

A Study of Communication in the Nanoscale Informal Science Education Network

Year 6

By: Jane Morgan Alexander, Gina Svarovsky, Juli Goss, Liz Rosino,
Leigh Ann Mesiti, Jenna LeComte-Hinely, and Christine Reich

April, 2012

Acknowledgements

The study's team members would like to thank all the NISE Network partners who participated in this study as well as the following individuals for their contributions:

- Marjorie Bequette and Marcie Benne for serving as study advisors and contributing vital expertise, critical feedback, and insights throughout all phases of the study;
- The members of the NISE Net Leadership team who reviewed the final report, including Larry Bell, Paul Martin, Catherine McCarthy, Vrylena Olney, and especially Rae Ostman who not only reviewed the report, but also contributed to the study throughout by serving as the Leadership team liaison; and
- The members of the Museum of Science Research and Evaluation Department, Oregon Museum of Science and Industry Evaluation and Visitor Studies Division, and Science Museum of Minnesota Evaluation and Research in Learning Department who assisted in transcription and data organization, including Amanda Colligan, Sunewan Chunhasuwan, Al Onkka, and Maria Montiel.

This report was based on work supported by the National Science Foundation under Grant No. DRL-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.



Christine Reich
Museum of Science
1 Science Park
Boston, MA 02114
creich [at] mos [dot] org

Table of Contents

Executive Summary	4
Background	6
NISE Network.....	6
Network Communication Study.....	8
Methods	10
Focus groups.....	10
Interviews.....	12
Data analysis.....	15
Study limitations.....	16
Findings	18
Communication that happens through NanoDays.....	18
Communication that happens through face-to-face meetings.....	23
Communication that happens through the regional hub structure.....	29
Communication that happens through the nisenet.org website.....	33
Communication that happens through other components beyond the four primary components.....	36
Network communication that is desired.....	39
Summary of findings.....	45
Reflections	46
Directionality and impact on community.....	46
Expansion of existing communication components.....	47
Reflections from a Network Leadership representative.....	49
References	50
Appendix A	51
Description of Network components.....	51
Appendix B	54
Focus group protocol with Tier 1 partners.....	54
Appendix C	59
Interview protocol with Tier 2 and 3 partners.....	59

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 (nano).” Funded by the National Science Foundation through two consecutive grants totaling over \$40 million that extend over 10 years, NISE Net is one of the largest informal science education (ISE) initiatives ever undertaken.

A Study of Communication in the NISE Network (Network Communication Study), conducted during the sixth year of the grant, sought to learn how the four primary communication components that were developed in the first 5 years of NISE Net (NanoDays, face-to-face meetings, the regional hub structure, and the nisenet.org website) are functioning within the Network. In particular, the study explored how these components communicate information, ideas, and practices related to NISE Net between and within the three Network tiers.

Using a qualitative approach, 7 focus groups with 24 individuals in Tier 1 and 39 semi-structured interviews with professionals in Tiers 2 and 3 were conducted. Only Tier 2 and 3 partners who were actively involved in NISE Net were selected to participate in the study so as to capture the “best case” description of communication within the Network to illustrate how this network optimally functions. Tier 2 and 3 partners were identified as actively engaged if they had hosted or participated in a NanoDays event in the past 3 years and had attended at least one NISE Net professional development offering. Due to these sampling constraints, the study does not draw conclusions about the experience of less involved Network partners.

Findings from this study suggest that the four primary communication components are the essential and predominant means of communication between the actively involved partners of the Network, and each component has its particular strengths and weaknesses. In particular, the following findings emerged from this study:

- **NanoDays makes nano content seem “doable.”** NanoDays kits, acknowledged by involved partners in all tiers to be a useful representation of the professionalism of the Network, communicate messages about the accessibility of nano content.
- **Face-to-face meetings contribute to a sense of NISE Net community.** Through face-to-face meetings held throughout the year, Network partners learn general information about NISE Net and develop personal connections with Network peers.
- **The regional hub structure provides a personal, go-to resource for professionals in Tiers 2 and 3.** The regional hub structure serves as a central resource to disseminate Network updates and respond to partners’ needs.
- **The NISE Network website (nisenet.org) is used to convey general information about NISE Net.**

In addition to the four primary communication components, some Network partners also use the Nano Bite (NISE Net’s monthly e-newsletter) and social networking groups on LinkedIn and Facebook.

The spread of information and messages throughout the Network highlights that actively involved NISE Net partners, regardless of tier, especially value components that allow for multidirectional communication within and between all three tiers, such as face-to-face meetings and the regional hub structure. These involved partners also identified challenges to the flow of communication in the Network and expressed a desire for increased communication within the Network overall, signifying that an expansion or redesign of existing communication components could benefit the Network.

Background

NISE Network

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 (nano)” (NISE Network, 2011). Funded by the National Science Foundation through two consecutive grants that extend over 10 years and amount to a total of over \$40 million, NISE Net is one of the largest informal science education (ISE) initiatives ever undertaken. Begun in 2005, the Network has continuously expanded. By the end of Year 5, NISE Net encompassed close to 400 science museum and university partner institutions across the nation (Reich, et al., 2011).

Network tier structure

The NISE Network is divided into three tiers that differ according to the roles and responsibilities of the partner institutions within each tier and the level of NISE Net support the institutions receive. Partner institutions can move between the tiers due to staffing changes, shifting priorities, and fluctuating levels of activity in the Network. In Year 6, the tier definitions are as follows:

- **Tier 1 - Core Partners:** These grant-funded partners operate the Network. Core partner institutions are charged with leading the field in raising public awareness, understanding, and engagement with nanoscale science, technology, and engineering. This includes developing informal educational products, creating professional development opportunities, and building the capacity of other Network institutions and partners.
- **Tier 2 - Nano-Infused Partners:** These institutions are the primary recipients of Network resources and professional development efforts, including regional workshops, online workshops, and network-wide meetings. The goal of the Network is to have nano content be “infused” into Tier 2 institutional programming by the end of Year 10. The Network is actively working to increase the capacity of nano-infused partners to deliver nano education experiences beyond NanoDays as an ongoing, sustainable part of their institutions’ programming.
- **Tier 3 - Broad Reach Partners:** Institutions in this tier may take materials or ideas from the Network and use them in their own activities. The Network aims to introduce nano informal education to Tier 3 organizations to the extent that these organizations can participate in, at the least, some limited form of nano educational outreach, such as participation in NanoDays. The Network uses a publically accessible website and an open-source catalog of educational materials, as well as presentations at professional conferences to broaden the reach of nano education to these institutions.

NISE Network Leadership (NEGNOG)

NEGNOG (Network Executive Group and Network Operational Group) is the NISE Network’s leadership team that is primarily responsible for the operation and functioning of NISE Net. This team oversees the financial management of the NSF grant, provides

Network leadership and management, and coordinates efforts that impact multiple working groups (working groups are described in detail below), such as Network-wide communication and Network-wide meetings. Furthermore, the Network Executive Group (NEG) is responsible for the overall goals and strategy of the Network, including planning the long-term direction and projected impact of the NISE Network. The Network Operational Group (NOG) is responsible for the “on the ground” Network coordination and operation, and focuses particularly on issues that affect individual working groups.

NISE Network working groups

The Network has built institutional and individual leadership capacity by establishing multi-institutional working groups comprised of Tier 1 partners who carry out all aspects of the Network’s efforts. In Years 6 and 7, these groups were the following: Community, Content Steering, Evaluation, Exhibits, Inclusive Audiences, NanoDays, Programs, Research, Research Center- Informal Science Education Partnerships (RISE), and Website. The working groups meet regularly to develop aspects of the Network and to coordinate resource development. Each working group is led by a working group leader who reports group efforts to the rest of the Network. The Network strategy of raising capacity, particularly within Tiers 1 and 2, is based upon professional development, and professional development activities and efforts are embedded in every working group.

Network components that facilitate communication

During Years 1 through 5 of the NISE Network, the NISE Net Leadership team and working groups built a network of science museums and universities that work together to engage the public in learning about nanoscale science, engineering, and technology (St. John, et al., 2009). The NISE Network consists of a number of structural components that were demonstrated to be successful in facilitating connections between partners, fostering professional learning, and encouraging the implementation of informal science learning experiences to engage the public in nano education (Reich, et al., 2011; St. John, et al., 2009). The Network components include the following: NanoDays events and the corresponding kit of materials; regional hub leaders who connect NISE Net partners in each region and the broader Network; the nisenet.org website that provides professionals with information and resources about nano learning; and face-to-face meetings that bring together Network partners, including the Network-wide Meeting, regional and national workshops, and site visits. See Appendix A for an in-depth description of each component that facilitates communication¹.

¹ For the purposes of this report, the structural components of the Network that facilitate communication are referred to as communication “components” or “mechanisms.”

Network Communication Study

Purpose and focus

The communication of ideas and the flow of information are vital to the structure, sustainability, and growth of the NISE Network. Therefore, a study of NISE Net communication not only illuminates how information, ideas, and messages are exchanged, but describes the broader network structures that connect numerous and disparate institutions and individuals to create an interrelated group. In particular, this study examines the extent to which the communication components of the Network are effective at conveying NISE Net information, ideas, and practices within, between, and beyond the three Network tiers.

A study focusing on NISE Net communication was undertaken in the sixth year of the NSF grant because it was anticipated that such a study would not only supply a solid foundation for studying public and professional impacts in the future, but would also provide a deeper understanding of how the Network functions for those who are most engaged. Furthermore, by examining this topic in Year 6, the Network Leadership team would be able to make changes or adjustments to improve communication in the remaining four years of NISE Net. With such intentions, the study was designed to be a developmental evaluation, a method of evaluation used for the purpose of organizational learning and development, as it was to study a structure that was already in place with the intention of improving that structure in the future (Patton, 2002).

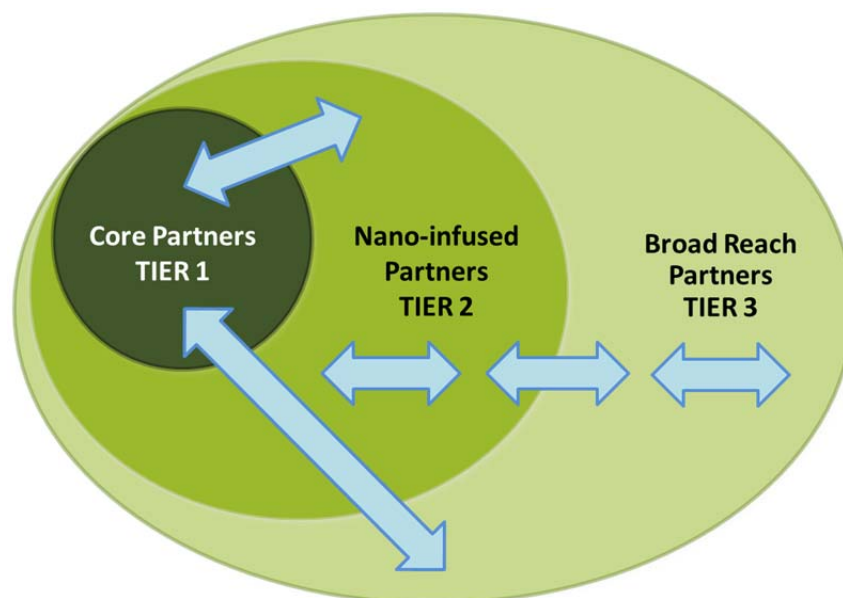


Fig. 1. Communication between and within the Network tiers investigated in the Network Communication Study.

A key assumption of the Network Communication Study is that communication exists within and between the three Network tiers. Figure 1 illustrates the flow of Network communication that was investigated in the study; the arrows in Figure 1 indicate how communication is perceived by the Network to flow within and between each of the three tiers. This study took place in two stages:

1. The first stage of the study focused on the perspective of Tier 1 partners² and investigated the information and messages Tier 1 receives from and shares with the Network, as well as how information and messages are broadcast or received by Tier 1. For this stage of the study, focus groups were conducted with Tier 1 partners.
2. The second stage of the study focused on the perspective of Tier 2 and 3 partners and considered what Network information and messages are shared and disseminated by professionals in these tiers. For this stage of the study, interviews were conducted with Tier 2 and 3 partners who were known to be actively involved in NISE Net activities.

Lessons learned from this study can be used to both improve the ability of the Network communication components to facilitate the exchange of information, ideas, and practices within NISE Net, and to explore whether and how these components could be repurposed to introduce new topics (beyond nano) into the Network.

