NISE network
NANOSCALE INFORMAL SCIENCE EDUCATION

Public Reach Estimations for the NISE Network

Gina Navoa Svarovsky, Juli Goss, and Elizabeth Kunz Kollmann

January 16, 2015

Acknowledgements

This work would not have been possible without the effort and collaboration of the entire NISE Network, including all Network partners and Network Leadership. The authors wish to thank all current and former members of the NISE Net Evaluation Team for their efforts contributing to this summary, including all of the work that has taken place over the past 10 years. For a more detailed list of acknowledgements, please refer to acknowledgements with evaluation reports found on nisenet.org.

This report was based on work supported by the National Science Foundation under Grant No. ESI-0940143. Any opinions, findings, and conclusions or recommendations expressed in this report are those of the author(s) and do not necessarily reflect the views of the Foundation.

Gina Navoa Svarovsky
University of Notre Dame
107 Carole Sandner Hall
Notre Dame, IN 46556
gsvarovsky@nd.edu
574-631-3829

Table of Contents

Executive Summary

The Nanoscale Informal Science Education Network (NISE Net) is a national community of researchers and informal science educators dedicated to fostering public awareness, engagement, and understanding of nanoscale science, engineering, and technology. Since its inception in 2005, the NISE Net has developed a wide range of activities, programs, and exhibits for public audiences that have been implemented within over 500 institutions across the country.

The purpose of this document is to consolidate and archive all of the major public reach estimates that have been generated as part of the Network evaluation. Brief descriptions of the counting studies and projection methods used to generate these estimates will be included here, with additional information available in other referenced NISE Network evaluation reports and appendices. Finally, strengths and limitations of these estimates will be discussed, as well as future directions for - and implications of - this work.

Summary of Reach Estimates

1. Over the life of the project, the NISE Network is estimated to have reached over 30 million people.

This overarching estimate was generated by combining the projected reach across the NISE Net's most resource-intensive educational efforts, NanoDays and the *Nano* exhibition, over the 10-year period that the NISE Network was funded by the National Science Foundation.

2. At the end of the project, it is estimated that NanoDays events and year-round NanoDays kit usage by Network partners reach over one million people per year.

By 2015, there were 250 physical NanoDays kits distributed to Network partners each year. These kits were used by nearly every recipient for special events during the national NanoDays week (March 28 – April 5, 2015). In addition, beginning in 2011, 100% of all partners completing NanoDays reports indicate the use of kit materials throughout the year for additional nano-themed programming for the public.

3. As of year 10 of the project, it is estimated that the *Nano* exhibition will reach over 10 million people per year.

By 2015, there were 93 copies of the 400 square-foot *Nano* exhibition on display at Network institutions throughout the country. Network partners agree to having *Nano* on their floors for at least two years after receiving it. Because of its small size and modular design, *Nano* is commonly placed in higher-traffic areas within institutions, thus contributing to high reach estimates.

4. These estimates, based on systematic counting studies conducted by evaluators, are conservative by design.

Developing reach estimates, particularly for large, distributed, and national projects like the NISE Network, necessarily involves making some assumptions and extrapolations. In order to generate the most accurate estimates possible for the NISE Net, multiple counting studies that sampled across partner types and locations were conducted over the life of the Network. Evaluators consistently reported the most conservative reach projections generated in order to minimize overestimation.

Introduction

The Nanoscale Informal Science Education Network (NISE Net) is a national community of researchers and informal science educators dedicated to fostering public awareness, engagement, and understanding of nanoscale science, engineering, and technology. Since its inception in 2005, the NISE Net has developed a wide range of activities, programs, and exhibits for public audiences that have been implemented within over 500 institutions across the country.

Exploring the public reach of a project like the NISE Net, where Network partners have been empowered to engage the public in numerous ways, can be quite challenging given the vast array of contact points with different audiences. However, developing a rich and robust understanding of the public reach of a project like NISE Net is essential, not only for federally-required reporting purposes, but also for exploring the reach and impact of a project of this magnitude. NISE Net has been one of the largest - and longest - ISE efforts funded by the National Science Foundation, and therefore, examining the breadth of impact possible with such an investment is critical to advancing the ISE field.

The purpose of this document is to consolidate and archive all of the major public reach estimates that have been generated as part of the Network evaluation. Brief descriptions of the counting studies and projection methods used to generate these estimates will be included here, with additional information available in other referenced NISE Network reports and appendices. Finally, strengths and limitations of these estimates will be discussed, as well as future directions for - and implications of - this work.

Methods

Over the funded life of the NISE Network, public reach estimations have been generated for its largest educational products:

- ***NanoDays,*** which is an annual festival designed to engage the public with nano. Since 2008, at least 100 NanoDays kits comprised of nano-focused educational materials have been distributed to Network partners, who each host a NanoDays local event lasting from one day through one week. In 2015, there were 250 kits distributed, with 100% of partners completing NanoDays reports indicating the use of kit materials for educational programming throughout the year.

