



## NISE Net Public Impacts Summative Evaluation Progress on Year 4 Activities

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The NISE Net Public Impacts Summative Evaluation is conducted through the collaborative effort of three Research and Evaluation Departments (Museum of Science, Science Museum of Minnesota, and Oregon Museum of Science and Industry) and is overseen by the NISE Net Committee of Visitors (Bruce Lewenstein, Saul Rockman, and Frances Lawrenz<sup>1</sup>). This memorandum describes the progress made on the NISE Net summative evaluation during Year four of the five-year Network grant.

The summative evaluation draws upon a program theory model (Weiss, 1997) that allows us to measure not just how well the Network succeeds in its work, but also how it works. This program theory approach allows us to map the possible *pathways* NISE Net uses to connect the public with nanoscale science, engineering and technology (NSET). The summative evaluation also draws upon the National Science Foundation (NSF) Informal Science Education impact categories (Friedman, 2007). The summative evaluation team has identified and studied five pathways NISE Net uses to reach the public. At the same time, the evaluation team has considered how the findings and shifting work of the Network redefine the pathways. More details about the pathways are included in the Addendum at the end of this document.

The four summative evaluation studies conducted in Year 4 include the following<sup>2</sup>:

- Study 1: Reaching the public through NISE Net programs and exhibits
- Study 2: Reaching the public through NISE Net partner institutions
- Study 3: Estimating the reach of NanoDays 2009
- Study 4: Impact of NanoDays and other NISE programs on the public's nanoawareness

The four summative studies summarized here were conducted in the fourth year of a five year project. Therefore, the results are not definitive. This report summarizes initial summative evaluation findings and suggests issues for further investigation during Year 5.

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<sup>1</sup> For most of Year 4, Carol Weiss was a member of the Committee of Visitors. Unfortunately, she was not able to continue her term. Frances Lawrenz began her term in July 2009.

<sup>2</sup> Full, detailed reports are available for each study.

## CROSS-NETWORK SUMMARY OF FINDINGS & RECOMMENDATIONS

Looking across the results from the summative evaluation studies in Year 4, a number of patterns emerge about NISE Net public outreach activities, the impacts of those activities, and directions NISE Net should consider in the future.

### ***1. The NISE Net activities with broad reach tend to have little impact, and activities with small reach tend to have higher impact***

Review of the findings across studies (including those conducted by Multimedia Research in Year 3) demonstrates that the NISE Net products delivered by Tier I partners have the potential to impact public knowledge, understanding and interest of nanoscale science, engineering and technology. Yet currently, few NISE Net-developed programs, forums and exhibits are being conducted by the Tier I organizations outside of what is required for the purpose of the evaluation. Analysis of the NSF reporting data (also known as the “NISE Net metrics”) demonstrate that the 12 Tier I institutions<sup>3</sup> implemented approximately 1.4 programs per week per institution outside of NanoDays, and only 43% of the programs implemented were featured in the catalog of products. Conversely, findings from Study 4 on the impact of NanoDays demonstrate that the impacts of NanoDays events on nanoawareness are at best minimal. Yet Study 3, which documents the activities of the Network during NanoDays, demonstrates that this is where the Network has the greatest level of public outreach activity.

*Recommendation 1:* Moving forward, the Network should consider ways to address this divergence. Possible actions the Network could take include the following:

- Increase the likelihood that NISE Net programs and exhibits are delivered by Tier I institutions by providing incentives that would make it more likely that these institutions would deliver these programs (such as grant funding to deliver NISE Net programs and exhibits to the public); and
- Increase the potential impacts of NanoDays activities by emphasizing the public outreach goals among the participating institutions so that they are aware of the emphasis on nanoawareness for NanoDays and on the need to include both the risks and benefits of nano, among other important topics.