Cross-institutional study team

The nine evaluators involved in the study represented three different Tier 1 science museums: Museum of Science, Boston, Science Museum of Minnesota, and Oregon Museum of Science and Industry. In addition to the evaluation members, a Network Leadership representative periodically participated in team meetings to ensure that the direction of the study would produce findings that would be of most use to the Network. Due to the geographical distance between the three science museums conducting this study, the evaluation team met weekly via telephone and occasionally enhanced communication during the telephone meetings by utilizing Skype video conferencing and the screen-sharing capabilities of GoToMeeting. As the study advanced, evaluators traveled to the Science Museum of Minnesota for a 2-day, in-person meeting to discuss the nuances of the data and to plan for further data analysis. During the study, evaluators at each institution shared the responsibility for designing focus group and interview protocols, data collection, analysis, and report writing.

² Within the NISE Network, “partner” can refer to both an affiliated organization and the professional within that organization. In this report, “partner” refers to the individual and not the organization.

Methods

This study employs qualitative methods of investigation. Data collection consisted of focus groups with Tier 1 partners and semi-structured interviews with partners from Tiers 2 and 3. This structure allowed for partners in different levels of the Network to share their perceptions of Network communication within and across the tiers. Resulting focus group and interview data were examined to determine what was being communicated, by whom, and through which communication component(s). The team employed methods for enhancing the validity of qualitative research to increase the trustworthiness of the findings (Denzin, 1978; Lincoln & Guba, 1985; Maxwell, 1992).

Focus groups

In late July through early August 2011, the study team conducted 7 focus groups involving a total of 24 Tier 1 partners. Each focus group lasted about 1 hour and typically included three to four participants, one moderator, and one note-taker. Skype group video conferencing was used to involve participants from around the country, as well as audio recording and note-taking to accurately capture the data. A telephone conference line was set up during each focus group in case of technological difficulties with the Skype video conferencing. Moderators used a standardized focus group protocol (see Appendix B) with key discussion questions to ensure that each focus group would be conducted in the same format, thereby resulting in consistent data across focus groups.

Participant recruitment and sampling

All 44 Tier 1 professionals, excluding the 7 members of the Network Leadership group (NEGNOG) and the 13 members of the Evaluation group, were eligible to be included in the study. The decision was made to not include NEGNOG members because they were instrumental in defining the Network components that were to be the focus of the study and also because they collaborated with the Network Communication Study team to form the initial hypothesis of Network communication.

In early July 2011, each focus group moderator emailed her assigned group of Tier 1 members and invited them to participate in the study. Along with the invitation, the recruitment email included a description of the study and asked partners to share their availability for a focus group. If they were interested and available, Tier 1 partners were subsequently sent additional information regarding informed consent. Individuals were asked to respond to the informed consent email and state whether or not they agreed to participate in the focus group and to be audio recorded. If a participant did not give permission to be audio recorded, a note-taker was solely relied upon to capture the conversation. In total, six of the seven focus groups were audio recorded.

Recruitment efforts resulted in seven focus groups of three or four participants each. In total, 12 of the 13 eligible Tier 1 institutions were represented in the focus groups. These Tier 1 institutions included professional organizations, mid and large sized science museums, and universities. Additionally, focus group participants represented all the

NISE Net working groups that were eligible for participation in the study including: Community, Content Steering, Exhibits, Inclusive Audiences, NanoDays, Programs, Research, Research Center- Informal Science Education Partnerships, and Website.³

Description of focus group protocol

The focus group protocol began with an introduction to the study and clarification of some of the terms that would be used throughout the session and may be unfamiliar to partners. Several graphics were also shared over email to further clarify key terms, such as “Network communication” and “NISE Net information, ideas, and practices.” These terms provided a foundation for the study and were referred to repeatedly throughout the focus group protocol. The graphics and full protocol can be found in Appendix B.

The second section of the focus group protocol focused on the type of information that Tier 1 communicates to Tiers 2 and 3. This included information, ideas and practices that Tier 1 partners felt responsible for sharing with the Network and/or felt were being shared successfully. In this section, participants were also asked about challenges they faced when sharing information, ideas, and practices with Tiers 2 and 3.

The following section of the protocol focused on how Tiers 2 and 3 communicate back to Tier 1. Focus group participants were encouraged to share what information, ideas, and practices they already heard from the other tiers, as well as any information they desired to hear but currently did not.

The final section of the protocol addressed the four primary components of Network communication: NanoDays, the nisenet.org website, face-to-face meetings and the regional hub structure. Focus group participants were asked about the information, ideas, and messages that were shared through each component, and to identify the strengths and weaknesses of each component as a tool for communication among tiers. Partners were also asked to identify other methods or activities in the Network that promote communication of NISE Net information, ideas, and practices beyond the four primary communication components. The focus group protocol concluded by asking participants if they had any additional comments regarding communication in the Network. This question was included to ensure that the focus group captured any aspects that had not been previously mentioned.

³ Members of the Evaluation working group were not eligible for participation in this study.

Interviews

During late September and early October of 2011, the study team conducted 39 telephone interviews with Tier 2 and 3 partners. A semi-structured interview protocol, (see Appendix C) based loosely on the focus group protocol, was used. Each interview typically lasted about 1 hour, and most interviews were audio recorded. Recordings were later transcribed in preparation for data analysis.

Participant recruitment and sampling

Interview participants were selected using a purposive informant sampling approach, whereby only those Tier 2 and 3 partners from institutions that were actively involved in the Network were selected to participate in the study. The decision to include only actively engaged Tier 2 and 3 partners was made in order to capture a “best case” depiction of the extent to which the four primary communication components facilitate Network communication. It was assumed that partners who did not actively engage with the Network were likely to not actively communicate with the Network, and therefore, it was unlikely that these partners would provide information that was relevant to the direction and purpose of this study.

For the purposes of this study, professionals in Tier 2 and professionals in Tier 3 who were actively engaged in the NISE Network were considered to be one group of partners, while Tier 1 professionals formed a second group of partners. As previously defined, Tier 2 is comprised of institutions within which Tier 1 seeks to infuse nano, whereas Tier 3 is comprised of institutions that are typically involved in a limited amount of nano outreach. Despite these tier distinctions, for the purposes of the Network Communication Study, Tiers 2 and 3 were examined as one group. This approach was considered sound practice given that only those Tier 2 and 3 professionals who were determined to be actively involved in NISE Net, based on the team’s definition, were selected to participate in the study. Therefore, the combination of these two tiers was based on the assumption that actively involved members (regardless of belonging to Tier 2 or 3) share and receive NISE Net information and messages in a comparable manner and to a similar extent. The grouping of Tiers 2 and 3 is distinct from Tier 1 because Tier 1 professionals are responsible for developing the four primary communication components (NanoDays, face-to-face meetings, regional hubs, and nisenet.org). It is assumed that because Tier 1 created the communication components and is charged with disseminating information and messages to the broader Network, professionals in this tier would engage with the components in a different manner and to a different extent compared to those in Tiers 2 and 3. Because of these similarities and distinctions, Tier 1 formed one study group while the second study group encompassed both Tiers 2 and 3.

Identifying actively involved Tier 2 and 3 partners

The level of a Tier 2 or Tier 3 institution’s involvement in the Network was determined using the following criteria: the institution had hosted or participated in at least 1 NanoDays event in the past 3 years; and someone from the institution had participated in one or more NISE Net professional development offerings, such as a regional meeting, Network-wide meeting, conference workshop, or a partner site visit.

The sample of actively involved institutions was further refined to represent a range of characteristics: institution type (science museum, college/university, and children’s

museum), geographic region, and institution size (small and large).⁴ The resulting sample sought to fairly represent the types and regional locations of institutions that are somewhat or actively involved in NISE Net. The last step in identifying participants for the sample involved evaluators asking regional hub leaders to identify who they believed to be the most actively engaged partner at each institution in their respective regions. To maintain participant confidentiality, evaluators did not indicate to hub leaders which institutions had been included in the study sample.

Interview invitations were sent to the 87 professionals from Tier 2 and Tier 3 institutions selected for participation. If interested in participating and available, the partners were sent additional information for informed consent. Similar to the focus group consent process with Tier 1, interview participants were asked to respond to the informed consent email and state whether or not they agreed to participate in the study and to be audio recorded. If an individual did not wish to be recorded, a note-taker was present during the interview to capture the conversation.

Characteristics of participating institutions and partners

In total, 39 Tier 2 and 3 partners were interviewed, for an overall response rate of 45% (39 of 87). These partners represented the seven geographic regions of NISE Net, with greatest participation from the Midwest region. As illustrated in Table 1, about two-thirds of participants in the sample were Tier 2 partners. In both Tiers 2 and 3 a greater number of science museums and science centers were represented compared to universities. The science museums and science centers in the sample varied according to size, with slightly over half considered small institutions.

Table 1. Characteristics of institutions represented in the interviews.

Institutional Characteristics		Count	%
Network tier	Tier 2	27	69.2
	Tier 3	12	30.8
Type	Museum or science center	28	71.8
	University	11	28.2
Size	Small	22	56.4
	Large	6	15.4
	University	11	28.2

The interview sample of Tier 2 and 3 partners is both similar to and distinct from the rest of the NISE Network. The study sample is similar to the NISE Network because both the study sample and the Network consist of a greater number of science museums and science centers and fewer universities. The study sample is different than the rest of the

⁴ ISE institution size was defined using the criteria defined in the 2007 ASTC Sourcebook.

Network because NISE Net, as a whole, has a smaller percentage of Tier 2 institutions than Tier 3 institutions.⁵ Greater representation of Tier 2 institutions in the study could be a result of respondent attrition. Although evaluators sought to recruit a proportionate number of partners from each tier, it is possible that members of Tier 2 were more inclined to participate in an interview due to higher levels of prior involvement with the Network.

Additionally, interview participants varied in their level of familiarity with NISE Net and the number of years that they had belonged to the Network. About two-thirds of participants had been involved with the Network for 3 or more years, and only 1 participant was very new to the Network having been involved in NISE Net for less than 1 year see (Table 2).

Table 2. Duration of interview respondents' Network involvement.

Duration	Count	%
3-4 years	19	48.7
1-2 years	13	33.3
5 or more years	6	15.4
Less than 1 year	1	2.6
Total	39	100

Most interview participants played multiple roles within their organizations. A number of participants were executive directors, program coordinators, and directors of education and visitor experience. Several participants were developers of outreach programming and university professors. The responsibilities associated with these positions often meant that participants served as the organizer and on-the-floor facilitator for their organization's NanoDays events and other nano-related programming.

Description of interview protocol

To learn about participants' involvement in NISE Net, the interview protocol directed the interviewer to begin by asking participants about their role and experience in the Network, and how they had come to "understand what the Network was all about."

The next section of the interview sought to gather information about the different ideas, messages, and practices that actively engaged Tier 2 and 3 partners hear from Tier 1 and how these partners share back with the Network. Interviewees were also asked if there was anything about NISE Net that they wished they knew about more.

The objective of the last section of the interview protocol was to identify the messages actively involved Tier 2 and 3 partners hear specifically through the Network components: NanoDays, face-to-face meetings, the nisenet.org website, and the regional hub structure. In addition, evaluators asked interviewees what the strengths and

⁵ Network-wide data regarding institution size are not available for comparison.

weaknesses of each particular component were in communicating the messages that the interviewees identified. The interview concluded by asking individuals if there were any other methods or activities that promote communication within the Network that had not yet been discussed. (For the complete interview protocol, see Appendix C.)

Data analysis

The focus groups and interviews were designed to complement each other and capture the communication experience of both Tier 1 partners and actively involved Tier 2 and 3 partners. Evaluators analyzed focus group and interview data separately in order to fully understand each tier's perspective on Network communication. Preliminary findings from the focus group and interview data were then compared and further analysis was conducted to ascertain how the findings from the two groups might complement or contradict each other. Looking carefully across findings from all three tiers, evaluators sought to paint a complete picture of the function and operation of communication in the NISE Network as described by Network partners.

Data analysis overview

Upon completing the focus groups in early August 2011, evaluators examined the seven focus group transcripts and identified emergent themes in the data. These patterns centered on what information, ideas, and practices were being communicated throughout the Network, the direction of the communication (whether between, within, or across tiers), and the components that facilitated the flow of communication. These preliminary focus group findings were referenced to inform the development of the Tier 2 and 3 partner interview protocol.