- The ***Nano*** **exhibition**, which is an engaging 400-square-foot exhibition fabricated 93 times in duplicate and distributed to Network partners for public display across the country. Since the first seven copies were distributed in 2012, three additional batches of copies have been fabricated and shipped, with the final batch being put on display in 2015.

Because of the nature of these educational products and the ways that the public engages with them, different methods were developed to collect data and generate reach estimates, as briefly described below and explained in more detail in a variety of reports

and appendices (Pattison, Benne, & LeComte-Hinely, 2011; Reich & Goss, 2009; Svarovsky et al., 2013; Svarovsky, Tranby, Cardiel, Auster, & Bequette, 2015).

A driving force behind the development of these innovative approaches to create reach estimations was the Network's desire to move beyond simply reporting ticket sales at venues where NISE Net experiences were happening and more accurately report on the actual public engagement with nano. While raw attendance numbers can contribute to the overall understanding of a project's public reach, a more rigorous exploration of reach through systematic counting studies can provide a more complete and nuanced sense of how far a given project has extended its reach and effort. Of course, creating, refining, and implementing these techniques required a substantial investment of resources, and in many ways, NISE Net was in a unique position to take on this type of public reach analysis. One goal of compiling the Network's public reach estimation efforts here is to provide the Informal Science Education field with this documentation, as a platform to build on for future reach estimation work.

Projecting Public Reach for NanoDays Events

NanoDays events began happening in year 3 of the project (2008), when the Network distributed 100 kits to NISE Net partners. As such, the first systematic counting study conducted on NanoDays event reach happened in the following year, 2009, which was year 4 of the NISE Network. A second counting study was conducted in 2010, which was year 5 of the project and the close of the first round of grant funding from the National Science Foundation. Finally, updated reach estimates based on higher numbers of kit distribution were generated in 2014 and 2015, during the final two years of NSF funding for NISE Net. Table 1 describes the various reach estimates that have been generated for NanoDays events at different points in the project.

Project Year	Calendar Year	Type of Estimate	Method
Four	2009	Yearly	Counting Study
Five	2010	Yearly	Counting Study
Nine	2014	Yearly	Projection based on prior estimation factors
Ten	2015	Cumulative	Projection based on prior estimation factors

Table 1. Overview of reach estimate generation for NanoDays events.

2009 and 2010 Yearly Reach Estimate for NanoDays Events

For the public impacts summative evaluations in years 4 and 5, two studies were conducted which estimated the public reach of NanoDays. These year 4 and 5 counting studies used a consistent process and similar methods, with year 5 building and expanding upon year 4. In both studies, NanoDays host organizations were categorized as small museum, large museum, or university/other using exhibit square footage or operating budget—the methods of reporting data in the *2007 ASTC Sourcebook of Statistics and Analysis* (Association of Science-Technology Centers, 2008).

Estimating the public reach of NanoDays events relied on two data collection instruments: the counting protocol and the NanoDays report. The counting protocol, implemented at a subset of partner institutions in years 4 and 5, helped estimate the number of public encounters with nano that occur at each program type over a given period of time (e.g., per hour of a cart demo on the museum floor, per presentation of a stage program, etc.). During those same two project years, the NanoDays report helped estimate how much of each type of programming was happening at the NanoDays events hosted at partner institutions. The Evaluation Team then synthesized the data from the counting protocols and the data from the NanoDays reports in order establish the number of public encounters with nano at each organization type and size.

In addition, median encounter rates for NanoDays events at institutions of a given type and size were established based on these data, which allowed the Evaluation team to make projections about public reach for sites who received a kit but did not complete a NanoDays report during years 4 and 5. By combining the estimates from all of the reporting institutions with the estimates from these "non-reporting" institutions, yearly public reach estimates for NanoDays events in 2009 and 2010 were generated. For a more detailed description of the methods used in generating these estimates, see the year 4 counting study (Reich & Goss, 2009) and Part I of the Delivery & Reach study conducted in year 5 (Pattison et al., 2011).

2014 Yearly Reach Estimate for NanoDays 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 *Summative Study of NanoDays 2014 Events* (Svarovsky et al., 2015). However, given that 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 developed during the 2009 and 2010 studies described above and the 2014 kit distribution list generated by Network leadership. Kit recipients were sorted into small museums, large museums, or university/other in the same way as the prior counting studies. Once the numbers of small, large, and university sites were determined, these figures were multiplied by the median encounter rates from prior studies. For a more detailed description of these methods, see Svarovsky et al. (2015).

2014 Cumulative Estimate for NanoDays events Over the Life of the 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. As stated above, NanoDays events began being implemented in 2008, continuing every year through the Spring of 2015.

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 and sorting kit recipients into "small" and "large" institutional categories. 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. Using the median encounter rates from the 2009 and 2010 studies and the kit distribution data from each year, annual estimates for NanoDays event encounters were produced. Finally, the number of estimated encounters from each year were added together, in order to produce a cumulative public reach estimate for NanoDays events over the lifetime of the NISE Network. For a more detailed description of these methods, see the Appendix of this report.

