and enjoyable.	Volunteer responses to relevant survey questions.
Engage the public in learning about NSET.	Event attendees take away key messages from the four areas of the NISE Network content map.	Visitor responses to relevant survey and interview questions.
	Event volunteers take away key messages from the four areas of the NISE Network content map.	Volunteer responses to relevant survey questions.
Increase capacity of the field to engage the public in NSET programming.	Event volunteers gain confidence in engaging the public around NSET topics and become more interest in STEM activities and careers (as appropriate).	Volunteer responses to relevant survey questions.
	Public reach increases every year.	Event attendee reach estimates increase over time. Event volunteers come from a range of backgrounds.

Table 1. Indicators of success and sources of evidence for the 2014 Summative Study of NanoDays Events.

Summary of Findings

Finding 1: The estimated public reach of NanoDays 2014 is over 458,000 encounters for event attendees, and nearly 5,000 volunteers, across all events.

As described briefly above, evaluation staff relied on updated kit distribution information as well as the rigorously developed encounter estimation factors from the 2010 Delivery

and Reach study (Pattison, Benne, & LeComte-Hinely, 2011) to calculate an updated estimate of public encounters with nano during NanoDays events in 2014[3]. The final estimated number, which is intentionally conservative, is 458,887. This total reflects the 250 kits distributed in the spring of 2014.

Encounter-based estimates. As in prior NISE Net evaluation reports, it should be clearly stated that these reach estimates – as well as those generated in the 2010 Delivery and Reach study – are described in terms of "encounters", which translates to the number of times a member of the public engages in a nano-based activity at a NanoDays event. The reach estimate does not necessarily correspond to an estimated number of distinct individuals who have been reached by a NanoDays activity during an event.

Public encounter estimates over time. It is useful to place the counting estimates for 2014 in context to other encounter estimates for NanoDays over the life of the NISE Network. In 2008, the first year of NanoDays events, there were a conservatively estimated 171,457 public encounters during NanoDays, with 100 kits being distributed. In 2014, the number of kits had increased to 250, and the number of encounters had increased over two and one-half times the original estimate, as seen in both Table 2 and Figure 1. It should be noted that the encounter estimate for next year, 2015, is based on similar kit numbers and distribution to this year in 2014.

Conservative versus moderate encounter estimates. In both Table 2 and Figure 1, two sets of estimates are presented – a conservative estimate and a moderate estimate. Both sets of estimates are included here in order to reflect the likely range of public encounters over the life of the NISE Network.

Year	Number of Kits	Conservative Estimate	Moderate Estimate
2008	100	172,688	213,018
2009	206	366,754	*425,107
2010	200	358,698	*472,835
2011	200	363,362	448,223
2012	225	406,400	501,312
2013	225	413,584	510,174
2014	250	458,887	566,057
2015	250	458,887	**566,057
Total		2,999,260	3,702,784

*These two estimates are based on counting study data. **The estimate for 2015 is based on similar kit distribution in 2014.

Table 2. Public encounter estimates for NanoDays events, 2008-2015.

[3] Additional information about public reach during NanoDays events was collected from Network partners on the NanoDays 2014 report.

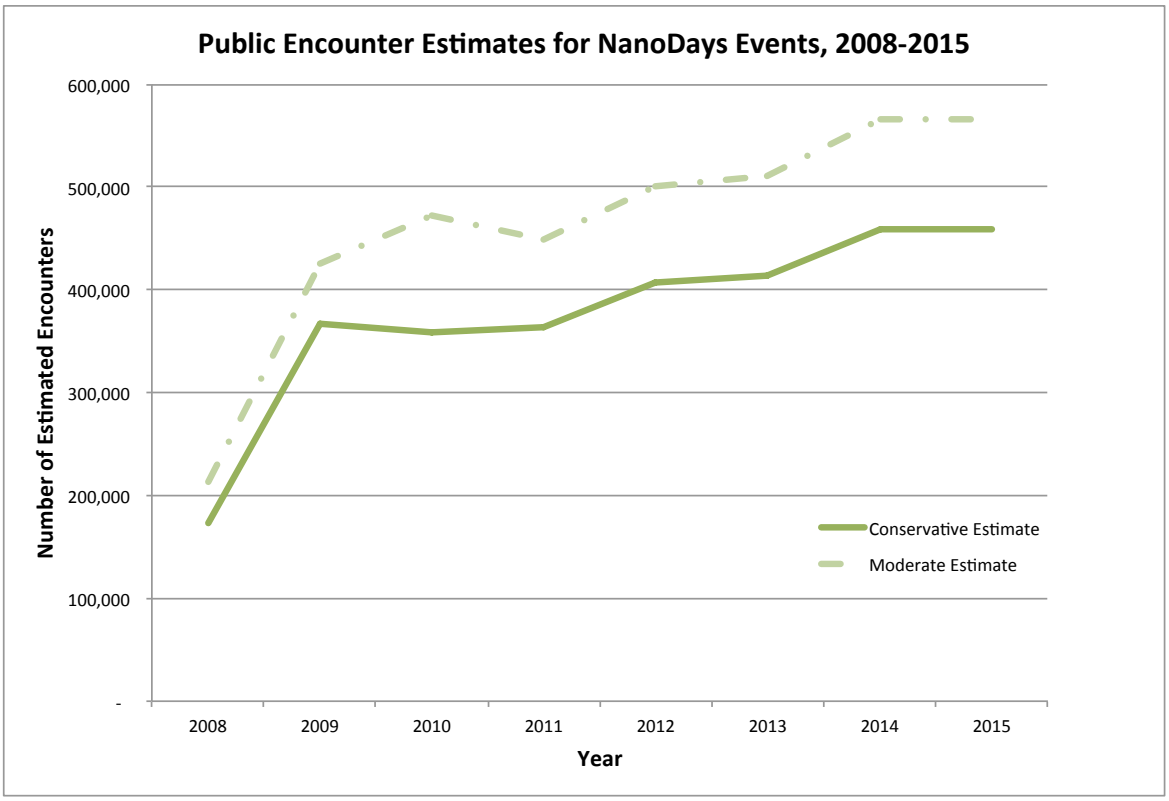

Figure 1. Public encounter estimates for NanoDays events, 2008-2015.

The conservative set of estimates were generated by using the estimation factors based on the median number of encounters per type of institution as reported in both the 2009 and 2010 Reach studies. The moderate set of estimates used an adjusted set of estimation factors, based on the ratios of the conservative encounter estimates to the more accurate counting study encounter estimates produced during those two earlier studies. The complete methods for determining these two estimates will be outlined in greater detail within the Appendix for this report, as well as in the NISE Network Public Reach Estimates Report (Svarovsky, Goss, & Kollmann, 2015).

Volunteer reach. Responses from Network partners on the NanoDays reporting survey (n=246 reporting institutions) indicate that there were a total of 4,992 volunteers involved in 210 NanoDays events across the country. The highest number of volunteers at any one institution was reported to be 200, while the median number was 15 volunteers.