### ***2. NISE Net programs and exhibits, including NanoDays, do not seem to impact public awareness of nanoscale science, engineering and technology***

Findings from the first year of Study 1 (on programs) and Study 4 (on NanoDays) suggest that NISE Net may not be impacting public awareness of nano as intended. This is noteworthy given that this is a high priority goal for the Network. Only 63% of the Study 1 survey participants felt that the program they viewed had a high influence on their awareness of nanotechnology (this is lower than a typical desirable rate of 75%). The lack of influence on nanoawareness is most apparent in the results from Study 4, where there was no significant difference between Treatment and Control Groups in terms of awareness of nanotechnology in general as well as nanotechnology applications and risks. In addition, 34% of the NanoDays participants surveyed reported that they had “heard nothing about nano”, and less than half of Treatment Group participants (48% of those who had experienced NanoDays) did not recall participating in NanoDays activities.

*Recommendation 2:* The Network should consider ways to improve the design of NISE Net programmatic experiences so that participants will be more likely to be aware of nano following participation in NISE Net public engagement activities.

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<sup>3</sup> Two institutions did not contribute to the NISE Net metrics in 2009.

### **3. Certain topics are more likely to be addressed within NISE Net than others.**

There is some evidence that the Network may be contributing to the public's understanding of the fundamentals of nanotechnology, and its materials, tools and applications, but it is not likely making a strong contribution to the public's understanding of the societal implications of nano.

Findings from Study 2 (implementation of NISE Net activities) demonstrate that within the Network, the partners are most likely to implement programs that address the fundamentals of nanotechnology and its materials, tools and applications. This is evident in both the survey responses of the Tier III partners and in the nisenet.org usage statistics. Likewise, the survey responses in Study 1 (program impacts) from the participants who experienced NISE Net programming demonstrate that they were able to articulate the main messages of the programs that addressed the fundamentals of nano and its materials, tools and applications.

Findings from Study 2 also demonstrate that within the Network, societal implications are less likely to be addressed than other topic areas. This may partially explain why in Study 4 NanoDays participants were more likely than the Control Group to have awareness of the potential benefits of nano, but were not more likely to have awareness of the potential risks. Studies of the public impact of NISE Net programs that address societal implications, however, show that participants do report learning about benefits and risks. This was found in the study of the science theater presentation that was conducted as part of Study 1, where 88% of the visitors were able to articulate the main messages of *NanoDreams*, a science theater presentation that addresses societal implications. Similar findings appear in Multimedia Research's summative evaluation of the Forum program, where participants demonstrate an increase in understanding of both the risks and the benefits of nano after participating in the event.

*Recommendation 3:* Moving forward, the Network should carefully align the priority content with implementation plans to ensure that the public has an opportunity to engage in the full-range of learning experiences that the Network has prioritized. Possible actions the Network could take include the following:

- Creating a prioritized list of content and share that list with the broader Network; and
- Encouraging Network partners to conduct programs that address societal implications (if this is deemed an important topic) by providing incentives.

### **4. Public outreach activities amongst Tier II, and III partners include the delivery of nano-related programs and exhibits, many of which were not created through NISE Net processes**

NISE Net developed programs account for about half of all public outreach activities in the Network. According to the results of a survey of the NISE Net database of contacts, 64% of the respondents implement NISE Net programs and exhibits with the public, and 58% conduct programs and exhibits that were not developed by NISE Net. Findings from the formative evaluation of the regional workshop similarly show that 58% of program implementations performed by Tier II institutions were originally created by NISE Net while 42% of the implementations featured programs that were not developed by NISE Net. The programs and exhibits implemented by Tier II and III partners that were not created through NISE Net processes represent a potentially untapped resource within the Network as they are not currently reflected in the NISE Net catalog.

*Recommendation 4:* Continue to explore options that would allow Tier II, and III partners to contribute programs and ideas for public engagement activities to nisenet.org.