Further analysis of the focus group data was undertaken during Fall 2011, at which time evaluators analyzed the focus group transcripts using a loosely structured coding scheme that was based on the focus group protocol, and identified and detailed emergent themes and patterns in the data. Evaluators then came together to discuss the themes they had identified and to draft a memo that described the primary focus group findings.

Upon completing and transcribing the 39 interviews, interview responses were coded using a detailed coding scheme and the qualitative analysis software program, NVivo. In contrast to the coding of the focus group data, more detailed coding was employed for the interview data given that the interview data were more nuanced and there was greater variation in participant responses across the 39 interviews than the 7 focus groups. However, the focus of the interview data analysis was similar to that of the focus group analysis and sought to identify the qualitative trends concerning the flow of NISE Net information, ideas, and practices throughout the tiers, and the Network structures that facilitate that flow.

After coding the interviews, evaluators drafted memos for each interview that summarized the primary themes. To further synthesize the information contained in each memo, evaluators completed a grid or table that highlighted the core findings that were associated with the Network communication components and their related set of codes. Together, evaluators reviewed the memos and discussed the study findings that corresponded across the memos, as well as those findings that were unique to individual interviews. Based on the individual interview memos, a comprehensive memo was drafted

that summarized the key interview findings. The comprehensive interview and focus group analysis memos were then compared to identify themes and patterns that complemented or contradicted each other or served to explain study findings.

Enhancing the trustworthiness of study findings

Evaluators took steps to increase the descriptive and interpretive validity and the trustworthiness of the study findings, including member checks and data triangulation.

- **Member checks** (Lincoln & Guba, 1985): To enhance the descriptive validity of the Network Communication Study findings, member checks were performed throughout the course of the evaluation. Member checks are used to obtain feedback from evaluation stakeholders throughout the evaluative process regarding the direction of the study and the accuracy of emerging themes (Maxwell, 1992); a member of the Network Leadership team was invited to participate in team meetings. This individual offered insights about identifying and sampling actively involved Tier 2 and 3 partners and gave feedback throughout the focus group and interview instrument development process to ensure that the instruments would accurately capture partners' perspectives. Evaluators presented preliminary study findings to members of the Network Leadership team in December 2011 and discussed how the findings might inform the current and future direction of the Network. Member checks throughout the evaluation process have ensured that the study report would provide an accurate description and interpretation of communication within the NISE Network.
- **Triangulation of findings across instruments and cases** (Denzin, 1978): Threats to interpretation validity can occur when evaluators attach their biases and beliefs to what they observation (Maxwell, 1992). To enhance interpretation validity, data were collected using two different methods and study findings were identified as consistent trends that were observed across multiple partners who participated in focus groups and interviews. Additionally, data analysis was performed by multiple evaluators who met frequently to review and discuss each other's work.

Study limitations

Data collection method constraints

Data collection methods differed by tier: Tier 1 professionals participated in focus groups while Tier 2 and 3 partners were interviewed individually. It is likely that richer qualitative data were gathered from these Tier 2 and 3 partners due to the nature of the interview format, which provided for a one-on-one conversation between a partner and an evaluator. In comparison, focus groups may have yielded less rich individual Tier 1 partner data. Because focus groups consisted of three or more partners, it is likely that some partners were not able to share all they wanted within the 1 hour duration of each group. Evaluators decided to engage Tier 2 and 3 partners individually rather than in focus groups based on the assumption that the nano education experience of these individuals and their involvement in NISE Net activities varied widely. In contrast, it was assumed that the nano experience and Network involvement of Tier 1 partners varied to a lesser extent. Tier 1 partners receive direct funding from the NSF grant to participate in working groups that are the engine of the Network. Because of the collaborative nature of

Tier 1, it is assumed that Tier 1 partners share similar perspectives regarding communication in NISE Net and experiences communicating with Network partners. Therefore, a focus group format was deemed as an appropriate data collection method for Tier 1. Prior evaluations describing the work of Tiers 1, 2, and 3 illustrate this difference in variability of perspectives and experience (Pattison, et al., 2011; Reich & Goss, 2009; St. John, et al., 2009).

Sampling constraints

Sampling selection was a limitation of this study. Evaluators sought to construct a sample of actively engaged Tier 2 and 3 partners in order to understand the optimal function of Network communication. As outlined above, evaluators identified eligible institutions based on institutional characteristics including type, size, and regional location. However, it was not always possible for evaluators to determine the activity level of partners within eligible institutions by referring to Network records. Therefore, evaluators requested regional hub leaders to identify the most actively involved individual at each institution in their region. Including regional hub leaders in the sampling process increased the trustworthiness of the study findings because it ensured that evaluators drew upon two sources (hub leaders and Network records) to identify eligible individuals. However, because this study included those partners who are active in NISE Net, the study is unable to draw conclusions about the experiences of those partners who are less involved in the Network.

Findings

The findings begin by discussing the communication that happens through each of the four primary communication components (NanoDays, face-to-face meetings, the regional hub structure, and nisenet.org). This is followed by a discussion of the communication that occurs through other avenues as identified by study participants. The findings section concludes by detailing the communication that is desired within the NISE Network. The beginning of each communication component is accompanied by a brief definition. More in-depth component descriptions are included in Appendix A.

Communication that happens through NanoDays

What is NanoDays?

NanoDays is a nationwide festival of educational programs about nanoscale science and engineering and its potential impact on the future.

NanoDays events are organized by NISE Network partner organizations and take place at over 200 science museums, research centers, and universities across the country primarily during a 3-week period each year. A kit of materials and activities, known as the NanoDays kit, is available for free through an application process; over 200 kits are distributed a year to NISE Net partners.

NanoDays says:

You can do nano!

The NanoDays kit makes complex topics like nanotechnology accessible to museum professionals and the public.

Finding 1: The NanoDays kit communicates nano content and messages like “nano is fun” and “anyone can do nano.”

During focus groups with Tier 1 partners and interviews with active Tier 2 and 3 partners, members of all three tiers identified the main messages and ideas they felt were communicated by NanoDays (particularly the NanoDays kit). Comments tended to be similar across tier affiliation. Tier 1 partners, some of whom help to create the kit and many of whom use the kit, suggested that the NanoDays kit is a tool that successfully communicates nano content and messages to Tier 2 and 3 partners. The kit conveys messages like:

- Nano can be fun and exciting.
- Anyone can do nano.
- Nano is all around us.
- NanoDays is a “common cause.”

For example, Tier 1 professionals stated:

I think the kits do a good job of saying nano is not scary. It's all around us. It's just a part of life.

I think the NanoDays kit communicates that nano is do-able and that it's a shared initiative and the fact that you're doing the same thing that 200 other people around the country are all doing is kind of empowering.

...the thing I've seen with the kits is [they communicate] to the partners that this potentially very difficult subject area is easy to do, and fun to do, because so many people tend to look at nano as either difficult or kind of boring. And when they get their hands on a kit or have exposure to the kits, they see that it's something that they don't have to develop themselves; that there's something easy to do. So, it really communicates to them that it's easy to do and it's worth doing—nano in informal science education.

When asked what messages were communicated to them through the NanoDays kit, active Tier 2 and 3 partners echoed many of the messages identified by Tier 1. Nearly half of Tier 2 and 3 partners who were interviewed said that the kit conveyed an empowering message about the accessibility of nano, such as “I’m not a scientist, but I can do nano.” About one-third of actively engaged Tier 2 and 3 partners felt the kit shared nano content “through activities that explain nanoscience.” Furthermore, about half of Tier 2 and 3 partners interviewed mentioned that the NanoDays kit emphasized how to communicate nano to the public and how to conduct a NanoDays event.

[The NanoDays kit] lays out a clear timeline and expectations of me and of the museum for implementing the program and reporting back. It gives lots of great suggestions for how to use each activity and how to put it on the floor.

I think what we take out of it is that it's important to put the nano information out there. It's packaged in a way to make it very easy so that any of our staff can take it out and use it. There's obviously been a lot of thought and preparation put into each one of those little boxes. And we definitely appreciate that because really you just open it and go.

Other messages partners heard from the kit were:

- Nano can have a significant impact on people.
- Nano is an important concept that should be taught to the public.
- Nano is fun.

Finding 2: The NanoDays kit represents the values and professionalism of the Network.

Active partners in all tiers identified the NanoDays kit as a successful representation of the professionalism of NISE Net.

NanoDays says:

Nano is important!

The quality of the NanoDays kit conveys the professionalism of the Network.

Tier 1 partners felt the high quality of the kit materials and activities conveyed that the Network believes nano education is important and worth doing, and that NISE Net is a professional and well-organized network. For example, Tier 1 partners explained:

I think it [the kit] communicates a very well-organized organization. I think it communicates a very well thought-out program structure around the information that we want to convey, whether it's for adults, whether it's for children or families.

I really do think that the NISE Network, regardless of the topic, the way that we structure this Network really comes out in a NanoDays kit. How much effort we put into... even the details that the job the [organizing museum] does, packaging it, looks very professional. And I just can't... it just brings satisfaction to me when I have a member of my hub call me and [they are] just glowing through the phone about how awesome it is. I really think that alone just communicates a tremendous amount about what this network is and what kind of effort we put into building this NanoDays kit.

For about half of Tier 2 and 3 partners who were interviewed, the quality of the kits demonstrated that NISE Net is a professional and trustworthy source of information that respects and values its partners. In describing this, active Tier 2 and 3 partners made comments such as the following:

So, it's kind of an indirect form of communication, but the kits themselves were just very impressively put together and thorough, and it's good quality materials and it's well-researched and obviously tested. ... To me, that communicated a level of professionalism and organization which was impressive.

I think [the kit] shows great respect. I think the care in creating it—all the resources, all the materials, all the activities—show a great deal of respect for us, as people in the field away from the brainchild of the operation.

The approach has been with such respect, and such value of everyone's participation, that it [communications that hosting NanoDays] truly is participation, I feel like they've conveyed a sense that everybody brings value to the effort and to the discussion.

NanoDays says:

Communication and dissemination of information are important!

Through this component the Network both disseminates and gathers information.

Finding 3: NanoDays is used by all tiers as a communication mechanism.

NanoDays is used by Tier 1 as a two-way communication tool in that it is used to disseminate Network information and updates, such as new educational products or how to engage different audiences, to the broader Network while simultaneously gathering information about Network partners, such as the details of their NanoDays events. Responses from active Tier 2 and 3 partners suggest that they recognize this multi-layered communication effort, and they employ NanoDays as a mechanism for communicating to Tier 1 about their nano activities, as

well as to individuals not involved in NISE Net. In addition, NanoDays serves as a starting point for many partners and further engages them in nano education.

I think the way we use the NanoDays kit [is as an entry point. Communication with a partner might go something like this:] 'Hey, come join the Network.' 'Oh, I don't know what you guys are.' 'Look, just get this kit and you'll never look back.'

I think [the NanoDays kit] communicates everything. It has all the information that they need in order to... do the different activities, and in the resource kit, or that please open first booklet, we try to give them a lot of different ideas for practices that they can do, so different ways of how to reach diverse audiences or how to modify their programs.

A key communication aspect of NanoDays takes place in the form of the online NanoDays report.⁶ In focus groups, Tier 1 professionals emphasized that the NanoDays report is the primary way in which they hear from Tiers 2 and 3 and learn about the size, scope, and reach of NanoDays events each year.

We really tend to only get feedback from [Tiers 2 and 3] through the NanoDays report in terms of what they're doing and then we find out, hey they're doing all this great stuff, but we only really find out about it once a year.

I guess probably the most prevalent [feedback we hear about] is what people do for NanoDays. We hear about it from all the usual suspects, as well as people we had no idea were doing NanoDays activities.

Tier 1 professionals use the information and feedback provided by Network partners in the NanoDays report to improve the design of the kit and report back to the National Science Foundation.

In addition, many actively engaged Tier 2 and 3 partners indicated that the NanoDays reporting form was the primary way in which they communicated with and provided feedback to Tier 1.

So far [communication has] primarily been through the reporting for the NanoDays in particular. I usually spend at least a good hour or two writing down my comments and part of that is because I found out from the first year that I did that... the suggestions that I made the following year really made a

⁶ All institutions who receive a NanoDays kit are required to complete the online NanoDays report after hosting their event(s). Although the content and composition of the report has varied over the years, the report currently consists of two sections - a reporting section and a survey section. The reporting section is a required section that captures information related to partners' NanoDays events, including collaborating organizations, the type and number of public audiences reached, and a description of public educational experiences provided. This information is used for reporting purposes related to the oversight and management of grant resources. The survey section of the report is optional and gathers partners' feedback on prospective public educational products and professional resources. This information is used to gauge interest in the products and plan for the development of additional Network resources.

difference about the friendliness of the activity, the kid friendliness... it really showed through.