Potential Implications of Finding 1

When put in context relative to other encounter estimates based on both earlier counting studies and updated kit distribution information, the 2014 encounter estimate suggests that the NISE Network has achieved one of its main professional goals, which is to increase the capacity of the field to engage in NSET programming. The NISE Network has

developed the infrastructure necessary to reach the public in NSET activities through a well coordinated, and nation-wide, festival.

Finding 2: NanoDays events are successful in providing event attendees with an engaging experience and in promoting learning of nano concepts.

Event attendee data across all study sites (n=326 for adult surveys, n=95 for adult interviews, n=87 for youth interviews) demonstrates that NanoDays events met public learning goals as defined by the Network Leadership and the NanoDays team.

Engaging programming. The NanoDays events sampled for this study were all located in museums, which represent the majority of sites where NanoDays kits are distributed. At these events, most adult event attendees (73%) reported knowing that there was a specific NanoDays event happening at the museum, and of those, approximately a third (32%) reported coming specifically for NanoDays. Almost all adult event attendees reported finding NanoDays interesting and enjoyable (97% and 98% respectively), and almost all youth event attendees (96%) found NanoDays fun.

In addition, interviews conducted with a subset of adult event attendees suggest that almost all of them (93%) would come back to a future NanoDays event.

Learning about nano content. Learning goals for event attendees were grounded in the four areas of the NISE Network content map:

1. Nanometer-sized things are very small, and often behave differently than larger things do.

2. Scientists and engineers have formed the interdisciplinary field of nanotechnology by investigating properties and manipulating matter at the nanoscale.

3. Nanoscience, nanotechnology, and nanoengineering lead to new knowledge and innovations that weren't possible before.

4. Nanotechnologies have costs, risks, and benefits that affect our lives in ways we cannot always predict.

In the NanoDays summative study, focused learning on nano content was primarily measured through a set of questions that asked adult event attendees to rate their confidence in five items, each of which involved talking about and describing some aspect of the content map, before and after their NanoDays experience. These survey questions were also used in the *Summative Evaluation of the Nano Mini-exhibition* (Svarovsky et. al, 2013).

As seen in Table 3 below, the analysis reveals that adult event attendees showed a statistically significant increase in their confidence levels for all five items (and thus spanning the NISE Net content map) after their NanoDays experiences, with a medium-small statistical effect size.

	Percent of visitors reporting top two levels of confidence after NanoDays	Mean confidence score, pre	Mean confidence score, post	Effect Size
Talk about how scientists are able to build things atom by atom at the nanoscale (n=305)	39%	1.90	2.32**	0.33
Describe one example of how nanoscale objects behave differently than other objects (n=306)	52%	1.90	2.56**	0.42
Name a product, technology, example in nature that involves nanoscale science (n=306)	58%	2.18	2.69**	0.34
Identify at least two factors to consider when thinking about using new nanoproducts or nanotechnologies (n=306)	47%	1.87	2.42**	0.41
Identify at least one way that nano will impact my life in the future (n=305)	54%	2.16	2.61**	0.34

**Mean increase significant at p<0.01, Wilcoxon Signed Rank Test; Scale goes from 1-4.

Table 3. Visitor levels of confidence before and after NanoDays.

Exploring learning of NISE Net content areas a bit further, over half (63%) of adult event attendees interviewed for the study reported that they learned about something that connected to an aspect of their own life during NanoDays. In addition, most of the youth attendees (88%) who were interviewed were able to identify something specific to a NanoDays activity when asked if they had heard about any "new inventions or high-tech stuff" during their time at the museum during the NanoDays event.

Table 4 provides an overview of the different NanoDays event indicators of success associated with Finding 2.

Indicator of Success	Indicator met?	Evidence from Event Attendee Data
Provide engaging NSET programming for public audiences.	Yes	Almost all adults and youth surveyed and/or interviewed for the study found NanoDays interesting, enjoyable, and/or fun; almost all adults interviewed said they would return for a future NanoDays event.
Engage the public in learning about NSET.	Yes	There were statistically significant increases in adult event attendee confidence about nano; 63% of interviewed adults saw a connection to their lives at NanoDays; 88% of youth interviewed identified specific aspects of NanoDays activities when asked about new technologies.

Table 4. Summary of indicators demonstrating the success of the NanoDays for event attendees.

Potential Implications of Finding 2

Finding 2 suggests that NanoDays has achieved its primary public goals of providing engaging NSET programing for public audiences and engaging the public in learning about NSET. Network partners implement interesting and enjoyable events that resonate with both adults and children. In addition to developing high quality activities for the event attendees, the NISE Network's efforts to help partners market, brand, and theme their event appear to be successful for most of the adult attendees who participated in the study.

Finding 3: NanoDays events are also successful in providing event volunteers with an engaging experience and in promoting learning of nano concepts.

Event volunteer data collected nationally (n=325) further demonstrates that NanoDays events met public learning goals as defined by the Network Leadership and the NanoDays team.

Engaging experiences with NanoDays events. As mentioned above, NISE Net partners reported working with 4,992 volunteers across their NanoDays activities (NanoDays Report Data, 2014). Partners were also asked to indicate the types of volunteers who participated in their events, as seen in Table 5 below.

Volunteer Category	Percent of reporting organizations (n=246)
High School Students	43%
Undergraduate College Students	57%
Graduate Students	--[4]
Scientists/engineers/professors at a college or university	39%
Scientists/engineers from industry	14%
Science outreach professionals at a college or university	23%
PreK-12 Education Professionals	18%
Museum/ISE Professionals	40%
Family/friends of event staff	20%
Volunteers from existing volunteer pool	48%
Other type of volunteer	11%
No volunteers at event	10%

Table 5. Summary of the types of volunteers participating in NanoDays 2014 events as reported by Network Partners on the NanoDays 2014 report.

[4] Network partners most likely grouped graduate students into other categories, including "Undergraduate College Students" and "Scientists/engineers/professors at a college or university". Only one Network partner indicated graduate student volunteers specifically.

The number of respondents to the online Volunteer Survey (n=347) compared to the total number of volunteers reported on the NanoDays 2014 report suggests an estimated 6.8% response rate. This is a conservative estimate, which seems appropriate given the inherent uncertainty involved with the survey recruitment method where NanoDays event coordinators were asked to send a link to the survey to their event volunteer list. As such, it is perhaps more important to note that each of the categories listed above was represented within the sample of volunteers who responded to the survey, as seen in Table 8 below.

Of the 347 responses received from volunteers, only 325 were included in analysis, with 22 responses omitted from the data set due to the volunteer indicating they were below our minimum age of 16. Almost one-fourth of volunteer respondents (23%) were repeat NanoDays volunteers.

Volunteers identified key reasons for participating in NanoDays events, with the following three reasons being most identified: "It was an opportunity for outreach with youth in science education", "[it] sounded like a fun event", and "I wanted to support the institution where I volunteered". The three most popular aspects of volunteering included "watching people's reactions to demos/activities", "seeing enthusiasm around nanotechnology and science", and "interacting with NanoDays attendees". Volunteers also asked to identify challenging aspects of their experiences, and the top three challenges reported were "adapting the concepts of nanotechnology for younger audiences", "communicating the principles of nanotechnology", and "engaging attendees during the demo/activity". However, despite these challenges, volunteers who responded to the survey had an overwhelmingly positive view of their experience, as demonstrated by their responses when asked "If a friend or colleague asked you what you have gained from your NanoDays volunteering experience overall, what would you say?" Emergent themes from responses to this question can be seen in Table 6 below.