Translating estimates from "encounters" to "people reached"

While using the term "encounters" was effective for communication about public reach within the Evaluation team and ultimately with the Network Leadership, this term was still difficult to use in broader communication about the NISE Net and its impact. As NanoDays became the established signature event for NISE Net over time, Network leadership became increasingly interested in sharing these reach estimates and numbers more broadly and with a wide range of audiences. In order to support this effort, and to encourage the use of the counting studies' systematically gathered estimates, the Evaluation team explored the development of a conversion factor between the estimated number of public encounters with nano during NanoDays events to an estimated number of people reached by NanoDays events. After consulting a range of sources, the conversion factor was determined to be 2.5 encounters per person.

Estimating 2.5 encounters per person is consistent with other evaluations conducted about events similar to NanoDays. An evaluation of the Renewable Energy Fair at the Museum of Science, Boston found that visitors went to an average of 2.2 exhibitor tables (Kollmann & Bronnenkant, 2011). Other data collected at three sites across the U.S. for events similar to NanoDays for the Building with Biology project found that visitors most often reported visiting two to five table-top demonstrations (out of the options 0-1, 2-5, or 6 or more) (Todd, Kollmann, Cohn, Ong, & Pfeifle, 2015). Similarly, an evaluation conducted at the Museum of Science, Boston of a staffed lab experience found that visitors participated in two to three activities out of the five or six present (Mesiti & Lindgren-Streicher, 2015).

For clarity, all of the estimates for NanoDays presented in this document will be presented in number of people reached. For original estimates at the encounter level, see the year 4 counting study (Reich & Goss, 2009), Part I of the Delivery & Reach study conducted in year 5 (Pattison et al., 2011), and the 2014 Summative Evaluation of NanoDays events (Svarovsky et al., 2015).

Projecting Public Reach for NanoDays Kit Material Use throughout the Year

As part of the annual NanoDays reports completed by kit recipients, partners were traditionally asked whether or not they used kit materials outside of NanoDays events. Over time, the percentage of partners receiving kits who used NanoDays activities throughout the year steadily increased. Beginning in 2011 and continuing every year

afterwards, 100% of partners who completed NanoDays reports indicate the use of kit materials beyond the window of NanoDays events.

In order to learn more about partners' usage of kit materials throughout the year, additional questions were added to the 2014 NanoDays Report. These questions, given to each organization who hosted a NanoDays 2014 event, asked approximately how often their organization uses each kind of kit material outside of NanoDays events. Evaluators then combined this data with estimates for the number of people reached by different types of activities (such as outreach events and summer camps) in order to generate an overall estimate for how many people are reached by NanoDays kit materials throughout the year. Based on these calculations, it was determined that in 2014, NanoDays materials reached approximately five times as many people throughout the year as they did during the NanoDays events of that year. For a more detailed description of these estimation processes, see the Appendix of this document.

In addition, the "5x" estimation factor was ultimately applied to the other years NanoDays kits were distributed in order to project the public reach of NanoDays materials throughout the year over the life of the NISE Net. The decision to use this estimation factor was made by the Evaluation team after much deliberation. Certainly, applying this estimation factor– derived from data collected in 2014, when the Network was presumably different than it was in 2008, when NanoDays began – equally across the years may result in some overestimation. However, as can be seen in the Appendix, the estimation factor was generated quite conservatively, and in the absence of other data, applying this data-based factor across the years was still more accurate than simply reporting annual attendance for each institution receiving NanoDays kits from 2008-2015.

Projecting Public Reach for the *Nano* Exhibition

Reach estimates for the *Nano* exhibition have been generated at two points in the network as seen in Table 2 – initially as part of the 2013 Summative Evaluation of *Nano* (Svarovsky et al., 2013) and then once again in 2014.

Project Year	Calendar Year	Type of Estimate	Method
Eight	2013	Yearly	Counting study
Nine	2014	Cumulative	Projection based on prior estimation factors

Table 2. Overview of reach estimate generation for the Nano *exhibition.*

2013 Yearly Reach Estimate for the Nano *Exhibition*

As part of the summative evaluation of Nano, a counting study was conducted at seven of the initial exhibition host sites. A counting protocol was developed and implemented at each of the sites to sample visitor contact rates with *Nano* across different days, times, and locations over the course of a week. These counts were then translated into average visitor contact rates, which could be multiplied by the documented annual attendance at each of the seven sites.

2014 Cumulative Estimate for the Nano Exhibition Over the Life of the NISE Net

An estimation factor per copy of the exhibition was generated based on the counting study done as part of the Summative Evaluation. This estimate was then used to generate reach estimates for the additional batches of *Nano* that were distributed in 2014 and 2015. These estimates made the assumption that copies were on display constantly for an entire year as required in the initial contract. For a more detailed description of these methods, see the Appendix of this report.