I try to fill it in with as much detail as possible because I can tell that they're being very conscientious about trying to do a good job disseminating [the kit] and polishing it.

There's always the report that you file at the end [of NanoDays]. I've done that every year. I know we've included pictures so people can see [what we've done], which is always fun. But that's probably the only way I've communicated back from that.

Tier 2 and 3 partners who are active in the Network also use NanoDays events as a mechanism for communication with individuals not involved in NISE Net. About one-third of Tier 2 and 3 partners who were interviewed talked about NanoDays with individuals outside of the NISE Network in order to foster local partnerships and to provide professional development opportunities to teachers. Several partners conducted kit activities in school classrooms, teacher professional development sessions, and community centers. Others gave kit activities to scientists at their local university and posted NanoDays videos on their institution's website.

We shared the NanoDays information with the [local science center].

We've used [NanoDays] to leverage ties with middle and high school teachers and students and even some undergraduate university students.

I put all the activities - pictures, slides, videos - online in a website so people can see what we did and click on the links and see what we had.

Conclusion

NanoDays is a nationwide festival of educational programs about nanoscale science and engineering and its potential impact on the future. A kit of materials and activities is available to NISE Net partners who host a NanoDays event. This study finds that the ease with which the kit activities can be implemented by museum professionals communicates that nanotechnology can be accessible and fun for everyone. Furthermore, the high quality of the kit materials and activities represents the professionalism and values of the Network.

Tier 1 also utilizes NanoDays to collect information from participating partner institutions. Through the online NanoDays reporting form, actively engaged Tier 2 and 3 partners share with Tier 1 the scope and reach of their event and provide feedback on prospective Network activities and professional development resources. For many partners who participated in the study, NanoDays is the primary way in which they communicate across the three tiers and with local partners.

Communication that happens through face-to-face meetings

What are face-to-face meetings?

Face-to-face meetings are organized by Tier 1 partners and facilitate exposure to educational content and networking activities.

NISE Network face-to-face meetings include the Network-wide meeting, regional and national workshops, and partner site visits.

Face-to-face meetings say:

We are here for you!

Through this component Tier 1 welcomes partners and provides information to promote and support nano programming.

Finding 4: Face-to-face meetings principally communicate that NISE Net is a supportive community. Meetings also convey general information such as nano content and implementation strategies for nano programming.

NISE Net partners have the opportunity to meet in-person each year at meetings, workshops, and partner site visits. Through these face-to-face meetings, Tier 1 seeks to express that all partners are valued members of the NISE Network. At meetings Tier 1 also communicates general information about NISE Net and provides Network updates. In addition, meetings provide Tier 1 the opportunity to share ideas and practices related to nanotechnology that are more complex and nuanced.

Helping partners feel they are a part of the Network is a key objective of the face-to-face meetings. As a Tier 1 partner stated, “So we’re using these meetings to communicate nano-specific content, but we’re also building relationships that are building the field.” Tier 1 partners feel that face-to-face meetings not only allow partners to become better acquainted, but also provide a medium for mentoring partners and encouraging deeper commitment to and involvement in nano education. Partner site visits were seen as particularly helpful in that they enabled one-on-one communication between museum professionals and their regional hub leader.

I think the face-to-face meetings help to break down some of the enormity of the Network and of the [nisenet.org] catalog. People can have conversations and meet the actual person so it is no longer just an email address.

I’m really in favor of face-to-face meetings like site visits. Certain questions come up when you see something happen. You can share tricks that you have come up with when you are doing your own thing. Also, you can see their facility and what partners are dealing with.

...the site visits have again, they’ve been a really meaningful way to get to know your partner....you just get so much out of seeing where people are working,

what their physical environment is, their constraints or their capacity for doing NISE Net-related work.

The majority of Tier 2 and 3 partners who were interviewed felt the NISE Net is a supportive network that supports and values its partners. In particular several active Tier 2 and 3 partners felt face-to-face meetings communicated “the Network is a community” and “everyone is welcome:”

[Face-to-face meetings communicate] that we're valued. That... despite my hesitation for sharing, [sharing] is welcome and that people value it.

I was just very honored to be there. And that sent a completely, a very positive message to me. Made me feel good.

I think they [face-to-face meetings] communicate, again, that you are an important partner in this process and that your development is important to us. To us you're worth investing in and to me that's been a really important thing.

In addition to the message of community, face-to-face meetings communicate general information about the Network. Tier 1 partners use meetings to share about NISE Net's current work, as well as its history. As one Tier 1 partner stated, “[Face-to-face meetings communicate] just general information – why is the Network important, why was the Network formed, why are we all working in this field?” Similarly, another Tier 1 partner stated, “I feel like [face-to-face meetings are] also a great way for [partners] to find out what other opportunities NISE Net offers.”

Echoing comments made by Tier 1, about half of Tier 2 and 3 partners who were interviewed said they learned general information about the Network at the meetings, specifically, information about what the Network is and what it does, NISE Net resources and new products, and potential partnerships that they could form.

[Face-to-face meetings] stay in line with what the whole purpose of the NISE Network is: to provide the resources. And the meetings provide different ways of how those resources are being used, or [avenues for] creating future partnerships.

The regional hub meeting was when I really realized all the people that are in the area that I could use as resources as well.

Mostly that the [regional meeting] made us aware of the different opportunities out there. I didn't know you could apply for a new kit every year, I didn't know you could get mini-grants, or details about what people were doing, or what a science café is. These things were all new to me. [The meeting] communicated the available resources.

I think [face-to-face meetings] are the most valuable portion of the whole thing. I mean, while I love the catalog and I love all this other stuff, the face-to-face meetings have been what advanced me the most in the whole process.

Besides general information, Tier 1 frequently seeks to introduce complex nano content and practices through face-to-face meetings. Specifically, Tier 1 partners use face-to-face meetings to instruct Tiers 2 and 3 on how to modify and implement nano programs for diverse audiences and how to integrate nano into existing programming at their institutions. A Tier 1 partner reflected, “Most of the communication I’ve done has been through these site visits... [I communicate] that the activities that are there are meant to be interpreted and not necessarily to be literally used straight as they are.” Another Tier 1 partner spoke of a recent NISE Network workshop saying it invited attendees to, “come and learn [about] our programs and learn why we do what we do and how we create these programs...[the workshop] was around how to deliver a program effectively.”

Interview data from active Tier 2 and 3 partners provide evidence that face-to-face meetings communicate messages beyond general NISE Net information. Nearly a quarter of Tier 2 and 3 partners who were interviewed indicated that they also learned nano content at the meetings. Reflecting on the nano content she had learned, one partner humorously commented, “When I went to my first nano workshop, I had no idea what they were talking about. And now I know enough to make me dangerous.” About a quarter of interviewees also mentioned that at face-to-face meetings they learned about the practice of working collaboratively with other professionals such as researchers, scientists, NISE Net partners, and even evaluators.

[Face-to-face meetings communicate] that there’s value in museums collaborating with folks doing work out in the field and... that the folks in the science world are as interested in outreach opportunities as we are.

I think that it was a valuable thing being at the meeting because it was a blend of people from the education world and from the research world. I think that having a place to have conversations like that is really important.

A number of active Tier 2 and 3 partners also took away from the meetings new ideas for integrating nano into their own institutions and the message that nano can be accessible to both the public and informal science education professionals. Partners learned modifications and implementation strategies to heighten the accessibility of nano, and particularly benefited from learning about the nano-related activities and programs conducted by their peers.

Finding 5: Members of all tiers communicate through face-to-face meetings and view meetings as essential to community-building.

In the majority of Tier 1 focus groups and Tier 2 and 3 interviews, face-to-face meetings were described as an essential communication mechanism that promotes community building within the NISE Network. Members from Tiers 1, 2, and 3 generally enjoy NISE Net meetings and feel they benefit from the gatherings primarily because they provide partners the opportunity to interact with ISE colleagues who are also engaged in nano education. Several Tier 1 partners

Face-to-face meetings say:

You are part of a community!

Through face-to-face meetings the Network builds relationships and promotes deeper involvement in nano education.

identified the advantages that meetings specifically afford Tiers 2 and 3.

I think probably the most effective communication I've seen has been when we've gotten largely Tier 2 partners, but probably some Tier 3 as well, together with each other to share their own experiences because they understand where they're coming from, in terms of what their needs are, and what benefit they've gotten from NISE Net resources.

I think [face-to-face meetings are] maybe empowering them, in a way, building community. That again, there are 300 other people [who are] a part of this network, it's not just the hub leader and a couple other people in the region.

I think that the site visits are really crucial....To have that hub leader come down and kind of feel like, 'Hey, I'm your entryway into the Network and there's a huge network,' and how do you find...who's the right person. It just eases that a little bit, in order for them to find that.

Furthermore, Tier 1 felt that meetings provide opportunities to partners at mid-sized and small institutions for travel and professional development that would not otherwise be available to them. As one Tier 1 partner stated:

...many of the people in the Tier 2 cohort and beyond don't have an opportunity to travel much for professional development whereas most of the Tier 1 partners have a lot of travel – a lot of interaction with others who are thinking about new ways of doing our work. This is a pretty valuable opportunity for many of our Tier 2 partners and that we want them to have it, I think, is an important message that we send through face-to-face meetings.

Interviewed Tier 2 and 3 partners also mentioned using face-to-face meetings as an opportunity to interact with their peers in the Network. Many of the conversations that partners reported having at NISE Net meetings were about implementing NISE Net educational products (particularly the NanoDays kit). One partner spoke of benefiting from seeing what other partners in the Network were doing stating,

...the face-to-face meetings provide a nice opportunity to see what other folks are doing with the same stuff. Because while the programs are out there and, you know, everybody sort of does their own variation on that, so I think that that's a nice message that I take from the face-to-face meetings is the 'feel free to adapt this that best suits your institution,' which I think is important because I think people get tied up in 'here's what the lesson plan says, we have to do it this way.' It's nice to see, 'hey actually if that doesn't work for you, let's talk about a way that might, and here's some other organizations, this is what they're doing.'

For some partners, conversations at face-to-face meetings were often a catalyst for future discussions via phone and email. In interviews, several Tier 2 and 3 partners indicated that they planned to follow up with people they had met at the recent 2011 Regional Meeting about possible partnerships, NISE Net programming, and projects beyond nano. As one partner stated:

Up until that Regional Meeting...we were sending in evaluations and sort of filling out the necessary required forms, but there wasn't a lot of talk about programming going back and forth. It was like you know 'we got the kits, we used the kits, we told them how we used the kits,' and now I feel like I have a...now I have a group of about 20 people that I can email, ask about programming, ask what's working, what's not working, and have a dialog generated.

Several actively engaged Tier 2 and 3 partners used face-to-face meetings as an opportunity to communicate with their regional hub leader or other members of Tier 1. These conversations often provided feedback on activities and the direction of the Network. However, some partners indicated in interviews that they were not aware that face-to-face meetings could be used to give feedback to Tier 1. Rather, they viewed the meetings as a forum through which they unilaterally received information from Tier 1. A few partners expressed that they hesitated to give feedback at face-to-face meetings because it might jeopardize their access to Network resources.

People aren't going to rush off and say they're not using one of the dozen activities. [Because] it would make them look bad or put them in a position not to be accepted for the physical kits the following year.... I understand why people don't talk about what didn't work. I wish they did, but I understand why they don't.

Conclusion

Organized and hosted by Tier 1, face-to-face meetings offer Tiers 2 and 3 the chance to interact with Network partners in-person. Through face-to-face meetings, Tier 1 partners share general information about NISE Net, give Network updates, and provide focused training around complex topics such as integrating nano into existing museum programming and educating diverse audiences about nanotechnology.

At meetings, actively involved Tier 2 and 3 partners learn nano content, gather information about the Network, and learn from their peers about implementing and integrating nano programming at their institution. Active Tier 2 and 3 partners particularly benefit from face-to-face meetings as meetings afford mid-sized and small museums the opportunity to travel and receive professional development, which might not otherwise be available to them.