Emergent Themes	Example	Percent of respondents (n=326)
Experience engaging people	"I've gained experience in communicating science to younger and older audiences."	46%
Gained Nano-related knowledge	"I have learned more about how we use nanotechnology in our everyday life and how it can impact our future."	25%
Great experience/Fun	"I really enjoyed working with our local science organization and have asked to participate again. I am volunteering again next weekend."	21%
Gained general science knowledge	"[I gained an] additional understanding of the physical world."	11%
New perspectives on science and technology	"I gained a whole new outlook on science and am eager to learn more about nano science. I checked out from our local library an audio series on nano. It is very interesting."	8%
Other		10%

Table 6. Summary of themes from respondents indicating what they have gained from volunteering at NanoDays.

Learning about nano content. Nano-related learning goals for event volunteers were also grounded in the four areas of the NISE Network content map mentioned above. The

same questions asking adult event attendees to rate their confidence in five items before and after their NanoDays experience were also asked of event volunteers. Analysis reveals that volunteers also showed a statistically significant increase in their confidence levels after their NanoDays experiences, as seen in Table 7. In addition, the medium effect sizes observed in the volunteers' gains in confidence appear to be larger than those observed in the attendee data. This finding may be due to a deeper level of engagement and exposure with nano content for volunteers, who commonly facilitate NanoDays activities.

	Percent of volunteers reporting top two levels of confidence after NanoDays	Mean confidence score, pre	Mean confidence score, post	Effect Size
Talk about how scientists are able to build things atom by atom at the nanoscale (n=325)	73%	2.33	2.94**	0.47
Describe an example of how nanoscale objects behave differently than other objects (n=323)	82%	2.46	3.14**	0.48
Name a product, technology, or example in nature that involves nanoscale science (n=322)	90%	2.71	3.34**	0.44
Identify at least two factors to consider when thinking about using new nanoproducts or nanotechnologies (n=321)	78%	2.39	3.08**	0.49
Identify at least one way that nano will impact my life in the future (n=323)	88%	2.69	3.30**	0.43

**Mean increase significant at p<0.01, Wilcoxon Signed Rank Test; Scale goes from 1-4.

Table 7. Volunteer levels of confidence about nano before and after NanoDays.

Potential Implications of Finding 3

NanoDays volunteers are an interesting public audience to study, since they are somewhat of a hybrid public-professional audience. Volunteers are members of the public, in that they do not typically work for informal science education (ISE) organizations and/or Network partners, but yet they are invited to engage in ISE practices when facilitating NanoDays activities with event attendees. Finding 3 suggests that this unique role also helps NanoDays meet its public goals of engagement and learning, and in some ways, provides an opportunity for larger impacts (as compared to those observed for event attendees) in these areas.

Finding 4: Volunteering at NanoDays positively impacts interest in STEM activities/careers and confidence around engaging the public in nano.

Event volunteer data indicates that volunteering at NanoDays can have additional impacts on volunteers beyond the public goals of engagement and learning about nano content. In particular, these additional impacts suggest that providing opportunities for volunteers to engage in NanoDays may have helped the NISE Network meet some of its broader professional goals while engaging a public audience.

Interest in STEM activities/careers. NanoDays volunteers come from a range of backgrounds, though the majority of Volunteer Survey respondents were students or educators of some kind, as seen in Table 8. Graduate students and undergraduate students who had decided on their majors were the two most common types of volunteer respondents, comprising over half of the sample (n=326).

Category	Number of Respondents	Percent of Respondents
High School Students	48	15%
Undecided Undergraduate Students	5	2%
Decided Undergraduate Students	84	26%
Graduate Students	84	26%
PreK-12 Educators	17	5%
ISE Educators	22	7%
Science Outreach Professionals at a college or university	6	2%
Scientists/Engineers/Professors from a college or university	23	7%
Scientists/Engineers from industry	7	2%
Retired Scientists/Engineers	7	2%
Other	23	7%
Total	326	

Table 8. NanoDays volunteers, distributed by the category respondents most closely self-identified with at the time of taking the survey.

Table 9 below provides the breakdown of respondents based on where their NanoDays event was held, showing that the majority of respondents had volunteered at museum-based events.

	Number of Respondents	Percent of Respondents	Number of Institutions	Percent of Institutions
Museum	205	63%	43	74%
University	110	34%	15	26%
Other	10	3%	N/A	
Total	325		58	

Table 9. Institutional affiliation of volunteer respondents.

Volunteers were asked to rate their interest before and after their NanoDays experience in a set of STEM-related activities such as "learning about how science is connected to my daily life" and "visiting places where I can learn about science." These interest items were customized to respondents based on how they self-identified along the categories presented above. Respondents were placed into four groups, based on how they self-identified:

- Group 1: Undecided students. This group included all high school respondents and undecided undergraduate students.
- Group 2: Educators. This group included all PreK-12 educators, ISE educators, and Science Outreach professionals.
- Group 3: Volunteers on the STEM Career Track. This group included undergraduates who had decided their major, graduate students, scientists, engineers, professors, and retired STEM professionals.
- Group 4: Volunteers who identified as "other". These volunteers could be non-STEM professionals, regular volunteers from an institution's volunteer pool, friends or family of ISE professionals hosting a NanoDays event, etc.

Across all groups, there were statistically significant increases in interest levels for each of the presented STEM activities, though some of the observed effect sizes were quite small, as seen in Tables 10 through 13 below.

Interest in STEM activities, Group 1. One notable data point is that high school students and undecided undergraduate students reported a statistically significant increase in their interest level in learning about science careers from pre- to post-NanoDays volunteering, as seen in Table 10 below. Although the effect size is quite small for these items, it is encouraging to see that even a brief volunteering experience such as the one commonly seen in NanoDays can have an impact on these areas of STEM interest.

Interest Items, Group 1	Percent of volunteers reporting top two levels of interest after NanoDays	Mean confidence score, pre	Mean confidence score, post	Effect Size
Checking out science news stories from any source (online, TV, and/or print) (n=54)	87%	2.85	3.24**	0.17
Learning about science careers (n=54)	80%	2.93	3.19**	0.14
Studying science in school) (n=54)	81%	3.10	3.33**	0.13
Learning about how science is connected to my daily life (n=54)	93%	3.17	3.48**	0.16
Visiting places where I can learn about science (such as museums, zoos, and/or aquariums) (n=54)	94%	3.09	3.48**	0.17
Talking with my friends/family about science topics (n=54)	81%	2.67	3.13**	0.17

**Mean increase significant at p<0.01, Wilcoxon Signed Rank Test; Scale goes from 1-4.

Table 10. Group 1 (high school and undecided undergraduate students) volunteer levels of interest in a range of STEM-related activities before and after NanoDays.

Members of Group 2 – educators focused primarily on learners in the Pre-K-12 age range – were asked a different version of interest items, as seen in Table 11 below. Increases in the interest levels for each of the items were statistically significant, though again, the effect sizes appear to be quite small.