Summary of Public Reach Estimates

In this section, the final reach estimates for the NISE Network are presented. All estimates reported here are the most conservative numbers generated by the project evaluators. For information about additional estimates that were less conservative, see the Appendix.

Reach Estimates for NanoDays Events

Table 3 outlines the public reach estimates for NanoDays events over the life of the project. At the time of estimation, the distribution of kits for 2015 was not yet finalized; therefore, the estimates from 2014 were used as an approximation.

Year	Number of Kits	Estimated Number of Encounters	Estimated Number of People Reached
2008	100	172,688	69,075
2009	206	366,754	146,702
2010	200	358,698	143,479
2011	200	363,362	145,345
2012	225	406,400	162,560
2013	225	413,584	165,434
2014	250	458,887	183,555
2015	250	*458,887**	*183,555**
Project Total		2,999,260	1,199,704

*The estimate for 2015 is based on similar kit distribution in 2014.

Table 3. Public reach estimates for NanoDays events, 2008-2015.

Over the life of the project, NanoDays events are estimated to have resulted in nearly three million public encounters with nano, which translates to almost 1.2 million people from 2008-2015.

Reach Estimates for NanoDays Kit Material Use throughout the Year

Table 4 outlines the public reach estimates for NanoDays kit material use throughout the year, including everyday programming for the public within Network institutions.

Year	Number of Kits	Estimated Number of People Reached
2008	100	345,376
2009	206	733,508
2010	200	717,396
2011	200	726,396
2012	225	812,800
2013	225	827,168
2014	250	917,774
2015	250	*917,774**
Project Total		5,998,520

*The estimate for 2015 is based on similar kit distribution in 2014.

Table 4. Public reach estimates for NanoDays kit usage throughout the year, 2008-2015.

Over the life of the project, additional programming that used NanoDays kit materials is estimated to have reached almost six million people from 2008-2015.

Total Reach Estimates for NanoDays

By combining the reach estimates for NanoDays events and kit use throughout the year, the total number of people reached via NISE Net's NanoDays effort can be estimated, as seen in Table 5.

Year	Estimated Number of People Reached by Events	Estimated Number of People Reached by Kit Use Throughout the Year	Total Estimated Number of People Reached via NanoDays Effort
2008	69,075	345,376	414,451
2009	146,702	733,508	880,210
2010	143,479	717,396	860,875
2011	145,345	726,396	872,069
2012	162,560	812,800	975,360
2013	165,434	827,168	992,602
2014	183,555	917,774	1,101,329
2015	*183,555**	*917,774**	*1,101,329**
Project Total	1,199,704	5,998,520	7,198,224

*The estimate for 2015 is based on similar kit distribution in 2014.

Table 5. Public reach estimates for NanoDays overall, 2008-2015.

Over the life of the project, it is estimated that the NanoDays effort will have reached over seven million people between 2008-2015.

Reach Estimates for the *Nano* Exhibition

Table 6 outlines the public reach estimates for the *Nano* exhibition, first debuted in 2012. By 2015, 93 copies of the exhibition will be on display in Network institutions throughout the country.

Year	Total Number of Exhibition Copies on Display	Estimated Number of People Reached
2012	7	1,182,861
2013	49	5,262,760
2014	70	7,302,710
2015	93	9,536,940
Project Total		23,285,271

Table 6. Public reach estimates for the Nano exhibition, 2012-2015.

Over the last three years of the project, *Nano* will make a significant impact on the public reach of the NISE Net, with an estimated 23.2 million visitors coming into contact with the exhibition.

Total Project Reach Estimates for the NISE Network

Table 7 compiles the total reach estimates for the NISE Network across both NanoDays and *Nano* exhibition.

Year	Total Estimated Number of People Reached via NanoDays Effort	Total Estimated Number of People Reached via the *Nano* Exhibition	Total Estimated Number of People Reached by NISE Net
2008	414,451	---	414,451
2009	880,210	---	880,210
2010	860,875	---	860,875
2011	872,069	---	872,069
2012	975,360	1,182,861	2,158,221
2013	992,602	5,262,760	6,255,362
2014	1,101,329	7,302,710	8,404,039
2015	1,101,329	9,536,940	10,638,269
		PROJECT GRAND TOTAL	**30,483,496**

Table 7. Total project reach for the NISE Network, 2008-2015.

Based on the reach estimates of these deliverables, NISE Net is projected to have reached over 30.4 million people over its lifetime. Figure 1 illustrates the growth of the Network's reach over time.