Findings from this study indicate that meetings foster communication across all three Network tiers. Partners who are actively involved in the Network view face-to-face meetings as an essential part of NISE Net that fosters community building and conveys to partners that they are valued and supported.

Although many of the Tier 2 and 3 partners who were interviewed indicated that they use meetings to share with each other, few partners viewed the meetings as an opportunity to provide feedback to Tier 1. Some active Tier 2 and 3 partners hesitated to give feedback at meetings feeling it could affect their chance to receive further resources from the Network.

Communication that happens through the regional hub structure

What is the regional hub structure?

The NISE Network community of partners within the United States is organized around seven geographically defined "regional hubs." Each region is overseen by a hub leader who is in regular contact with his or her regional partners. Regional hub leaders provide general information about the Network, update their partners about available Network resources, help institutions establish local partnerships, and conduct face-to-face meetings and partner site visits in their region. Hub leaders generally meet weekly via telephone to plan and coordinate outreach to Tiers 2 and 3.

Regional hub structure says:

We are your go-to resource!

Through this component hub leaders provide personalized support and information to the broader Network.

Finding 6: The regional hub structure connects Network tiers and is essential for communicating Network information, updates, and providing ongoing support.

The regional hub structure with its seven hubs and hub leaders was designed to be "the face of the Network to Tier 2 and 3 partners," as described by one Tier 1 partner. Through the regional hub structure, Tier 1 disseminates information about the Network and its initiatives, directs partners to NISE Net resources, and ensures that Tiers 2 and 3 have a personal Network contact. Several regional hub leaders, all in separate focus groups, described the responsibilities of their position and the information they share with Tier 2 and 3 professionals.

As a community hub leader I feel like I am responsible for communicating a lot of information about both the purpose and output of the Network to the Tier 2 partners. So, everything from what is nano, why should we be doing it, but then, you know, what does the network do, how it can support you, what are the resources the network has developed, all of that information. I feel like I'm the conduit for the Tier 2 partners.

It's also questions, you know, "I can't find this on the website can you help me get it?" Or "we're interested in doing this kind of program, what would be a good lead for it?" Often it is that "I need... I need Tiny Teacups, where can I get them?" or mundane stuff like that.

I kind of feel like I have to communicate on many different levels with [Tier 2 and 3 partners], whether it's NanoDays, whether it's issues they have with the kit or resources that they want, ideas or programming, how the Network can help them, what types of programs we have, how can they get their programs into our NanoDays kits, really just being a voice for almost everything in the Network.

Indeed, regional hub leaders serve as a main conduit between Tier 1 and the broader Network. This is acknowledged not only by hub leaders, but also by other members of Tier 1. As one Tier 1 professional stated, “I think really anytime we have sort of an important idea that we as a Network want to make sure gets to the right people, that’s going to get a response, really [that] happens through that [regional hub] structure.” Similarly, another Tier 1 partner commented, “Regional hub leaders are the public face of NISE Net. They man booths for NISE Net at conferences. You can pick up the phone and call them with questions.”

In interviews, Tier 2 and 3 partners echoed many of the messages that Tier 1 partners felt the regional hub structure communicated. About half of actively engaged Tier 2 and 3 partners heard general information about Network activities (upcoming meetings, conferences, workshops) and resources (mini-grants, NanoDays kits, mini-exhibitions) from their regional hub leader. Many Tier 2 and 3 partners who were interviewed praised their hub leaders for the support and resources they offered them.

[He] just does a good job as a regional rep. He communicates what our hub does. He always tells us when the kits are ready....he was the one who sent out the information when the mini grants were ready. He’s always there with information, either an email or something like that.

I know I don’t have to wait until the next meeting. I know that I can call [my regional hub leader].

When we attended the meeting last week in [city], I have to say [regional hub leader] did an amazing job with that workshop. She really did and I told her I think that was one of the best ones that we ever attended.

Finding 7: The regional hub structure fosters community at the regional level.

In addition to disseminating information, Tier 1 professionals felt that the regional hub structure facilitates local connections and partnerships and cultivates a sense of community that helps Tiers 2 and 3 feel part of the Network.

...the hub structure is really good at making connections and again breaking down the enormity of the Network.

It’s easy. You introduce two people. It’s an email. You give them a call. You say, hey, Dr. X lives in your area and I talked to him or her and they’d love to work with you. You send an email introducing them and then you have a collaboration. It’s great.

[The regional hub structure offers] encouragement. Partnership. They pair people up. And the third thing is putting them in touch with the right people—they act as a bridge.

Regional hub structure says:

You are also part of a local community!

Through this component hub leaders help partners build local connections and relationships.

Actively involved Tier 2 and 3 partners also felt that the regional hub structure not only provided them with information about the Network, but fostered community building among partners and broadcast messages like, “we’re part of a whole” and “we’re in this together.” Along with a sense of community, the majority of Tier 2 and 3 partners who were interviewed felt the hub structure, particularly the hub leader, communicated to them that the Network values, supports, and cares about them.

[The regional hub structure communicates] that they love us and feel we’re valid and that they couldn’t be who they are without us doing what we do. And that is very uplifting.

It is a really important way of finding out ‘hey, yeah we do want to hear from you.’ It is a reminder that there are resources right in our own community. It eases that path for participation. Again, coming from a smaller museum, it makes it a lot more accessible rather than calling somebody up from the [large science center], not that [regional hub institution] is any less of a museum, but they have reached out to us personally because they are our hub. It definitely creates a sense that there is a commitment to everyone in the network.

It [the regional hub structure] gives me a personal person to talk to, it gives me somebody that I have a name for, who I know knows me. It’s not like some person way off that I’m never going to meet and is talking to several thousand people. I have a representative who’s probably in contact with a couple dozen to a couple hundred people, I’m guessing, I’m not really sure. But he knows who I am, he knows me by name, he may remember a couple of things about me and my particular situation and it’s a personal connection I guess, again.

Regional hub structure says:

Please contact us!

Although the regional hub structure is designed to be a conduit of communication across the tiers, only a few Tier 2 and 3 partners actively communicate with their hub leader.

Finding 8: While regional hub leaders are frequently in contact with their partners, only some Tier 2 and 3 professionals initiate communication with their hub leader.

Although regional hub leaders are the primary communication link between Tier 1 and Tiers 2 and 3, just a quarter of Tier 2 and 3 partners who were interviewed indicated active communication with regional hub leaders that went beyond interacting at face-to-face meetings and completing the NanoDays report. In other words, apart from in-person meetings and submitting their NanoDays report, many actively engaged Tier 2 and 3 partners do not contact their hub leader directly. Rather, most partners receive Network updates and information from their hub leader, but they do not respond or otherwise initiate communication with their hub leader. This finding is particularly surprising given that Tier 2 and 3 partners were purposefully sampled from those institutions that were identified as “actively involved” in the Network and would therefore be assumed to have higher levels of communication with their hub leader.

Partners who did initiate communication with their hub leader shared questions, feedback on activities, requests for additional resources and partnership support, and updates on nano-related activities they were conducting at their institution.

So anytime I have a question or I need support for something or I don't know, I always go through [the hub leader]. So I've never really tried to directly contact the Network without going to [the hub leader].

I know I can contact [regional hub leader] or anyone in the Network with questions and someone gets back to me or there are programs that I can pull. So in that respect, I think it's one of the most supportive networks that I've seen.

I had trouble accessing the website with the catalog for a really long time. So through my hub manager and people in [my region], I would ask them questions or when I found that I needed something, I would email and they would go, "Well did you know this or that?"

When I did the mini-grant I called other people to say, "Hey! We're thinking about doing this mini-grant." So I said to [my hub leader], "Hey, can I come over and look at your cart?" And so I would talk with her and I would share with her my ideas and she would give me feedback on what she thought of my ideas.

Conclusion

The NISE Net is divided into seven geographically defined "regional hubs" that are overseen by a hub leader. This study finds the regional hub structure to be a primary communication mechanism that links the three tiers and provides Tier 2 and 3 professionals with a personal Tier 1 Network contact. Through the hub structure, hub leaders share Network information and updates, direct partners toward NISE Net resources, answer questions, and promote the formation of local partnerships, thereby cultivating a sense of regional community.

In turn, Tiers 2 and 3 partners who are actively involved in the Network receive a significant amount of information from their regional hub leader. Interviewed partners in Tier 2 and 3 feel that their hub leader is supportive and responsive to their needs and interests.

Beyond interacting with hub leaders at regional meetings and submitting the NanoDays report, few Tier 2 and 3 partners in the study sample actively sought to communicate with their hub leader. Rather, most partners received Network updates and information from their hub leader, but they did not respond to this communication or otherwise initiate communication with their hub leader. Those partners who did communicate with their hub leader shared their questions, feedback, requests for resources and additional supports, and updates about their institution's nano programming.

Communication that happens through the nisenet.org website

What is nisenet.org?

The NISE Network website (nisenet.org) provides educational resources and tools to NISE Net members (and to anyone who chooses to visit the website) that can be downloaded free of charge.

nisenet.org says:

You can do MORE nano!

Through the website, Tier 1 conveys the abundance of NISE Net resources.

Finding 9: Despite Tier 1 partners' concern that the website can be an information overload, Tiers 2 and 3 feel the website successfully communicates the extent of NISE Net resources.

The nisenet.org website communicates the extent of the Network's resources, including educational products and community efforts. Although Tier 1 perceived this component to be potentially difficult to navigate, actively involved Tier 2 and 3 partners continue to access the website and appreciated having an online resource.

Tier 1 partners viewed the nisenet.org website as a mechanism that describes the Network and communicates the multiplicity of NISE Net activities, products, and resources, and the number of individuals and institutions that are part of the Network. In separate focus groups, Tier 1 partners stated:

The website seems to be the most useful thing around [that gives you] access to the activities and content....

I do think the website communicates well about who we are.

Oh, I totally agree with that. You know, 'cause if you look at the website now, the first thing you see is 'community,' you see 'network,' you see 'catalog.' It clearly communicates, 'that's what this website's for.'

When asked in interviews what the website communicated to them, nearly all active Tier 2 and 3 partners who had visited nisenet.org mentioned the resources, activities, implementation ideas, and Network information and updates. About a quarter of partners who were interviewed indicated that the website conveyed nano content, and a few partners mentioned that nisenet.org communicated the messages that "NISE Net is a community" and "the Network is there to help."

Well, [the website communicates] things about the next kit, about the next meeting, updates... the resources that are available, there's that one part you can order things, there's almost like a catalog, too. I guess it's a portal for resources. That's how I see it.

They try to make [the activities] as accessible as possible so that whatever your comfort level was with nano, we've got something for you. If you need to see someone do a demo before you feel comfortable doing it, then that video is

probably up there of somebody doing the demo. The fact that you've got that comfort level that all or most of the activities that are up there have been reviewed by scientists, have been reviewed by other educators, and you've kind of got that comfort level that somebody's already tested this out and I can pull it out and feel pretty good about it and if I'm really curious I can actually go in and read what the reviews have said and what changes folks have made. And the message is once again, "here's nano and it's approachable and anybody can do it in their institution."

Well, I think [the website] communicates several things. It communicates the amount of members, the whole community that's engaged. It provides all the educational material that I think that you would need to get started and it provides a foundation for you to engage other departments.

The massive amount of information on the website was perceived by Tier 1 partners to be both a strength and a challenge. While Tier 1 partners felt that nisenet.org conveyed to website visitors the scope of the Network and that "there's a community," Tier 1 partners worried that the amount of information on the website made it difficult for visitors to find what they were seeking. Several Tier 1 partners expressed concern that website visitors were likely overwhelmed by the breadth of the content and as a result, the website was being underutilized. Although Tier 1 partners generally agreed that the website could be improved, most partners also felt that it was an effective mechanism for communicating to Tiers 2 and 3. For instance, one partner stated, "Yes, it's a little tricky to navigate and find exactly what you want, but it's a *really* nice way to communicate to partners the extent of the Network, and sort of the largeness of this project in a very clear way...."

Despite Tier 1 partners' concern that the website was challenging for visitors to navigate, only 2 of the 39 Tier 2 and 3 partners interviewed indicated that they had difficulty finding the information they were seeking on the website, and several partners were enthusiastic about nisenet.org.

I love the website. It's very user friendly. It's easy not just for myself to use, but I can send staff onto the website to look something up and they can flip through it very easily. It's very nice.