Interest Items, GROUP 2	Percent of volunteers reporting top two levels of interest after NanoDays	Mean confidence score, pre	Mean confidence score, post	Effect Size
Checking out science news stories from any source (online, TV, and/or print) (n=45)	89%	3.11	3.40**	0.13
Learning about how science is connected to my daily life	91%	3.09	3.36**	0.12
Visiting places where I can learn about science (such as museums, zoos, and/or aquariums) (n=45)	93%	3.27	3.53**	0.12
Talking with friends/family about science topics (n=45)	89%	3.09	3.31**	0.12
Talking with young people about science topics (n=45)	89%	3.13	3.40**	0.12

**Mean increase significant at p<0.01, Wilcoxon Signed Rank Test; Scale goes from 1-4.

Table 11. Volunteer levels of interest in a range of STEM-related activities before and after NanoDays for Group 2 (PreK-12 educators, ISE educators, and science outreach professionals).

Members of Group 3, who were volunteers already on a STEM career trajectory, were asked a third set of interest items, as seen in Table 12. Increases in the interest levels for each of the items were statistically significant, with medium-small effect sizes. One notable item for this group, however, was the increase in interest in talking to the public about science, which had a medium to medium-large effect size.

Interest Items, GROUP 3	Percent of volunteers reporting top two levels of interest after NanoDays	Mean confidence score, pre	Mean confidence score, post	Effect Size
Checking out science news stories from any source (online, TV, and/or print) (n=203)	90%	3.14	3.31**	0.28
Learning about how science is connected to my daily life (n=202)	94%	3.28	3.43**	0.23
Visiting places where I can learn about science (such as museums, zoos, and/or aquariums) (n=203)	91%	3.18	3.40**	0.29
Talking with friends/family about science topics (n=203)	89%	3.10	3.29**	0.27
Talking with the public about science topics (n=202)	83%	2.75	3.16**	0.40

**Mean increase significant at p<0.01, Wilcoxon Signed Rank Test; Scale goes from 1-4.

Table 12. Levels of interest in a range of STEM-related activities before and after NanoDays for Group 3 (Scientists, Engineers, Professors, Graduate Students, and Decided Undergraduate students).

Lastly, as seen in Table 13, the same set of interest items asked in Table 11 were also asked to the group of volunteers in Group 4, who identified as "other". Here, only four of the five items had a statistically significant increase, with interest in "visiting places where I can learn about science" being the item that had no statistical difference from pre to post. However, the effect sizes of this small group of volunteer respondents (n=23) were medium to medium large.

	Percent of volunteers reporting top two levels of interest after NanoDays	Mean confidence score, pre	Mean confidence score, post	Effect Size
Checking out science news stories from any source (online, TV, and/or print) (n=23)	87%	2.91	3.22**	0.37
Learning about how science is connected to my daily life (n=202)	87%	3.00	3.26*	0.34
Visiting places where I can learn about science (such as museums, zoos, and/or aquariums) (n=23)	86%	3.30	3.43	0.19
Talking with friends/family about science topics (n=203)	78%	2.91	3.23**	0.37
Talking with the public about science topics (n=202)	65%	2.52	3.00**	0.44

**Mean increase significant at p<0.01; *mean increase significant at p<0.05, Wilcoxon Signed Rank Test; Scale goes from 1-4.

Table 13. Levels of interest in a range of STEM-related activities before and after NanoDays for volunteers identifying as "other".

Use of NanoDays materials by volunteers beyond the event. In addition to the questions about confidence and interest, the Volunteer Survey also asked respondents a few questions about their own use and dissemination of NanoDays materials outside of the event. The majority of educators have told a colleague about NanoDays activities (71% for PreK-12 and ISE educators; 55% of university-level educators) and some have implemented NanoDays activities in their classrooms (24% of PreK-12 and ISE educators; 11% of university-level educators). The use of NISE Net resources outside of NanoDays is summarized in Tables 14 and 15 below.

Since you began volunteering at NanoDays events, which of the following, if any, have occurred? Please check all that apply.	Percent of respondents (n=45)
I have told a colleague about the educational activities associated with NanoDays.	71%
I have visited whatisnano.org.	36%
I have visited nisenet.org.	36%
I have used NanoDays materials in the classroom.	29%
I have implemented new ways of engaging the public in nano learning experiences within my organization.	24%
I have initiated a partnership related to nano education with an informal learning or research organization.	7%
None of these have occurred.	9%

Table 14. Use of NISE Net resources outside of NanoDays for PreK-12 educators, ISE educators, and science outreach professionals.

Since you began volunteering at NanoDays events, which of the following, if any, have occurred? Please check all that apply.	Percent of respondents (n=121)
I have told a colleague about the educational activities associated with NanoDays.	65%
I have visited nisenet.org.	37%
I have visited whatisnano.org.	23%
I have used NanoDays activities in the classroom.	17%
I have implemented new ways of engaging the public in nano learning experiences within my organization.	14%
I have initiated a partnership related to nano education with an informal learning or research organization.	10%
None of these have occurred.	17%

Table 15. Use of NISE Net resources outside of NanoDays by volunteer Scientists, Engineers, Professors, and Graduate Students.

Learning about engaging the public in nano activities. Volunteers were asked to rate their confidence in five different practices associated with engaging the public in nano before and after their NanoDays experience. These five items were taken from the annual partner survey administered as part of the NISE Net Professional Impacts Evaluation Study (Goss et al., forthcoming). Analysis reveals that volunteers showed a statistically significant increase in their confidence levels after their NanoDays experiences, with a medium-small statistical effect size as seen in Table 16.

	Percent of volunteers reporting top two levels of confidence after NanoDays	Mean confidence score, pre	Mean confidence score, post	Effect Size
Engage young children (n=322)	90%	2.89	3.29**	0.39
Engage adult audiences (n=321)	92%	2.96	3.28**	0.35
Engage Spanish-speaking audiences (n=321)	22%	1.57	1.78**	0.28
Engage public audiences with content related to the societal implications of science (n=320)	72%	2.52	2.88**	0.37
Communicate to public audiences about research findings from the field of science (n=323)	75%	2.59	2.97**	0.38

**Mean increase significant at p<0.01, Wilcoxon Signed Rank Test; Scale goes from 1-4.

Table 16. Volunteer levels of confidence in engaging the public before and after NanoDays.

Table 17 provides an overview of the different NanoDays event indicators of success associated with Findings 3 and 4.

Indicator of Success	Indicator met?	Evidence from Volunteer Survey Data
Provide engaging NSET programming for public audiences.	Yes	Volunteers view their volunteering experiences positively and have many reasons for volunteering.
Engage the public in learning about NSET.	Yes	Volunteers report a statistically significant increase in confidence around nano content areas. This increase is larger in size than the increase for event attendees.
Increase capacity of the field to engage the public in NSET programming.	Yes	Volunteers report a statistically significant increase in STEM activities and careers (when appropriate); volunteers also report sharing NanoDays materials with colleagues and using NanoDays activities in other learning contexts, including the formal classroom.

Table 17. Summary of indicators demonstrating the success of NanoDays for event volunteers.