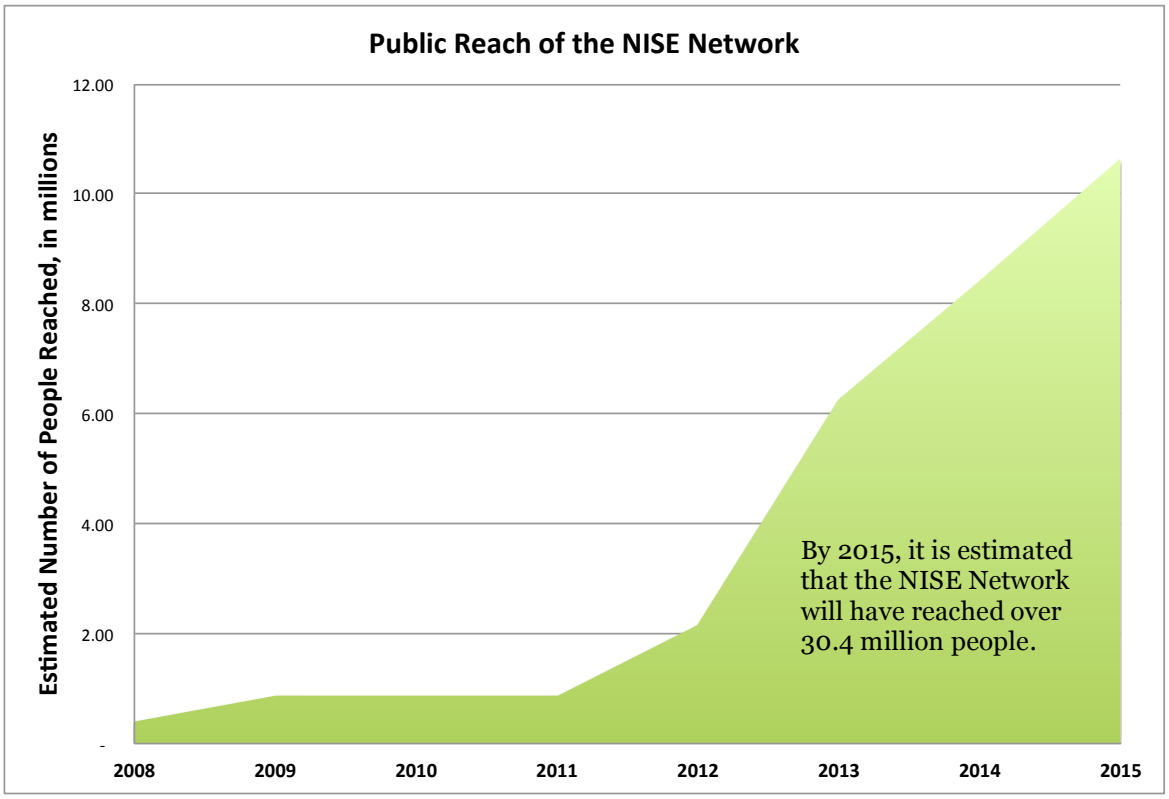

Figure 1. Growth of estimated public reach of the NISE Net from 2008-2015.

Discussion

Over the course of 10 years, the NISE Network has grown into a vibrant and active informal science education community focused on introducing the public to nano. Estimating the public reach of the NISE Network has been an ongoing process throughout the project which has involved multiple counting studies and other data-based projections. By 2015, it is estimated that the NISE Net will have reached over 30.4 million people through its two largest products: NanoDays and the *Nano* exhibition.

Contextualizing the Public Reach of NISE Net

This impressive reach is comparable to large-scale touring exhibitions, such as the suite of BodyWorlds exhibitions that have reached over 40 million people across the globe since 1995[1], and Titanic: The Artifact Exhibition, which has reached more than 25 million visitors worldwide since 1987[2]. Perhaps more interestingly, though, is that the reach of NISE Net was only made possible through the commitment and active participation of over 500 Network partners throughout the country, making nano accessible to a wide range of communities across the U.S. – including many smaller communities that a) would not be very likely to attract a large scale touring exhibition for an extended engagement, and b) may not have ready access to learning opportunities focused on current scientific research. As such, the geographic reach of NISE Net should also be considered when discussing the public reach of the project.

Limitations of These Estimates

Of course, it is essential to acknowledge that the reach estimates included in this summary document are still, in fact, estimates. As with any large-scale, national project, counting the *exact* number of people reached is simply not feasible. As with any effort to estimate the number of people reached by an initiative, the desire for exactness and accuracy must be balanced with the resources available to generate such estimates. The estimates presented here have been systematically generated – and refined – over time; as such, they provide a more accurate and realistic portrayal of the Network's reach than simply counting annual gate revenue for all Network partners. It should be noted, though, that these estimates were also generated at different points over the life of the Network, and each estimate had a different focus. In looking at these estimates together, there is no systematic way to tell whether a person counted during a NanoDays event would also be a person included in the estimate for the *Nano* exhibition. In other words, it must be acknowledged that the potential exists for some of people included in the overall public reach estimate to have been counted more than once.

However, even if that were the case, the 30.4 million estimate for the public reach of NISE Net is still quite conservative, particularly when the following points are considered:

- The numbers presented in this document are the most conservative numbers generated by the estimation methods. Information about other NISE Net reach

[1] Retrieved from http://www.bodyworlds.com/en/exhibitions/questions_answers.html on 9/8/2015.
[2] Retrieved from http://www.premierexhibitions.com/exhibitions/3/3/titanic-artifact-exhibition/about-us on 9/8/2015.

estimates that are less conservative, but still based on the data collected as part of the evaluation of the Network, can be found in the Appendix as well as prior reports (Reich & Goss, 2009; Pattison et al., 2010, Svarovsky et al., 2013; Svarovsky et al., 2015).