It's got a lot of depth to it in the sense of... it has lots of, you know, it's got pictures, it's got evaluations, it's got the guide, it's got videos, it's.... So, you know, it's communicating, 'hey, this is a one-stop-shop place for you to come for everything you need.'

I think that the strength [of the website] is just the volume of information that's available. You know, from the videos to downloading the file that you need for the thing or reading helpful hints that other people have used on there. I mean it's just an incredible tool that gosh... it's great!

Furthermore, in regards to Tier 1 partners' concern that the website was underutilized, out of the 39 Tier 2 and 3 partners who were interviewed, just 1 individual had never visited nisenet.org while 6 partners said they visited the site infrequently. In contrast, 30 Tier 2 and 3 partners who were interviewed said they visited nisenet.org regularly or were familiar with the website.

Finding 10: The nisenet.org website is managed and populated with content from Tier 1. Active Tier 2 and 3 partners receive this content, but rarely use the website to communicate back.

The nisenet.org website is a mechanism that communicates information in a unilateral direction - Tier 1 outward to the other tiers.⁷ In interviews, few Tier 2 and 3 professionals indicated that they updated their nisenet.org personal profile, accessed the website to connect to other Network partners, or shared the website with individuals not involved with NISE Net. In general, actively engaged Tier 2 and 3 partners view the website as a repository of information and resources and not a mechanism through which they can communicate with the Network.

nisenet.org says:

Here is a wealth of Network information and resources!

Through this component Tier 1 disseminates Network information outward.

Conclusion

The nisenet.org website offers both NISE Net and non NISE Net affiliated individuals a wealth of education resources and tools related to nano education. Despite Tier 1 partners' concerns that the breadth of information on the website makes it difficult for website visitors to navigate through the site, nearly all Tier 2 and 3 partners who were interviewed were familiar with nisenet.org and felt that it was an effective mechanism through which to receive information from Tier 1. However, the unilateral direction of communication contributed to actively engaged Tier 2 and 3 professionals feeling that the website was a repository of information and not a mechanism through which they could communicate with the Network.

⁷ Although the website features a commenting function whereby partners can comment on NISE Net products, resources, and activities, only a few partners have made use of this function. Website visitors can also post comments to the NISE Network Blog, but such posts rarely occur.

Communication that happens through other components beyond the four primary components

Other communication mechanisms

The Nano Bite: A NISE Network e-newsletter is sent to partners monthly. It often includes information about upcoming deadlines regarding Network resources such as applications and reporting for NanoDays kits, mini-grants, or the mini-exhibition; links to recently uploaded resources on nisenet.org; partner highlights; nano-related news articles; and a nano haiku.

Social Networking: The Network uses various social networking sites such as Facebook, LinkedIn, and Twitter.

The Nano Bite and social networking sites say:

We have some interesting and timely information for you!

Through this component Tier 1 keeps in touch with partners and provides timely updates.

Finding 11: The Nano Bite newsletter communicates general information to members of all tiers while social networking is utilized by only some partners.

Beyond the four primary components of communication in NISE Net (NanoDays, face-to-face meetings, the regional hub structure, and the nisenet.org website) the Nano Bite e-newsletter, as well as social networking sites, connect some partners to the Network.

When asked to identify additional communication mechanisms that NISE Net utilized beyond the four primary components, unprompted, Tier 1 partners mentioned the Nano Bite newsletter. In focus groups, Tier 1 professionals explained that the newsletter, emailed to all NISE Net partners at the beginning of every month, is a format that is used to share Network updates and highlight the work of select Tier 2 and 3 partners. Several Tier 1 partners felt the Nano Bite was successful in reaching a broad number of NISE Net professionals.

[The Nano Bite] let's people know that stuff is happening, that there's new stuff going on, that people are doing stuff and that the Network is active and I think that's a really important message.

It's a way for [Network partners] to be, a very passive way for them to be, a part of the Network and at the very least, hopefully, they're at least skimming through some of the messages that we're trying to put out there.

I think the Nano Bite is probably critical to getting [partners] to visit the website.

[The Nano Bite] is not spam. It seems to be getting the important messages across to folks; at least they seem to enjoy it.

About a quarter of Tier 2 and 3 partners who were interviewed indicated that they received general information and Network updates from the Nano Bite newsletter. Those Tier 2 and 3 partners who mentioned the Nano Bite reported hearing about general Network updates such as what is new in the catalog or the application or reporting deadlines for Network resources like mini-grants and NanoDays kits. Tier 2 and 3 partners who were interviewed also mentioned that the Nano Bite relayed the idea that certain practices were being encouraged by NISE Net such as educating the public on the societal and ethical implications of nano, working with diverse audiences, and partnering with scientists and researchers.

So there's the Nano Bite newsletter that comes out monthly, and so that helps me like find out what's new on the website.

The Nano Bite is a good reminder, a good way of communicating. I mean for me, one of the kind of few ways that I'm regularly interacting with is just reading, you know, it's not me giving feedback, it's me seeing that.

That's been pretty valuable as well and some of those hacks it seems like I recall seeing those in the Nano Bites that come out. You know, 'Hey, someone did this with this program you may want to check it out,' and so that's been pretty valuable as well.

I've seen it in the Nano Bites...that we should be looking for and making research partners.

Unprompted during interviews, a few Tier 2 and 3 partners mentioned learning about NISE Net and receiving Network updates through social networking offerings such as the NISE Net Facebook and LinkedIn groups and via Twitter. Some Tier 1 partners are interested in expanding social networking efforts to communicate with a greater number of partners. For example, Tier 1 partners stated during separate focus groups:

I think another really cool way to [communicate with Tier 2 and 3], kind of like with the Nano Bite, the newsletter, is through the Facebook page that we have. I know that we do have a Facebook page and we do put stuff on it, but I think it would be great to have all of our partners 'like' the page and just get updates from us through there. It would probably also be cool to have them post some of the things that they're doing on the page, so that they're sharing their ideas with us and with the other partners as well.

It is really exciting to hear [other focus group participant] talk about the plans for pushing the social networking further and further. In part because I am wondering if eventually that could turn into Tier 3 talking more to us. We get that at conferences and use the Annual Meeting as an example of that. But also when we present at ASTC and Association of Children's Museums, for the rest of the conference I have people coming up to me and talking about NISE Net and [it would be good] if there were ways for pushing that through social media.

Actively involved Tier 2 and 3 partners also mentioned social networking sites, but saw them as a way to gain instead of contribute information. The few Tier 2 and 3 partners who did access Network information and updates through social networking sites usually did not use these mechanisms to communicate back to Tier 1 or to individuals outside of the NISE Network. Partners identified several reasons why they did not communicate through social networking, including lack of technical know-how, preference for communicating in-person, and limited time. As one partner explained, "...I haven't broadcast a message or Facebooked anybody or Twittered. I haven't done anything like that. It's just been mainly through the meetings. Because that's when I'm thinking about it too. Once the event is over and I'm kind of, I'm on two bazillion other things." Similarly, another partner described her reluctance to use social networking sites, "I am the generation that really doesn't appreciate Facebook particularly, so I don't do this every day, I don't go look. But you know, it might be a couple times a month, something will strike me and I'll go read it." However, another Tier 2 partner stated her appreciation for ongoing written communication saying, "I learn better just through the web and kind of looking at information that way; through the written. The written really is helpful to me."

Conclusion

When asked whether there were additional communication mechanisms that NISE Net employed beyond the four primary components, in focus groups and interviews Tier 1, 2, and 3 professionals voluntarily referenced the Nano Bite newsletter and social networking groups with reasonable frequency. Through the Nano Bite, Tier 1 shares NISE Net updates, reinforces Network practices, and highlights the nano work of selected partners.

Tier 1 also employs social networking groups to reach out to professionals in Tiers 2 and 3. However, in interviews only a few actively engaged Tier 2 and 3 partners indicated that they participate in NISE Net social networking due to lack of technical know-how, time, and a preference for in-person communication.

Network communication that is desired

*Tier 1 partners
want to know:*

*How do I convey
challenging
content?*

Finding 12: Tier 1 partners find some NISE Net information and content challenging to communicate to Tier 2 and 3 partners.

NISE Net is a national network that aims to communicate nano-related content and education practices that can be difficult to share. When asked what information, ideas, or practices are challenging to convey to Tier 2 and 3 partners, Tier 1 identified several practices that they not only find difficult to communicate, but that the ISE field struggles with as well. These practices include educating

the public about the societal and ethical implications of nano and training ISE professionals on how to reach underserved and underrepresented public audiences. For example, Tier 1 partners stated:

I guess it's the SEI stuff, the societal and ethical implication stuff... I think it's a bigger question that the field is struggling with.

What kind of information can we provide to the other partners to get them to feel comfortable with reaching out to diverse audiences?

Although Tier 1 seeks to convey challenging Network practices primarily through face-to-face meetings, in the interviews hardly any Tier 2 and 3 partners mentioned hearing about these practices. It is particularly surprising that only a few partners mentioned that the meetings communicated the societal and ethical implications of nano, given that this topic was a primary focus of the 2011 Regional Meeting and 21 of the 39 Tier 2 and 3 partners interviewed had attended one to three weeks prior to their interview.

Tier 1 partners also mentioned the difficulty they experienced in describing the organization of the NISE Network, and indicated that they struggled to communicate some of the more general information about the Network and its resources.

[It is challenging to communicate] how NISE Net works. Like how the products really get put together and the relationships between the groups... I feel that's always a piece that is a little bit missing, and I think it's super interesting about the project and might even be more interesting to Tier 2 and Tier 3 partners in addition to the content. This project, it's not just about nano, but it's also really a sort of grand experiment. I don't know that we've talked about that enough and that they are part of this pretty groundbreaking experience or experiment for the field.

I wish we had a better way of highlighting not only new programs, but old programs that more people should be utilizing.

Similarly, partners in Tiers 2 and 3 who were interviewed desired more general information about NISE Net, including information about exhibits, what the Network needs from Tier 2 and 3 partners, how they can become more involved in NISE Net, and a

list of institutions in the Network organized by type. Some Tier 2 and 3 partners were also interested in learning about the overall results from the NanoDays reports that they filled out each year. Although the results from the NanoDays reports are made available on the nisenet.org website, it is evident that a number of partners are unaware of their location. Several partners suggested that the Network send out email updates that would alert them about partnership and funding opportunities and when new products and resources were available.

I wish I knew more about the [NanoDays] evaluation, like what they're finding out is more effective.... I've never heard them talk directly about the data that's being collected.

It would be great to be able to have a list of some different grants to go for in the science educational outreach area.

I would just like to have more email, even if it's just notices of new things coming out of whatever the national network is as well...maybe give me a menu of things to sign up for.

Finding 13: Active members of all tiers wish to know more about the nano educational activities happening throughout the year at NISE Net institutions.

During both focus groups and interviews, partners were asked if there was anything they wished was communicated more throughout the Network. Individuals mentioned both areas they were interested in hearing more about as well as information they were interested in sharing. Across tier affiliation, partners strongly desired to know more about the nano educational activities happening throughout the year in organizations other than their own. Actively engaged Tier 2 and 3 partners were also interested in sharing more about the nano activities they carried out at their own institutions throughout the year.

Network partners want to know:

How are Network products being implemented?

In focus groups, many Tier 1 partners indicated an interest in knowing which nano educational activities members of Tiers 2 and 3 were implementing during the year other than the NanoDays kit. Although the nisenet.org website has a feature that highlights the Network products that are most frequently downloaded, it is apparent that a number of Tier 1 professionals do not use or know that this feature exists.

I wish we could get some statistics about what are the most used activities in the catalog. We keep adding more and more to that, but there's never, at least to my knowledge, there has never been any indication as to what types of activities end up getting used the most.

I'd also like to see how people are integrating the NISE Net programs into their overall programming....

I would love to be able to know or gauge partners' interest... have we created things that they really want to use?

When asked what information about NISE Net's products, work, or operations they wished the Network shared more with them, actively engaged Tier 2 and 3 partners most frequently expressed interest in learning new ways to implement NISE Net products, particularly NanoDays programming. Partners wanted to hear how other institutions in the Network modified, adapted, or "hacked" activities, especially for children, family, and adult audiences. Interviewed Tier 2 and 3 partners also wanted to know how other institutions might be integrating nano beyond the yearly NanoDays events and activities, and how to put NanoDays components together to create a more coherent message about nanotechnology and its significance.