Potential implications of Finding 4

Finding 4 provides additional information about the impacts of volunteering at NanoDays, which includes slightly increased interest in STEM activities and careers, as well as increased confidence in engaging the public in NSET activities. Both of these findings suggest that providing meaningful opportunities for the public – and in particular, students at the high school, undergraduate, and graduate levels – to engage in informal science education activities as facilitators can contribute to increasing the capacity of the ISE field in engaging the general public in fruitful ISE experiences.

Conclusion

When originally launched in 2008, NanoDays was envisioned as an ambitious effort to galvanize the ISE field for a one-week period to engage the public in NSET activities. The NISE Network had two specific goals for the public related to NanoDays, which were to:

1) provide engaging NSET experiences for the public, and

2) engage the public in learning about NSET concepts.

Six years after the first NanoDays events, findings from this summative study have shown that NanoDays has clearly met these goals for members of the public. In addition, by engaging members of the public as volunteers that facilitate nano activities for event attendees, NanoDays has also accomplished some of its professional goals as well, including increasing the ISE field's capacity to provide NSET activities to the public.

As such, the NanoDays model can be seen as a valid and successful approach for educating the public and building capacity around new and current STEM topics.

This study has multiple implications for the informal science learning field and also generates further questions for inquiry. In particular, the initial exploration of the learning and perspectives of NanoDays volunteers suggests that even brief experiences in facilitating informal STEM learning environments for the broader public can have a positive impact on the STEM interest and confidence of several key audiences, including high school students and undecided undergraduate students. Additional evaluation and research investigating the model of volunteering developed through NanoDays could yield further insights into this phenomenon and potentially inform the design and implementation of future volunteering opportunities within the ISE field. Moreover, a deeper examination of these brief volunteer experiences – including the possibility of longitudinal studies of repeat volunteers – could also identify key factors within these experiences that can be more intentionally incorporated or avoided in future ISE endeavors.

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Appendix: Description of Methods and Supplemental Findings

As described in the Summary of Findings, the Nanoscale Informal Science Education Network (NISE Net) Public Impacts Evaluation group embarked on a three-year study in March, 2012, to explore the public impacts of the most resource-intensive educational products developed by the Network. During the second phase of the study, the Public Impacts Evaluation focused on conducting a summative evaluation of NanoDays 2014 events. This appendix will provide a more complete description of our study methods as well as supplemental findings that support and expand on those presented in the Summary of Findings.

Description of NanoDays

NanoDays is a nationwide festival focused on educating the public about nanoscale science, engineering, and technology. Founded by the NISE Network in 2008, NanoDays involves partner institutions in hosting an array of events during a particular week of the year – generally from the last weekend in March through the first weekend in April. Every year, Network partners can apply to receive a NanoDays kit, which includes introduction guides, volunteer training manuals, informative posters for display during the event, marketing materials, and approximately 12-15 comprehensive activity packets (including activity materials, guides, and display items). Over time, 100% of partners receiving NanoDays kits reported using them for nano programming throughout the year, not just during the week of NanoDays.

Summative Evaluation Questions

In the spring of 2014, a summative evaluation of NanoDays events was conducted. The evaluation questions guiding this study were:

1. What is the projected public reach of NanoDays events in 2014?
2. Are 'mature' NanoDays events successful in providing an engaging experience and promoting learning of nano concepts for public audiences, including event attendees and event volunteers?
3. Does volunteering at NanoDays events have other impacts on volunteers, including increased interest in STEM activities/careers and confidence around engaging the public in nano?

In order to answer these questions, a range of different methods were used, as described below.

Methods

The study used an array of methods to answer the summative evaluation questions, including public reach estimation techniques, surveys and interviews with event attendees, and an online survey for event volunteers.

Reach Estimates for NanoDays

In order to address the first summative evaluation question about the public reach of NanoDays, two specific reach estimates were generated as part of the summative study: one estimate that explored the public reach of NanoDays 2014 events, and another that explored the public reach of all NanoDays events over the life of the Network. The following sections describe how both estimates were developed.

Estimated Reach for NanoDays 2014 Events

Because the total number of NanoDays kits increased to 250 in the final years of the NISE Net, generating updated reach estimates for NanoDays events became one of the key evaluation questions in the NanoDays 2014 Summative Study. However, given the main focus of that study was to explore public learning at NanoDays events, a full counting study such as those described above was beyond the scope of the 2014 summative evaluation. Thus, no new data collection specifically focused on counting visitors was conducted for the estimates generated in 2014; instead, the updated reach estimate drew on the *Median Encounter Rates (MERs)* developed during the 2009 and 2010 studies described above (and restated here in Table 1):

***Table 1. Median Encounter Rates (MERs) based on institution type and size*[5].**

Institution type	Median Encounter Rates (per institution)
Large/Medium Museums	3,496
Small/Very Small Museums	1,231
Universities & Other	1,365

These MERs were based on the "median number of total encounters calculated for institutions that completed the NanoDays report, by organizational category" (Pattison, Benne, & LeComte-Hinely, 2011; p. 37). As in the 2009 and 2010 studies, these classifications for museum size are based on the 2008 ASTC Sourcebook. For clarity, the size descriptions are presented here in Table 2 below.

[5] These estimates were originally listed in Table 27, on page 37, in the *2010 Delivery and Reach Study* (Pattison, Benne, LeComte-Hinely, 2011).

Table 2. Categories from 2008 ASTC Sourcebook (ASTC, 2008).

Museum size	Annual Budget	Interior Exhibit Space (ft²)
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

In order to generate the public reach estimate for NanoDays 2014, an updated NanoDays kit distribution list was needed. Kit recipients were sorted into "small" and "large" museums based on criteria in Table 2 (ASTC, 2008). If an institution's classification was unknown, the MER for Small/Very Small museums was used, in order to generate the most conservative and reliable estimate of reach. The resulting distribution of NanoDays kits in 2014 is presented in Table 3 below.

Table 3. Distribution of NanoDays kits across the NISE Net in 2014.

Museum size	Number of institutions that received NanoDays Kits in 2014
Large/Medium	63
Small/Very Small	119
University	63
Unknown	5

Once the numbers of small, large, and university sites were determined, these figures were multiplied by the encounter estimate factors from the 2010 Delivery and Reach study (Pattison, Benne, & LeComte-Hinely, 2011) in Table 1 to generate the total estimate of 458,887 encounters for NanoDays 2014 events around the country, as seen in Table 4:

Table 4. Total Number of Estimated Encounters for NanoDays 2014 Events.

Museum size	Number of institutions that received NanoDays Kits in 2014	Number of estimated encounters
Large/Medium	63	220,248
Small/Very Small	119	146,489
University	63	85,995
Unknown	5	6,155
TOTAL ESTIMATED ENCOUNTERS in 2014		**458,887**

Reach Estimates for NanoDays Events Over the Life of NISE Net

In addition to calculating the total estimated encounters during NanoDays 2014, the summative evaluation also generated a total reach estimate for NanoDays events over the life of the NISE Network. NanoDays events began being implemented in 2008, continuing every year through the Spring of 2015.