- The only deliverables included in the public reach estimates were NanoDays and the *Nano* exhibition. While these are clearly the two biggest deliverables created by NISE Net, over 300 additional educational products have been developed by the Network. Members of the public reached by these other products have not been included in the estimates presented here.

- Descriptions and guides for all NISE Net's educational products are available for download at nisenet.org free of charge. Members of the public reached by the implementation of these downloaded resources have also not been included in the estimates presented here.

Therefore, even though the overall 30.4 million estimate may include some duplicate counts of the public, the additional reach of NISE Net products that was not included in the projections presented here helps offset any potential overestimation.

As with any reach estimation for a project, the numbers only tell one part of the NISE Net story. Descriptions about the actual experiences of the public with nano and the learning outcomes associated with these experiences can be found in several other studies (Guberman et al., 2015; Kollmann et al., 2015; Scheufele & Sun, 2015; Svarovsky et al., 2013; Svarovsky et al., 2015) as well as in the final NISE Net evaluation report that will be completed in 2016.

Finally, it should be acknowledged that moving to more data-driven and systematic methods of estimation such as the ones used by the NISE Net requires a substantial amount of resources that may not be within the scope and budget of a particular project. The public reach estimation techniques of the NISE Net were able to be developed over a period of several years, due in large part to the commitment of the Network leadership to generating estimates grounded in data. Therefore, one goal of this document is to have a place where all the reach estimation numbers can be found in one place. An additional goal of this document was to provide the Informal Science Education field with a brief overview and introduction to the methods used by the NISE Net to generate its reach estimates, in the hopes that other projects and initiatives may draw and build on these techniques in the future.

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Appendix

Duplicated vs. Unduplicated Counts

Below is a brief description of duplicated and unduplicated counts, as described by the Online Project Monitoring System (OPMS) found at http://www.iseopms.org/. An unduplicated count means that every person included in a particular reach estimate is a unique person who may have engaged with multiple activities during a single event. A duplicated count means that a person may have been counted multiple times at the same event; often, duplicated counts are the only counts that are possible for events that are as complex and broad as NanoDays. Figure A1 illustrates the difference between an unduplicated and duplicated count.

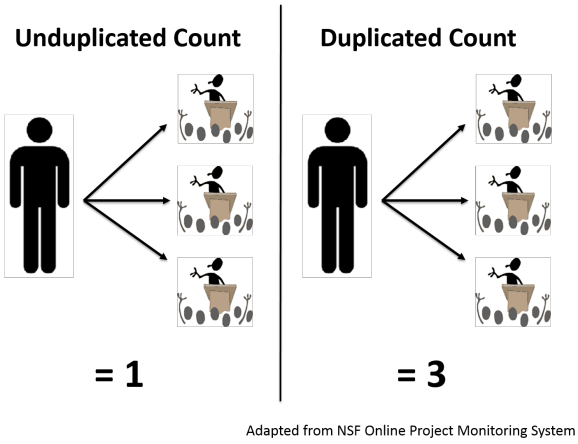

Figure A1. OPMS illustration of different counts.

The National Science Foundation says either type of count is acceptable for reporting purposes, acknowledging the immense difficulty that can come with developing an unduplicated count.

The first counting study conducted by the NISE Net in 2009 acknowledges the possibility of overestimation because individuals might attend more than one experience at NanoDays. While developing the reach estimate for that first study, methods were used to counteract this potential overestimation and duplicate counting. Estimates that resulted from that first study were reported as "estimated number of people reached".

The study conducted in 2010 report moved one step further along this trajectory; instead of describing reach in terms of "people reached", the findings and estimates of that study are reported in "encounter rates". This was because the Evaluation Team felt like the term "encounter" was a more accurate way of discussing these estimations of NanoDays reach – and in many ways, the term was easier to understand and communicate as compared to the term "Duplicate Count". As such, the Evaluation Team, and ultimately the project leadership, adopted the "encounter estimate" language throughout.

Estimating the public reach of the NanoDays kit materials throughout the year

As briefly described in the full document, in 2014, efforts were made to project the public reach of NanoDays kit materials throughout the year. In order to determine if a full counting study (similar to the 2009 and 2010 NanoDays counting studies) was necessary, evaluators began assembling what was known about partners' usage of kit materials throughout the year. According to the Delivery & Reach Study (Pattison et al., 2011), 65% of survey respondents reported using cart demonstrations and facilitated activities both during and outside of NanoDays. When the NanoDays summative evaluation was conducted in year 9, 100% of partners who completed a NanoDays report indicated the use of kit materials throughout the year (Svarovsky et al, 2015).