Sampled Tier 2 and 3 partners not only wanted to hear more from the Network, but they also wanted to share more with other NISE Net institutions. Partners most frequently expressed a desire to communicate their own implementation ideas, activities, and program modifications to the Network. Some partners had even developed nano-related activities at their institution that they wanted to share with others.

I wish we could visit each other's NanoDays.... I wish somebody would come to ours and tell me what they liked or what they didn't like and help me think of ideas of what could we add....

One of the things that would be helpful for me, and I'm sure for other people, is to sort of have people's experiences with these NanoDays kits and these activities somehow recorded. So that they might say, "Well you know, this was really great, but we tweaked it this way or you might want to think about doing it another way."

When active Tier 2 and 3 partners were asked what prevented them from sharing ideas, feedback, and activities with the Network, many cited that they were not sure if there was a mechanism in place to share with other partners. Some professionals also identified several personal challenges to sharing, such as a lack of time and uncertainty whether the information they have to share would be valuable or interesting to others in the Network. Several partners indicated that although they had developed nano-related activities that they used at their own institution, they hesitated to share them with the Network because the content could be inaccurate:

We've come up with a few nano activities that we do. But I'll be honest with you, because we came up with them we're a little hesitant to share them because we're afraid we're not doing the science right... I'll be honest with you, I get intimidated about trying to share that with you guys because I'm afraid I will be completely wrong.

Network partners want to know:

How can we communicate more?

Finding 14: Members of all tiers identified challenges related to current structures that restrict greater Network-wide communication.

In reflecting on their communication efforts over the years, members of Tiers 1, 2, and 3 described several challenges to greater Network-wide communication. Tier 1, including regional hub leaders and non-regional hub leaders, highlighted the constraints of the existing regional hub structure as well as other limiting aspects of communication within Tier 1. Tier 2 and 3 partners who were interviewed indicated that they perceived there was not a mechanism in place for them to share and receive more nano ideas, activities, and feedback with partners in their tier, as well as the broader Network.

Focus group data suggest that there are several structural and contextual challenges to sharing information with and about Tiers 2 and 3. The primary structural limitation that was cited by Tier 1 partners was the perception that the regional leaders are the main conduit for communication with the other tiers. While this regional hub structure ensures that Tier 2 and 3 partners have a knowledgeable and supportive Network contact, some Tier 1 partners feel that this structure constrains the amount of information they receive about and from Tiers 2 and 3. In general, partners expressed that they would benefit from more “within Tier 1 communication” so that more individuals in Tier 1 could hear the activities or concerns of Tiers 2 and 3.

I think perhaps one of the challenges that we continue to work through within Tier 1 is to how to connect some of the working groups with the regional hub leaders. This is so that there is better two-way communication both in terms of better understanding what the needs are of the hubs that are working with the Tier 2 and Tier 3 partners and then how do we best get out information to them. I think we've been doing it somewhat ad hoc and working on building structures, but there's room for improvement there.

Regional hub leaders and the other folks in the Community group say, 'Oh, you know our partners are doing great stuff!' Well great, but how do we capture that?

When I told [Tier 1 partner] that one of my members in [my] region was doing one of the nano plays, they were super excited. [I thought], 'Well, I wonder how we could get her that type of information or how [Tier 1 partners] can find out if these people are using these plays.'

I think the hub leaders are an underutilized source of information and leadership for Tier 1, and I feel like they should always be front and center and frankly always leading conversations and that sort of thing... I'd rather be getting regular communication from them or having them stand up in the front of the room and talk to me.

A contextual limitation to communication announced during focus groups was the perception of Tier 1 partners that it was not part of their role in NISE Net to communicate

outward to Tiers 2 and 3. During focus groups, a number of Tier 1 partners said they did not communicate with Tiers 2 and 3 and deferred to the regional hub leaders to answer questions about Tier 2 and 3 partner communication. For instance, when asked what NISE Net information, ideas, and practices Tier 1 typically hears from Tiers 2 and 3, one partner responded, “I will let the other two people answer that, they are regional people.” Her colleague in the same focus group similarly responded, “I don’t actually work directly with our partners, [hub leader] is our regional coordinator, so I don’t hear a lot of the questions that get asked.” Another Tier 1 partner anticipated attending a Regional Meeting saying, “So there I actually get *direct* contact with partners. Normally from where I sit, I don’t have that direct contact with them.”

Hub leaders who participated in focus groups highlighted the challenges of their role. Some hub leaders cited difficulty communicating within the Network due to the considerable size of NISE Net. Some hub leaders expressed a desire to direct questions they received from Tier 2 and 3 partners to other Tier 1 professionals who have expertise in various areas. For instance, Tier 1 partners stated:

I think where it begins to fall apart a little bit... it's a little more difficult because we sort of set up these... not barriers, but these individuals [hub leaders]. It does sort of limit the way that I think partners communicate and dialog with the rest of the Network. But I do have to say overall, I think it would be challenging not to have a point of contact. The Network is so large and there's so many pieces that you need to have someone you can call....

Overall, I think the avenues of communication are fairly open. It would be nice to have partners be asking to talk to other people in the Network. There's a little bit of the 'everything has to go through the hub' thing.

I'm wondering about when someone has a question about overall NISE Network strategies and why we're doing what we do, if, in being the hub leader, if I have that correct information. So, is that chain from NEGNOG coming down successfully through the partners so that they can be that voice of the Network? I just recently had [a call] from [institution] about why we did something the way we did and they totally disagreed with it. So, the information that they received at the Network-wide Meeting was very contradictory to what was being said now by the NISE Network... But I wonder if there's a lack of communication between NEGNOG and the rest of the group....

In addition to the issues highlighted by Tier 1 partners, active members of Tiers 2 and 3 also identified several structural limitations to communicating ideas and activities. A number of Tier 2 and 3 partners who were interviewed expressed that except for face-to-face meetings, the Network did not provide partners with a mechanism through which they could share their ideas and activities. Active partners in Tiers 2 and 3 suggested that nisenet.org could provide a space to upload activities,⁸ and that Facebook and partner site

⁸ From these suggestions it is apparent that a number of partners are unaware that they can submit educational resources to the nisenet.org catalog where the resources are reviewed for accuracy by Tier 1 professionals before being made available to the public.

visits could be utilized to communicate implementation ideas and to solicit feedback on what they had created. Expressing a desire to share nano activities she had developed, but not knowing how, one partner explained:

Yes, I'd totally want to share those [activities]. I didn't do it because there wasn't a place on the [NanoDays] report that asked me to or allowed me to upload materials. I got really busy and didn't have time to go looking on the website for another way to upload them... if it didn't come out and be really obvious. I didn't have time to go seek it out and find a way to share the materials, so I didn't. It ended up being a low priority, but I imagine it's something they might want.

Conclusion

Network partners from all tiers expressed a wish to know more about the nano educational activities that took place at other NISE Net institutions throughout the year. In particular, Tier 1 partners desired to learn what activities and resources Tier 2 and 3 partners used frequently and what additional resources or supports partners in these tiers might need. In turn, Tier 2 and 3 professionals who were interviewed wished to learn how their Network colleagues were implementing NISE Net activities at their own institutions, and some partners expressed a desire to share with the Network the nano activities they had developed. However, Tier 2 and 3 partners did not perceive that there was a mechanism through which they could share their own activities and receive partner feedback.

Members in all tiers who participated in the study identified structural and contextual issues that limited greater communication in the NISE Network. The regional hub structure was identified as a Network structure that is essential to communication, but one that can restrict the amount of information from Tiers 2 and 3 that is shared with all Tier 1 partners. While regional hub leaders offer Tier 2 and 3 partners a personal contact, hub leaders can feel burdened by the amount of information they are responsible for relaying within and across tiers.

Summary of findings

Listed below are the principal findings from this study of communication between and within the NISE Network tiers.

NanoDays

1. The NanoDays kit communicates nano content and messages like “nano is fun” and “anyone can do nano.”
2. The NanoDays kit represents the values and professionalism of the Network.
3. NanoDays is used by all tiers as a communication mechanism.

Face-to-face meetings

4. Face-to-face meetings principally communicate that NISE Net is a supportive community. Meetings also convey general information such as nano content and implementation strategies for nano programming.
5. Active members of all tiers communicate through face-to-face meetings and view meetings as essential to community-building.

Regional hub structure

6. The regional hub structure connects Network tiers and is essential for communicating Network information, updates, and providing ongoing support.
7. The regional hub structure fosters community at the regional level.
8. While regional hub leaders are frequently in contact with their partners, only some active involved Tier 2 and 3 professionals initiate communication with their hub leader.

nisenet.org website

9. Despite Tier 1 partners’ concern that the website can be an information overload, active Tiers 2 and 3 feel the website successfully communicates the extent of NISE Net resources.
10. The nisenet.org website is managed and populated with content from Tier 1. Actively engaged Tier 2 and 3 partners receive this content, but rarely use the website to communicate back.

Other components

11. The Nano Bite newsletter communicates general information successfully to members of all tiers while social networking is used by only some partners.

Communication that is desired

12. Tier 1 partners find some NISE Net information and content challenging to communicate to Tier 2 and 3 partners.
13. Active members of all tiers wish to know more about the nano educational activities happening throughout the year at NISE Net institutions.
14. Active members of all tiers identified challenges related to current structures that restrict greater Network-wide communication.

Reflections

Findings from this study establish that actively engaged partners in the NISE Network primarily communicate with each other through four established components: NanoDays, face-to-face meetings, the regional hub structure, and the nisenet.org website. In addition to the four primary components, two other components were identified as methods through which some Network partners communicate, specifically, the Nano Bite newsletter and social networking groups, such as LinkedIn and Facebook. Through all these communication channels, Tier 1 seeks to convey NISE Net information, ideas, and practices to Tier 2 and 3 partners. In turn, some of the components allow Tier 2 and 3 partners to communicate within and between tiers. While active members from all three tiers use the same channels of communication, what is communicated through each channel and to whom it is communicated can differ according to tier. Furthermore, partners illuminated ways in which the communication components of the Network fail to elicit and share certain types of information within and across tiers. It is important to note that these findings are not generalizable to all Tier 2 and 3 partners in the Network, as only actively engaged professionals were selected to participate in the study. This study did not attempt to describe the experience of lesser involved individuals.

Directionality and impact on community

When examining how information, messages, and practices are spread throughout the Network, it is evident that active NISE Net partners, regardless of tier, most valued the mechanisms that allowed for multidirectional communication. Face-to-face meetings, in particular, were critical to cultivating a sense of community within NISE Net and were often a catalyst to partners' deeper involvement in the Network. The regional hub structure provided Tier 2 and 3 partners with a personal contact within Tier 1; however, the nature of the regional hub structure as a communication channel resulted in some Tier 1 partners feeling left out of the communication. Unidirectional communication components, like the nisenet.org website, were effective in disseminating information out to Tiers 2 and 3, but some active Tier 2 and 3 partners wished the website were designed to further facilitate communication with partners both within and between tiers.

Figure 2 is a graphical representation of the communication components of the Network and the extent to which two-way communication (communication between Tier 1 and Tiers 2 and 3) was found to occur. When illustrating communication between Tier 1 and Tiers 2 and 3, the arrow representing face-to-face meetings, the regional hub structure, and NanoDays is drawn in two directions. This shows that these three communication components facilitate the flow of information across all Network tiers. The arrow representing the nisenet.org website, the Nano Bite newsletter, and social networking groups is drawn in only one direction, highlighting that communication facilitated by these components is unidirectional, flowing from Tier 1 out to Tiers 2 and 3. As they are currently designed, the website, newsletter, and social networking groups are resources for Tiers 2 and 3 to access, and are not often perceived by partners as avenues through which Tiers 2 and 3 can share information with others in the Network.