Two sets of reach estimates were produced for each year of NanoDays events: a **Conservative estimate**, based directly on the Median Encounter Rates from 2010, and **Moderate estimate**, which increased yearly estimates by an Adjustment Factor described below. Together, these two estimates provide a range for the public reach of NanoDays over the life of NISE Net.

Procedure for developing the yearly Conservative estimate.

Using the same method as described in the previous section, the process for generating this estimate began with examining the NanoDays kit distribution lists for each year, as seen in Table 5. It should be noted that at the time of the reach estimate calculation, the NanoDays 2015 kits had not yet been awarded to specific partners; therefore, the distribution numbers from 2014 were used as an approximation for the final 250 kits in 2015.

Table 5. NanoDays Kit Distribution from 2008 – 2015.

Museum size	Number of institutions that received NanoDays Kits							
YEAR	2008	2009	2010	2011	2012	2013	2014	*2015**
Large/Medium	20	46	46	48	53	57	63	*(63)**
Small/Very Small	37	87	88	89	100	109	119	*(119)**
University	32	67	62	63	70	56	63	*(63)**
Unknown	11	6	4	0	2	3	5	*(5)**
TOTAL KITS (per year)	**100**	**206**	**200**	**200**	**225**	**225**	**250**	***250***

*At the time of estimate calculation, the 2015 kits had not yet been awarded, therefore the distribution numbers from 2014 were used as an approximation.

Using the MERs from the 2010 study and the distribution numbers from each year, annual estimates for NanoDays event encounters were produced, as seen in Tables 6 – 13.

Table 6. Conservative Estimate of Encounters for NanoDays 2008 Events.

Museum size	Number of institutions that received NanoDays Kits in 2008	Number of estimated encounters
Large/Medium	20	69,920
Small/Very Small	37	45,547
University	32	43,680
Unknown	11	13,541
TOTAL ESTIMATED ENCOUNTERS in 2008		**172,688**

Table 7. Conservative Estimate of Encounters for NanoDays 2009 Events.

Museum size	Number of institutions that received NanoDays Kits in 2009	Number of estimated encounters
Large/Medium	46	160,816
Small/Very Small	87	107,097
University	67	91,455
Unknown	6	7,386
TOTAL ESTIMATED ENCOUNTERS in 2009		**366,754**

Table 8. Conservative Estimate of Encounters for NanoDays 2010 Events.

Museum size	Number of institutions that received NanoDays Kits in 2010	Number of estimated encounters
Large/Medium	46	160,816
Small/Very Small	88	108,328
University	62	84,630
Unknown	4	4,924
TOTAL ESTIMATED ENCOUNTERS in 2010		**358,698**

Table 9. Conservative Estimate of Encounters for NanoDays 2011 Events.

Museum size	Number of institutions that received NanoDays Kits in 2011	Number of estimated encounters
Large/Medium	48	167,808
Small/Very Small	89	109,559
University	63	85,995
Unknown	0	--
TOTAL ESTIMATED ENCOUNTERS in 2011		**363,362**

Table 10. Conservative Estimate of Encounters for NanoDays 2012 Events.

Museum size	Number of institutions that received NanoDays Kits in 2012	Number of estimated encounters
Large/Medium	53	185,288
Small/Very Small	100	123,100
University	70	95,550
Unknown	2	2,462
TOTAL ESTIMATED ENCOUNTERS in 2012		**406,400**

Table 11. Conservative Estimate of Encounters for NanoDays 2013 Events.

Museum size	Number of institutions that received NanoDays Kits in 2013	Number of estimated encounters
Large/Medium	57	199,272
Small/Very Small	109	134,179
University	56	76,440
Unknown	3	3,693
TOTAL ESTIMATED ENCOUNTERS in 2013		**413,584**

Table 12. Conservative Estimate of Encounters for NanoDays 2014 Events.

Museum size	Number of institutions that received NanoDays Kits in 2014	Number of estimated encounters
Large/Medium	63	220,248
Small/Very Small	119	146,489
University	63	85,995
Unknown	5	6,155
TOTAL ESTIMATED ENCOUNTERS in 2014		**458,887**

As stated above, the final distribution of NanoDays kits in 2015 was not known at the time of the reach estimate calculation, so the same distribution numbers from 2014 were used:

Table 13. Conservative Estimate of Encounters for NanoDays 2015 Events.

Museum size	Number of institutions that received NanoDays Kits in 2015	Number of estimated encounters
Large/Medium	*63*	*220,248*
Small/Very Small	*119*	*146,489*
University	*63*	*85,995*
Unknown	*5*	*6,155*
TOTAL ESTIMATED ENCOUNTERS in 2015		***458,887***

Finally, the number of estimated encounters from each year were added together, in order to produce the conservative estimate of **2,999,260 encounters** during NanoDays events over the lifetime of the NISE Network, as seen in Table 14 below.

Table 14. Conservative Estimate of the Grand Total of Encounters for NanoDays Events over the life of the NISE Network.

Year	Number of NanoDays kits distributed	Number of estimated encounters
2008	100	172,688
2009	206	366,754
2010	200	358,698
2011	200	363,362
2012	225	406,400
2013	225	413,584
2014	250	458,887
2015	250	*458,887*
GRAND TOTAL ESTIMATED ENCOUNTERS		**2,999,260**

Procedures for developing the Moderate estimate.
The Conservative Estimates generated in the previous section provide one estimate for the public reach of NanoDays events over the lifetime of the NISE Network. However, when the Conservative Estimates in 2009 and 2010 are compared to the projected reach estimates generated through the counting studies (Reich & Goss, 2009; Pattison, Benne, LeComte-Hinley, 2011) described earlier in this document, a difference can be seen, as presented in Table 15:

Table 15. Comparison of Conservative Estimates to Estimates Generated as Part of the 2009 and 2010 Counting Studies.

Year	Number of NanoDays kits distributed	Conservative Estimate	Counting Study Estimate	Difference in estimates
2008	100	172,688	--	--
2009	206	366,754	425,107	58,353
2010	200	358,698	472,835	114,137
2011	200	363,362	--	--
2012	225	406,400	--	--
2013	225	413,584	--	--
2014	250	458,887	--	--
2015	250	*458,887*	--	--

These differences are due to the way these estimates were generated. The Conservative Estimates were generated using the Median Encounter Rates from the 2010 Delivery and Reach study, while the projections in 2009 and 2010 counting studies were generated using actual reporting and use data from Network partners (Reich & Goss, 2009; Pattison et al., 2011). Therefore, it is not surprising that a more accurate – and higher – number

was able to be generated based on more specific data. Moreover, the MERs created during the 2009 and 2010 studies were purposefully developed to be conservative in order to prevent over-estimation of public reach.

A more moderate, and less conservative, estimate of NanoDays reach, when paired with the Conservative Estimates from the previous section, can help further describe the public reach of these events. In order to generate the Moderate Estimates, the differences highlighted in Table 15 were used to produce an Adjustment Factor that would be applied to each of the Conservative Estimates in order to produce the Moderate Estimates for the years when no counting study was conducted.

In order to produce the Adjustment Factor, the ratio of the Conservative Estimate to the Counting Study Estimate was calculated for both 2009 and 2010, as seen in Table 16:

Table 16. Ratio of Conservative Estimates to Counting Study Estimates in 2009 and 2010.