In order to further understand how partners used NanoDays materials throughout the year, a question was added to the 2014 NanoDays Report. Responses are detailed in Table A1 and highlight that all types of products are used at some point throughout the year.

Survey Question: We'd like to ask you a few questions about how you have used NanoDays kit materials in the past outside of NanoDays events: Please identify approximately how often your organization uses NanoDays kit materials for additional programming outside of NanoDays events.

	Not applicable to my org	Daily	Several times a week	Once a week	Once a month	Several times a year	Once a year	Not sure
Cart demonstrations/ brief table top activities (n=189)	11	10	27	20	31	77	5	8
	6%	5%	14%	11%	16%	41%	3%	4%
K-12 school outreach activities (e.g. classes, after school programs, field trips, science fair) (n=186)	15	3	12	16	25	88	17	10
	8%	2%	7%	9%	13%	47%	9%	5%
Special events (e.g. family events, chemistry events, nano-related events other than NanoDays, family nights, festivals) (n=185)	10	0	1	5	9	113	32	15
	5%	0%	1%	3%	5%	61%	17%	8%
Camps (e.g. summer camp, holiday camp, day camp) (n=186)	36	3	4	4	3	76	45	15
	19%	2%	2%	2%	2%	41%	24%	8%
Outreach activities with ongoing community partners (e.g. libraries, scouts, Boys & Girls club) (n=186)	32	0	2	3	11	86	25	27
	17%	0%	1%	2%	6%	46%	13%	15%
Professional development* (for museum staff, school teachers, college students) (n=183)	35	0	1	2	11	54	52	28
	19%	0%	1%	1%	6%	30%	28%	15%
Longer museum programs (e.g. forums, classes, labs, science club) (n=180)	76	0	3	2	6	41	23	29
	42%	0%	2%	1%	3%	23%	13%	16%
Longer term display of materials in public spaces* (e.g. within exhibits, on the museum floor, on a table) (n=182)	80	25	2	7	4	17	10	37
	44%	14%	1%	4%	2%	9%	6%	20%
Lesson activities within college courses (n=182)	113	1	0	0	3	23	12	30
	62%	1%	0%	0%	2%	13%	7%	17%

* The categories of “professional development” and “longer term display of materials in public spaces” were not used to for this estimation of public reach. “Professional development” does not reach a public audience and “longer term display of materials in public spaces” would overlap with the *Nano* exhibition which had a counting study.

Table A1. Responses on the NanoDays 2014 report indicating approximate frequency of NanoDays kit material use throughout the year.

Evaluators analyzed these NanoDays Report responses by multiplying the approximate number of people reached by each program type by the number of times it was implemented each year. The following three tables describe this process. Table A2 provides the number of people reached for each type of offering and how this number was derived. Table A3 provides an example of one program type (cart demonstrations) to illustrate how the total number of people reached by each product type was determined. Table A4 shares the final number of people reached by all NanoDays product types used throughout the year with a public audience.

Activity Type	Approximate # of People Reached (per offering)	Data Source
Cart demonstrations/ brief table top activities	40	2009 and 2010 NanoDays counting studies: Encounter estimates for cart demonstrations were averaged across small museum, large museum, and university
K-12 school outreach activities (e.g. classes, after school programs, field trips, science fair)	60	Estimated class size of 30; Assumes two classes per outreach or one assembly of 60 students
Special events (e.g. family events, chemistry events, nano-related events other than NanoDays, family nights, festivals)	550	Median number of NanoDays attendees self-reported by 2014 NanoDays hosts. Assumed conservative because it is less than half of the median number of encounters per institution in the 2009 and 2010 NanoDays counting studies.
Camps (e.g. summer camp, holiday camp, day camp)	45	Estimated camp size of 15; Assumes 3 camps per season
Outreach activities with ongoing community partners (e.g. libraries, scouts, Boys & Girls club)	45	Estimated camp size of 15; Assumes 3 camps per season
Longer museum programs (e.g. forums, classes, labs, science club)	30	2009 and 2010 NanoDays counting studies: Encounter estimates for classroom activities were averaged across small museum, large museum, and university
Lesson activities within college courses	50	Estimated size of small lecture

Table A2. Number of people reached by each activity type and how this estimate was derived.

	# of Responses	X	Per Year Factor*	=	Total # of Offerings Per Year	X	# of people reached by a cart demo	=	Total # of people reached
Not applicable to my org	11		0		0		40		0
Daily	10		365		3650		40		146,000
Several times a week	27		3 * 52		4212		40		168,480
Once a week	20		52		1040		40		41,600
Once a month	31		12		372		40		14,880
Several times a year	77		5		385		40		15,400
Once a year	5		1		5		40		200
Not sure	8		0		0		40		0
					Total # of People Reached per Year by Cart Demos				**386,560**

*These "per year factors" were used for all activity types except "K-12 school outreach" which were adjusted for the school year, using 180 as the number of days, 36 as the number of weeks, and 9 as the number of months.

Table A3. The total number of people reached per year by cart demonstrations, as an example of how this number was estimated for each offering type.