### **Recommendations for modifications to the Summative Evaluation studies in Year 5**

Findings from the four summative studies in Year 4 point to areas for further investigation, including:

- *Explore how Tier I and II institutions make choices about which NISE Net programs and exhibits they implement and the frequency with which they implement them.* Study 2 in Year 5 could explore the current barriers that prevent Tier I and II institutions from implementing NISE Net programs and exhibits. This could result in findings to shape the Years 6-10 focus on the institutionalization of nano. This study could also identify the conditions that promote institutions to conduct nano programs, allowing the Network to better build on institutional strengths.
- *Explore the full range of public engagement activities currently being implemented by Tier I, II and III institutions, and revise the reporting forms to better reflect that range.* Currently, the data collected about public engagement activities largely focuses on program and exhibit implementations. Little is known about other activities, such as on-line learning experiences and news programs. Study 2 in Year 5 can be used to generate a more detailed picture of the full range of public engagement activities currently implemented by Network partners.
- *Continue to measure impacts of NanoDays at Tier I and II.* The nanoawareness instrument has been refined and tested through two pilot studies. This instrument can continue to be utilized in Year 5 to examine possible differences that may exist in the impacts of NanoDays in different institutions and different conditions.
- *Dig deeper into the possible impacts of the NISE Net catalog of products.* Study 1 demonstrated that catalog programs have the potential to impact the public's understanding of nano. The Year 5 study could be modified to study the public impacts of programs and exhibits in more depth rather than across the full range of activities.

## SUMMARY OF INDIVIDUAL STUDY FINDINGS

### ***Study 1: Reaching the public through NISE Net programs and exhibits***

Study 1 measures the impact of NISE Net-produced programs and exhibits when they are delivered, unmodified, to a public audience by Tier 1 institutions. In Year 4, this study used a survey instrument to measure the public impact of NISE Net program deliverables in terms of public (a) interest, (b) attitude, (c) understanding, and (d) awareness. Data collection focused on four NISE Net programs (two theater, two cart). Across these four programs, over 250 surveys were completed. This initial sample revealed some trends:

- Most participants (85%) were able to articulate the main message of the program.
- Almost all (more than 90%) of the participants had positive responses regarding enjoyment and interest.
- More than half (60-63%) of the participants had positive responses about awareness and relevance, but these numbers are below a more typically desirable rate of at least 75% of respondents.

### ***Study 2: Reaching the public through NISE Net partner institutions***

Study 2 looks to describe the activities of the Tier I, II and III institutions. The main question driving this study is the following: To what extent is NISE Net reaching the public through the different tiers of the Network? Study 2 relies on data collected from other studies throughout the Network to generate an understanding of the current level of public engagement activity in the Network. These sources include the following:

- A survey of the individuals in the NISE Net database of contacts;
- A survey of the individuals who attended the regional workshops;
- Web usage statistics from nisenet.org;
- NISE Net annual report metrics gathered from Tier I institutions; and
- NanoDays reports submitted online by individuals who received a NanoDays kit.

Preliminary findings from Study 2 include the following:

- Professionals from Tier I, II and III institutions conduct nano programs/exhibits
- Nano public outreach activities are still not widespread outside of NanoDays
- NISE Net-developed programs account for about half of all nano programs delivered to the public activities in the Network
- NISE Net products are being modified by Tier II and III institutions prior to use
- Nano programs delivered cover a range of topics, but the fundamentals of nano and materials, tools and applications are more likely to be covered than others
- Nano is delivered through a range of formats, but cart demonstrations are more widely used throughout the Network

### ***Study 3: Estimating the reach of NanoDays 2009***

Study 3 utilized a systematic process to generate an estimate of the number of people reached through the public outreach activities of NanoDays 2009. Two data collection instruments were utilized to generate this estimate: the counting protocol and the NanoDays report. The counting protocol was used to generate estimates for the number of people who participate in a NISE Net program or activity of a certain type. The NanoDays report was used to capture the number of activities of different program types that were hosted across all of the participating institutions.