(A)	(B)	(C)	(D)	(E)
Year	**Conservative Estimate**	**Counting Study Estimate**	**Difference in Estimates**	**Ratio of Conservative to Counting Study Estimates**
2009	366,754	425,107	58,353	**0.86**
2010	358,698	472,835	114,137	**0.76**

The ratios calculated in column E in Table X16 can be though of as the percentage of the Counting Study estimates that the Conservative Estimates covered. The average of these two ratios is **0.81**, which is then defined as the **Adjustment Factor:** the factor by which the Conservative Estimates should be adjusted in order to generate the Moderate Estimates. Equation Z1 describes the relationship of the Adjustment Factor and the two estimates:

$$Adjustment\ Factor = \frac{Conservative\ Estimate}{Moderate\ Estimate} \quad \text{(Z1).}$$

Solving for the Moderate Estimate generates equation Z2:

$$Moderate\ Estimate = \frac{Conservative\ Estimate}{Adjustment\ Factor} \quad \text{(Z2).}$$

Finally, by adjusting the Conservative Estimates in 2008 and 2011-2015 by the Adjustment Factor, Moderate Estimates for the public reach of NanoDays Events can be generated, as seen in Table 17 below.

Table 17. Conservative and Moderate Estimates for the public reach of NanoDays events over the lifetime of NISE Net.

Year	Number of NanoDays kits distributed	Conservative Estimate	Moderate Estimate
2008	100	172,688	213,018
2009	206	366,754	425,107*
2010	200	358,698	472,835*
2011	200	363,362	448,223
2012	225	406,400	501,312
2013	225	413,584	510,174
2014	250	458,887	566,057
2015	250	*458,887*	*566,057*
GRAND TOTALS	**1656**	**2,999,260**	**3,702,784**

*Numbers generated as a result of counting study.

Thus, over the eight year period that NanoDays events occurred annually, the range of estimated encounters with nano learning activities is between **3.0 to 3.7 million encounters.** For more information about how these encounter estimates were translated into a total estimated number of people reached by NanoDays events, see the Public Reach Estimations for the NISE Network report (Svarovsky, Goss, & Kollmann, 2015).

Surveys and Interviews with Event Attendees

In order to address the second summative evaluation question and explore the learning of NanoDays event attendees, data was collected at several event sites.

Data Collection Sites

Leveraging partners who were local to the three institutions that housed the evaluation team, event attendee data was collected at nine different event sites: the Bakken Museum in Minneapolis, MN; The Discovery Museums in Acton, MA; Duluth Children's Museum in Duluth, MN; the Connecticut Science Center in Hartford, CT; the Future of Flight Aviation Center & Boeing Tour in Mukilteo, WA; KidsQuest Children's Museum in Bellvue, WA; the Museum of Science in Boston, MA; the Science Factory Children's Museum and Exploration Dome in Eugene, OR; and Science Museum of Minnesota in St. Paul, MN. The dates of actual NanoDays events observed fell between 03/29/2014 and 04/18/2014, with some events falling outside the official range of the NanoDays 2014 festival.

Each of these institutions had hosted at least two NanoDays events before 2014, which was part of the sampling criteria used for the study. Sites were chosen in consultation with Evaluation Team members, the Regional Hub Leaders and Network Leadership.

Data Collection Protocol

In order to maximize sample size while balancing richness of data, data collectors traveled together to sites in teams of three. One data collector focused on collecting as many surveys from adults as possible, handing out several at a time via clipboard and then collecting them as soon as the adult participants were finished. The second and third data collectors worked together to identify family groups attending NanoDays – a core audience for NanoDays events. The second data collector would approach an adult in the group and conduct both the adult survey and a follow up interview probing for deeper explanation. The third data collector would conduct an interview with the children in the group, identifying a target child if there were several youth within the target age range. Table 18 below outlines the number of adult surveys and child interviews collected at each of the data collection sites.

Table 18. Summary of Data Collected at Each Sampling Site.

Sites	Location	Number of Adult Surveys	Number of Adult Survey and Interview with Child Interview
Connecticut Science Center	Connecticut	10	12
The Discovery Museums	Massachusetts	9	5
Museum of Science	Massachusetts	74	23
Bakken Museum	Minnesota	35	13
Duluth Children's Museum	Minnesota	6	6
Science Museum of Minnesota	Minnesota	74	18
Science Factory Children's Museum & Exploration Dome	Oregon	7	11
Future of Flight Aviation Center	Washington	12	3
KidsQuest Children's Museum	Washington	3	9
	GRAND TOTALS	**230**	**100**

Event Attendee Sample Demographics

Tables 19 – 25 describe the reported demographic information for the entire sample of adult event attendees who participated in the study.

Table 19. Adult Respondents' Levels of Interest in Science (n=313).

Interest in Science Rating	Percentage
0-6	23%
7-8	42%
9-10	34%

Table 20. Description of Group Composition attending NanoDays (n=314).

Group Type	Percentage
Adults only	2%
Adults and children	91%
N/A – I came alone.	7%

Table 21. Age of Adult Respondents (n=297).

Age	Percentage
8-12	2%
13-17	1%
18-21	1%
22-29	9%
30-39	41%
40-49	33%
50-59	6%
60-69	5%
70+	2%

Table 22. Age Ranges of Additional Members of the Group Attending NanoDays, Excluding the Adult Respondent (n=731).

Group Age Range	Percentage*
0-5	17%
6-8	23%
9-12	17%
13-17	4%
18-21	1%
22-29	4%
30-39	14%
40-49	10%
50-59	3%
60-69	4%
70-79	1%
80+	1%
N/A – I came alone.	1%

*Some visitors gave more than one response.

Table 23. Reported Gender of Adult Respondents (n=309).

Gender	Percentage
Male	40%
Female	60%
Other	1%

Table 24. Percentage of Adult Respondents Who Identify as Hispanic or Latino (n=300).

Hispanic or Latino	Percentage
Yes	7%
No	93%
Not Sure	0.3%

Table 25. Self-identified Racial Identities of Adult Respondents (n=306).

Race	Percentage
White	82%
Asian	10%
Black or African American	3%
American Indian or Alaskan Native	1%
Native Hawaiian or Other Pacific Islander	0.3%
Other*	5%
Not sure	1%

Visitors who replied " Other" gave additional information as below. (n=11)

- Mexican. [4]
- American.
- European.
- Filipino-American.
- German.
- Komi
- Puerto Rican.
- White/African.

Online Survey with Event Volunteers

In order to address the third summative evaluation question, a second public audience of event volunteers was included as a focus of the Summative Evaluation. After piloting a data collection method in 2013 and talking with NISE Net Leadership, Regional Hub Leaders, and NanoDays event coordinators, a revised protocol was developed for the 2014 study. This protocol involved creating an online survey for volunteers and then asking each NanoDays event coordinator to email the link to the survey out to their volunteer list. A total number of volunteers, 4,992, was determined from the NanoDays 2014 reports completed by partners and a response rate of 6.8% was determined based on the number of responses received (n=347).

Volunteer Survey Sample Demographics

Tables 26 – 29 describe the reported demographic information for the entire sample of volunteers who participated in the study.