Activity Type	Total # of People Reached per Year
Cart demonstrations/ brief table top activities	386,560
K-12 school outreach activities (e.g. classes, after school programs, field trips, science fair)	185,640
Special events (e.g. family events, chemistry events, nano-related events other than NanoDays, family nights, festivals)	616,550
Camps (e.g. summer camp, holiday camp, day camp)	107,460
Outreach activities with ongoing community partners (e.g. libraries, scouts, Boys & Girls club)	47,475
Longer museum programs (e.g. forums, classes, labs, science club)	26,160
Lesson activities within college courses	26,400
Total # of People Reached per Year by NanoDays materials outside of NanoDays	**1,396,245**

Table A4. Total number of people reached per year by NanoDays materials outside of NanoDays.

Using these calculations, the total estimated number of people reached throughout the year by NanoDays materials was around 1.4 million. In order to be conservative, as this projection is based on a wide range of data points, and estimation factors gathered through earlier studies, evaluators capped this number at 1,000,000.

Comparing the estimated public reach of 1,000,000 for kit use throughout the year in 2014 with the approximately 200,000 people reached during 2014 NanoDays events, it appeared that kit use outside of the annual NanoDays window resulted in approximately five times the public reach of the events. Ultimately, the "5x" estimation factor was applied to the other years NanoDays kits were distributed in order to project the public reach of NanoDays materials throughout the year over the life of the NISE Net. The decision to use this estimation factor was made by the Evaluation team after much deliberation. Certainly, applying this estimation factor– derived from data collected in 2014, when the Network was presumably different than it was in 2008, when NanoDays began – equally across the years may result in some overestimation. However, as described previously, the estimation factor was generated quite conservatively, and in the absence of other data, applying this data-based factor across the years was still more accurate than simply reporting annual attendance for each institution receiving NanoDays kits from 2008-2015.

Estimating the public reach of the *Nano* exhibition, 2012 – 2015

The *Nano* exhibition is a small, 400 sq. ft. exhibition that engages the public in learning about nano concepts and technologies. Developed in 2011, seven initial copies of the exhibition were installed at seven partner institutions across the country. At that time, the Network Leadership intended to make some number of additional copies of *Nano*, based on the findings of the summative evaluation conducted in 2012 (Svarovsky et al., 2013).

As part of the summative evaluation, a counting study was also implemented in order to estimate the public reach of *Nano*. During the counting study, *Nano* visitation rates were documented at seven different institutions, at different times of the day, and on different days of the week. Across all of these observations, the lowest average percentage of visitors who see *Nano* per year was 38% (Svarovsky et al., 2013).

At the time of generating final reach estimates in 2014, additional information about the total number of *Nano* copies was available, as seen in Table A5 below.

Year	Batch Number	Number of copies distributed
2012	Pilot	7
2013	Batch 1	42
2014	Batch 2	21
2015	Batch 3	23
	Total Copies of *Nano* Distributed	93

Table A5. Total number of Nano *exhibitions distributed, 2012-2015.*

In addition, distribution information for the Pilot batch, Batch 1, and Batch 2 was also available at the time of reach estimation. Since Network partners were asked to include annual attendance figures in their applications to host the *Nano* exhibition, this information was used to generate an average attendance per host institution figure, which was 255,633 visitors per year.

Using these pieces of information, yearly reach estimates for Nano were generated. The first step was to determine the estimated reach per copy of *Nano* based on the available information, as seen in Equation 1 below:

$$\text{Reach per copy of } Nano = \text{Average attendance at known host institutions} \times \text{Lowest observed percentage of } Nano \text{ visitation} \quad (1).$$

This resulted in a "per copy" reach estimate of 97,140 people.

After this figure was determined, reach estimates for each batch of *Nano* were based on the number of copies that were distributed in a given year, as seen in Equation 2:

Estimated reach of *Nano* per batch distributed = Reach per copy of *Nano* x Number of copies of *Nano* distributed in a given batch (2).

These calculations led to the estimates seen in Table A6.

Batch	Number of Exhibition Copies Distributed	Estimated Number of People Reached, by Batch
1	42	4,079,899
2	21	2,039,950
3	23	2,234,230

Table A6. Public reach estimates for the Nano exhibition, Batch 1 - 3.

It should be noted that the Pilot batch estimates were calculated as part of the Summative Evaluation of *Nano*. The projected reach of those first seven copies of Nano was 1,182,861 people annually. Thus, combining all of this information leads to the final reach estimates for *Nano* over time, as seen in Table A7.

Year	Batches Distributed	Total Number of Exhibition Copies on Display	Estimated Number of People Reached
2012	Pilot	7	1,182,861
2013	Pilot, Batch 1	49	5,262,760
2014	Pilot, Batches 1 & 2	70	7,302,710
2015	Pilot, Batches 1, 2 & 3	93	9,536,940
		GRAND TOTAL	**23,285,271**

Table A7. Public reach estimates for the Nano exhibition, 2012-2015.