Combining these data provides an estimate of the number of people who experienced NanoDays activities across the 200 institutions that received NanoDays kits. Findings from this study suggest that approximately 371,917 to 425,107 people participated in NanoDays 2009. This makes the NanoDays pathway the one that is currently identified as having the broadest public reach in the Network.

***Study 4: Impact of NanoDays on the publics' nanoawareness***

Study 4, also known as the Nanoawareness Study, looks at the impact of NanoDays activities when hosted at Tier I and Tier II institutions. The Nanoawareness Study was first conducted in Year 3 by Multimedia Research and then replicated in Year 4 by OMSI with slight changes to the methodology. Both the Year 3 and Year 4 studies used an email survey instrument where the responses of the Treatment Group (individuals who participated in nano educational activities during NanoDays as well as other time periods<sup>4</sup>) were compared to a Control Group that did not experience nano programming.

Findings from Year 3 and 4 studies suggest that the impact of NanoDays programming may not be consistent across institutions nor is the impact deep. When visitors who did and did not experience NanoDays nano programming in Year 3 were studied at the Tier I institutions, the study found that a significantly higher proportion of the Treatment Group had greater awareness of nanotechnology and nanotechnology applications, risks, and benefits than the Control Group. In Year 4, when the same survey questions were delivered to at the Tier II institutions, the results showed fewer significant differences between Treatment and Control Groups. The only similarity to Year 3 is that the Year 4 survey results suggested that a significantly higher proportion of the Treatment Group had greater awareness of nanotechnology benefits. That is, the Year 4 results revealed no significant differences between the percentage of Treatment and Control Group participants with regard to their awareness of nanotechnology in general and nanotechnology applications and risks.

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<sup>4</sup> Many of the experiences that visitors participated in during Year 3 took place during NanoDays, but not all.

## **Addendum: Program Theory Model**

The summative evaluation is driven by a program theory model (Weiss, 1997) that maps the possible pathways through which NISE Net can connect the public with nanoscale science, engineering and technology (NSET). The summative evaluation team has identified five pathways through which NISE Net can reach the public, each of which will likely have different impacts. This evaluation seeks to assess the likely impacts of each of these pathways, while simultaneously redefining the pathways as new findings emerge and the Network changes over time. The pathways as we know them in September 2009, include the following:

- The Tier I pathway is currently defined as the pathway where the programs and exhibits that were developed using NISE Net funding are implemented by Tier I institutions. Findings from studies 1 and 2 address this pathway.
- The Tier II pathway is currently defined as the pathway through which the regional and other partner institutions attend workshops, connect with regional hub leaders, learn about NISE Net resources and then implement nano programs and exhibits at their institutions. To generate a description of the public outreach activities that may be taking place within the Tier II pathway, existing data collected through the formative evaluation of the workshop participants was analyzed.
- The Tier III Pathway can be described as one where individuals (who work at organizations not represented in regional workshops) learn about NISE Net resources through nisenet.org and conference participation (amongst other avenues), download NISE Net products, and deliver them to the public. Study 2 is the only study that looked at the activities of the Tier III pathway.
- The Tier II and III-product pathway is best described as the pathway through which Tier II and III partners are able to share nano-education products they create with others through nisenet.org. This pathway is formed with the expectation that others will then utilize these resources to deliver nano education with the public. At this point in time, measuring the possible impacts of this pathway is not feasible as this mechanism has not yet been established through nisenet.org.
- Through the NanoDays Pathway, Tier I, II and III institutions deliver NISE Net and non-NISE Net nano education products to the public during a specific timeframe. Most of these partners use the NanoDays kits developed by NISE Net as a guide for conducting this programming. Studies 3 and 4 provide insights on the possible outcomes and impacts of NanoDays activities on the public.

**References**

Friedman, A. (2007). *Framework for evaluating impacts of informal science education projects*. Washington, DC: The National Science Foundation.

Weiss, C. (1997). *Evaluation* (Second ed.). Upper Saddle River, NJ: Prentice Hall.

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