Table 26. Reported Gender of Volunteer Respondents (n=324).

Gender	Percentage
Male	36.4%
Female	63.4%
Other*	0.3%

Table 27. Percentage of Volunteer Respondents that identify as Hispanic or Latino (n=324).

Hispanic or Latino	Percentage
Yes	9%
No	89.9%
Not sure	1.2%

Table 28. Self-identified Racial Identities of Volunteer Respondents (n=319).

Race	Percentage
White	70.9%
Asian	19.1%
Black or African American	5.3%
American Indian or Alaskan Native	2.8%
Native Hawaiian or Other Pacific Islander	0.3%
Other	4.1%
Not sure	1.6%

Table 29. Age categories of Volunteer Respondents (n=325).

Age	Percentage
Under 16	--
16-17	9.9%
18-21	21.2%
22-29	38.8%
30-39	11.1%
40-49	5.9%
50-59	4.9%
60-69	6.2%
70-79	1.9%
80+	0.3%

Supplemental Findings

In this section, additional findings from the Summative Evaluation not included in the Summary of Findings are presented.

Additional Findings for Event Attendees

A subset of adults who completed the survey were also asked to participate in a brief follow up interview. Table 30 describes the emergent themes from the adult responses to the question "In your own words, what would you say was the overall purpose of these NanoDays events?"

Table 30. Emergent Themes, Identifying the Overall Purpose of the NanoDays Event (n=94*).

Purpose of NanoDays Events	Percentage
Raise awareness generally about nano	45%
Raise awareness of general science & tech	32%
Learning specific nano concepts	10%
General educational activity	8%
Other	5%

When interview respondents were also asked whether or not they learned something during NanoDays that connected to an aspect of their own life, 63% (n=91) said yes. Those respondents were then asked to explain the connection further, and their responses broke out into three emergent themes: connecting to a specific person or group of people, connecting to a specific time in their lives, and connecting to a specific topic in their daily life. These themes were then broken out into secondary categories, as seen in Table 31 below.

Table 31. Emergent Themes, Identifying Connections Between NanoDays and the Respondent's Everyday Life (n=58*).

Main Category	Percent	Secondary Category	Percentage
Connection to a person/people	56%	Me	47%
		Someone else	7%
		Society broadly	2%
Connection to a time in their lives	64%	Present	60%
		Future	3%
Connection to a specific topic in daily life	52%	Electronic	28%
		Environment	12%
		Health and medication	12%

*Some responses are categorized under multiple themes.

Finally, interview respondents who were attending their first NanoDays experience (n=88) were asked whether they would want to come back to a NanoDays event in the future, and why. Of those first time attendees, 92% said they would definitely come back, and 8% responded with "maybe". When asked to explain their response, participants shared several reasons, outlined in Table 32 below.

Table 32. Emergent Themes, Why respondents would like to come back to a NanoDays event in the future (n=88).

Reasons for Returning to NanoDays	Percentage
The kids enjoyed it	47%
To learn/see new things	41%
The event is fun/interesting/enjoyable	21%
Visiting the ISE Institution	12%
To do hands-on activities	7%
Other	4%

Additional findings from the event attendee sample can be found in the Summary of Findings document (Svarovsky et al., 2014).

Additional Findings for Event Volunteers

Volunteers who participated in the online survey were asked to indicate where they had volunteered for NanoDays. Overall, 60 of the 250 institutions (24%) who received kits had at least one volunteer respond to the survey. Table 33 below lists the top 10 institutions in terms of number of respondents.

Table 33. NISE Net Institutions with the Most Volunteer Respondents (n=325).

Sites	Location	Number of Respondents	Percentage of Sample
Sciencenter	Ithaca, NY	25	8%
Purdue University	West Lafayette, IN	20	6%
Children's Museum of Houston	Houston, TX	20	6%
Washington Pavilion of Arts and Science	Sioux Falls, SD	19	6%
Mohawk Valley Community College	Utica, NY	18	6%
Auburn University	Auburn, AL	16	5%
University of California	Santa Barbara, CA	16	5%
Museum of Life & Science	Durham, NC	13	4%
Museum of Science	Boston, MA	12	4%
Montana State University Extended University, Burns Technology Center	Bozeman, MT	11	3%
	TOTALS	170	53%

Volunteers were asked about their previous volunteering experience, both at the organization where they volunteered for NanoDays, as well as with prior NanoDays events. Generally, about half of the respondents had volunteered at their organization before, and almost a quarter had volunteered at a previous NanoDays event. Tables 34-37 describe these results in more detail.

Table 34. Volunteer History at NISE Net Organization (n=325).

Previously Volunteered at Organization	Percentage
Yes	56%
No	44%

Table 35. Regularity of Volunteering at NISE Net Organization (n=181).

Regular Volunteering Shifts	Percentage
Yes	47%
No	51%

Table 36. NanoDays Volunteering History (2014) (n=325).

Volunteered Previously at NanoDays	Percentage
Yes	23%
No	77%

Table 37. Total Years Repeat Volunteers Have Contributed to NanoDays (n=77).

Total Years Volunteered at NanoDays Event	Percentage
2 total years (this year plus one additional year)	55%
3 total years (this year plus two additional years)	27%
4 or more total years (this year plus three or more additional years)	18%

Finally, in addition to the questions about confidence around both nano topics and engaging the public (which were reported in the Summary of Findings), volunteers were also asked why they chose to volunteer at NanoDays, what their favorite parts about the experience were, and what, if anything, they found challenging about the experience. Participants could select up to three responses per question, and the three most frequent responses for each question were reported in the Summary of Findings. However, for completeness, Tables 38-40 below include the percentages for all of the response options provided on the survey.

Table 38. Motivations for Volunteering at NanoDays (n=325).

Statements	Percentage
It was an opportunity for outreach with youth in science education.	65%
NanoDays sounded like a fun event.	47%
I wanted to support like a fun event.	37%
I wanted to share my personal knowledge of science with the public.	32%
Nanotechnology seemed like an interesting subject.	15%
A friend or family member asked me to volunteer.	11%
Other	8%

*Respondents could choose up to three of the above categories.

Table 39. Favorite Aspects of Volunteering for NanoDays (n=324).

Statements	Percentage
Watching people's reactions to demos/activities.	66%
Seeing enthusiasm around nanotechnology and science.	61%
Interacting with NanoDays attendees (i.e. museum visitors, youth, the community, the public).	52%
Facilitating the demos/activities.	51%
Explaining nano concepts and/or answering questions about nano.	34%
Not applicable – I did not have a favorite part of volunteering.	3%
Other	1%

*Respondents could choose up to three of the above categories.

Table 40. Most Challenging Aspects of Volunteering for NanoDays (n=323).

Statements	Percentage
Adapting the concepts of nanotechnology for younger audience (children 12 and under).	54%
Communicating the principles of nanotechnology.	44%
Engaging attendees during the demo/activity.	24%
Finding time to volunteer in general.	18%
Not Applicable – I didn't feel any aspects of volunteering were particularly challenging.	18%
Learning the material for an activity and preparing for the event.	15%
Time management during the demo/activity.	15%
Other	4%

*Respondents could choose up to three of the above categories.