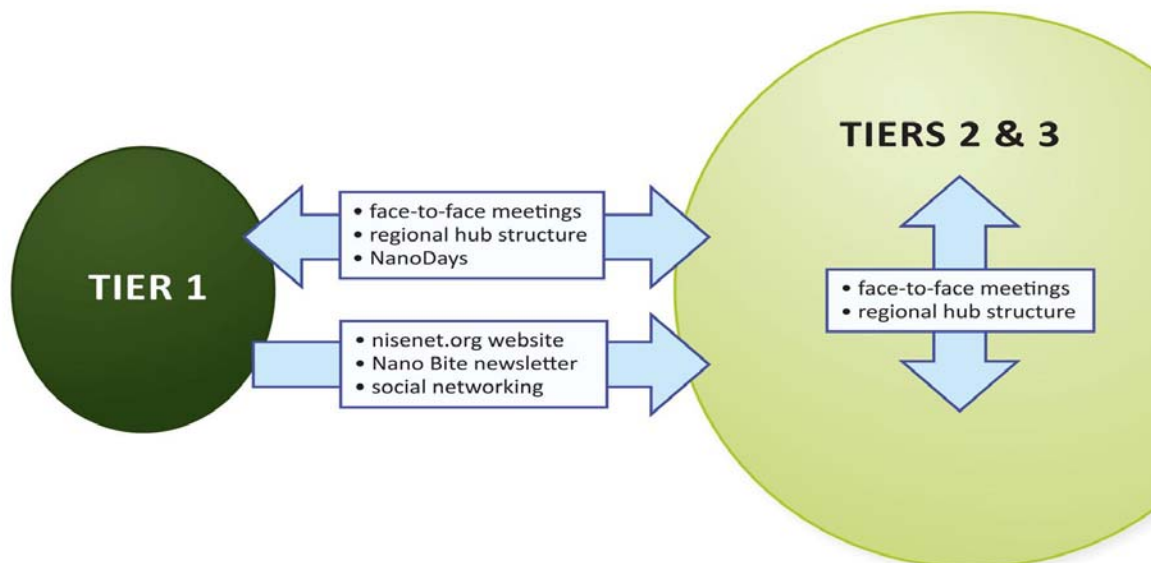


Fig. 2. Directionality of NISE Network communication components.

It is noteworthy that community-building and a sense of NISE Net community were key messages and outcomes of all four primary communication components. Examining this finding more closely it is evident that the components that most strongly communicated a sense of community were those that fostered multidirectional communication. Specifically, face-to-face meetings and the regional hub structure were found to play a key role in fostering community. However, the regional hub structure is most often used by Tier 1 to disseminate information while not all active Tier 2 and 3 partners reciprocate this communication; alternatively, face-to-face meetings engage all tiers in communication. Furthermore, face-to-face meetings was the communication component that partners in all tiers seem to value the most, and for a number of actively involved Tier 2 and 3 partners, attending a face-to-face meeting led to them becoming more involved in NISE Net.

Expansion of existing communication components

Network partners reported an interest in and, at times, a strong desire for greater communication within and between tiers, signifying that the Network would benefit from developing new communication components or redesigning existing mechanisms. In particular, Tier 1 reported interest in sharing more with Tiers 2 and 3 while active professionals in Tiers 2 and 3 want to hear more about the Network and its resources from Tier 1. Partners within these tiers are also eager to share and receive nano programming ideas and implementation strategies from the broader Network. In addition, Tier 1 partners desire greater communication within Tier 1. Specifically, Tier 1 partners want to hear more from regional hub leaders about the needs and interests of Tier 2 and 3 partners within their region. However, the avenues through which these conversations take place can fail to effectively provide Tier 1 partners with the information they want.

For greater understanding of the function and utility of the NISE Net communication components, it is useful to review findings related to these mechanisms from past evaluation studies. Two summative evaluation reports are particularly helpful to reference: the *Overview of the NISE Net* (St. John, et al., 2009), completed in the fourth year of the grant, as well as the

Review of NISE Network Evaluation Findings: Years 1-5 (Reich, et al., 2011), completed in the fifth year of the grant. These reports provide information regarding all four primary communication components and highlight that over the years Tier 2 and 3 partners have expressed an interest in contributing to the Network.

Overview of the NISE Net found that following the first round of Regional Workshops in Year 3, “almost all (94%) [responded in a survey that they] expect to contribute to the Network in the future” (St. John, et al., 2009). Also, a Year 4 Network-wide survey of 175 respondents found that the majority of respondents agreed (42%) or strongly agreed (47%) with the statement “I am interested in continuing to work with NISE Net” (St. John, et al., 2009). This expressed interest was further confirmed in the *Review of NISE Network Evaluation Findings*, which found that although “there was high interest among institutions to contribute to the Network, opportunities either did not exist or were underutilized during Years 1-5” (Reich, et al., 2011). An example *the Review* identified as an underutilized opportunity to contribute to the Network was the commenting function on nisenet.org whereby partners can post and respond to comments about specific catalog products. Even after this commenting function was highlighted in a professional development workshop hosted by NISE Net, evaluators found that more than a month after the workshop none of the workshop participants had posted comments (Reich, et al., 2011).

Other communication components, such as face-to-face meetings and the regional hub structure, have been more successful at facilitating communication between and within tiers, but there is an opportunity for refinement within the regional hub structure. Interviews conducted with regional hub leaders in Year 4, just as the regional hubs were becoming a formalized communication component, highlighted that the roles and responsibilities of a regional hub leader are to “serve as liaisons with the hub members in their region...recruit new members⁹...communicate with institutions and researchers who are already members...putting individuals in touch with other resources in their areas” (St. John, et al., 2009).

As NISE Net has expanded, so has the burden placed on regional hub leaders to disseminate the vast amount of Network information that is directed toward them. In essence, the difficulties that the regional hub structure experiences are a product of its own success. Placing too much emphasis on communicating through the regional hub structure requires hub leaders to have a broad grasp on all NISE Net content and relay that information to Network partners, while simultaneously relaying partner interests and updates back to Tier 1 professionals. As stated by a Tier 1 partner during a focus group, “I kind of feel that [the regional hub structure] is where the Network is successful at getting stuff done.” Tier 1 partners who are not regional hub leaders repeatedly expressed an interest to learn more about Tiers 2 and 3, suggesting that an expansion of the regional hub structure as a communication component could be beneficial to some Tier 1 professionals and would establish a closer connection to Tiers 2 and 3.

⁹ As the objective of NISE Net has shifted from expanding the Network to deepening existing relationships, recruiting new partners is no longer a primary focus of the regional hub leader.

Reflections from a Network Leadership representative

Throughout the process of evaluating the NISE Network communication components, evaluators sought input and feedback about the direction and findings of the study from the Network Leadership group. One Network leader served as a liaison between the Leadership group and the study team and periodically attended study team meetings to provide input throughout the duration of the evaluation. Upon completing a draft of the evaluation report, evaluators invited this individual to reflect on the evaluation findings and how the findings might influence NISE Net's overall strategy for Years 8-10.



In December 2011, the Network Leadership team (NEGNOG) met to plan NISE Net's project strategy for Years 8-10. We entered the meeting having already defined our overall strategic direction: to use and grow the capacity of Tier 2 organizations to engage the public in learning about nano. We also knew that in the final years of the project, we would be decreasing development work and increasing dissemination efforts. The Network Communication Study team provided us with their preliminary results, which helped us to identify and shape specific elements of the plan. In particular, we were influenced by evidence that Network partners would like to increase communication among all three tiers, especially related to activities and successful practices for engaging the public, and that partners most value network activities that support multi-directional interaction among all three tiers, such as in-person meetings. We were also struck by partners' appreciation for being part of a larger community working toward a common goal.

The resulting plan for Years 8-10, articulated at a meeting in January 2012, includes:

- *Creating substantial opportunities for partners of all tiers to interact and share what they do to engage the public in nano (e.g. through attending and presenting at regional and network-wide meetings);*
- *Providing more direct support to Tier 2 partners, encouraging them to integrate nano into their ongoing programming (e.g. through NanoDays kits, copies of the nano mini-exhibition, and mini-grants);*
- *Supporting more opportunities for partners from all tiers to contribute their expertise and learn from each other, promoting best practices and raising the capacity of the field (e.g. by offering in-person workshops and virtual meetings).*

With this overall direction in place, the individual workgroups are creating their scope of work for the coming years. This ongoing planning will continue to be informed by the study results.

In conclusion, communication within the NISE Network is primarily facilitated through four structural components: NanoDays, face-to-face meetings, the regional hub structure, and the nisenet.org website. Study participants also utilize, to a limited extent, the Nano Bite newsletter and social networking groups to send or receive NISE Net information. Professionals across all tiers value communication components that facilitate multidirectional communication, particularly face-to-face meetings. Partners in the study generally desire to hear and share more with others in the Network, and cite that components like nisenet.org and the regional hub structure could be expanded to allow greater contact. Network Leadership is currently drawing upon findings from this study to inform the strategy and direction of the Network in its final years.

References

- Denzin, N. K. (1978). *The research act: A theoretical introduction to sociological methods* (2nd ed.). New York, NY: McGraw Hill.
- Lincoln, Y. S., & Guba, E. G. (1985). *Naturalistic inquiry*. Newbury Park, CA: Sage Publications, Inc.
- Maxwell, J. A. (1992). Understanding and validity in qualitative research. *Harvard Educational Review*, 62(3), 279-300.
- NISE Network. (2011). NISE Network website homepage. from www.nisenet.org
- Pattison, S., Benne, M., & LeComte-Hinely, J. (2011). 2010 delivery and reach study: NISE Network 2010 summative evaluation: NISE Network.
- Patton, M. Q. (2002). *Qualitative research & evaluation methods*. Thousand Oaks, Sage Publications, Inc.
- Reich, C., & Goss, J. (2009). *Public impacts summative evaluation: Study 2*. Boston, MA: NISE Network.
- Reich, C., Goss, J., Kollmann, E. K., Morgan Alexander, J., & Grack Nelson, A. (2011). *Review of NISE Network evaluation findings: Years 1-5*. Boston, MA: NISE Network.
- St. John, M., Helms, J. V., Castori, P., Hirabayashi, J., Lopez, L., & Phillips, M. (2009). *Overview of the NISE Network evaluation*. Inverness, CA: Inverness Research Inc.

Appendix A

Description of Network components

The four primary communication components investigated in this study (NanoDays, face-to-face meetings, the regional hub structure, and nisenet.org) are described in further detail below.

NanoDays

NanoDays is a nationwide festival of educational programs about nanoscale science and engineering and its potential impact on the future. NanoDays events are organized by NISE Network partner organizations and take place at over 200 science museums, research centers, and universities across the country from Puerto Rico to Hawaii. The first nationwide week of events took place in 2008 with more than 100 institutions participating. This has grown to more than 200 yearly events.

Participating in NanoDays consists of hosting a day or a week of educational activities for the public on the theme of nanoscale science, engineering, and technology. These activities can come from the NISE Net NanoDays kit, the NISE Net online catalog, or other nano-themed activities not developed by NISE Net. Events often include any combination of hands-on activities and demos, speaker events, theater presentations, art shows, lab tours, lectures, forums, and science cafes.

Using a “ready-to-use” model, NanoDays kits contain activities as well as all materials and guides for planning and hosting a NanoDays event. There are two kinds of NanoDays kits: the physical kit and the digital kit. Both kits provide the same information about hands-on activities and include guides and tips regarding hosting a NanoDays event. The physical kit contains all materials and supplies for each activity and includes physical signage; digital kits include downloadable guides and printable graphic files. Each year the NanoDays kit has included a mix of new and past favorite hands-on activities in order to be useful to repeat collaborators, as well as new partners.

Physical NanoDays kits are distributed on an application basis to partner museums (primarily science museums and children’s museums) and nanoscience research institutions within the United States who deliver these programs and activities to public audiences. Kit recipients are expected to provide feedback about their NanoDays events using an online report.

Face-to-face meetings

Since its inception in 2005, NISE Net has had various face-to-face meetings including the Network-wide meeting, regional and national workshops, and partner site visits. These meetings serve as a source of professional development for broader Network partners and vary in their focus and audience. As of NISE Net Year 6, the Network alternates yearly between hosting one Network-wide meeting with a large number of Tier 2 and 3 partners (approximately 225 attendees) or hosting 7 regional meetings with a smaller group of mostly Tier 2 partners (approximately 30 attendees per meeting). Partner site visits to select Tier 2 and Tier 3 institutions began in Year 5 and have continued bi-yearly.

Network-wide meetings, previously known as Annual Meetings¹⁰, include keynote speakers, regional discussions, and smaller concurrent sessions designed to update Network partners on the status of the NISE Network and the broader field of nanoscale research. Regional discussions and concurrent sessions are intended to facilitate connections between individuals, including researchers and informal science educators. In addition to networking, partners are often exposed to new Network resources including new methods for engaging the public. These efforts are intended to increase partners' capacity at implementing nano educational products and foster community.

Regional meetings have been held in 2008, 2009, and 2011. Each region hosts a meeting that introduces or updates partners on the current status of the NISE Net, its educational resources, and the larger community. These meetings are usually hosted by the regional hub institution and include informal science educators and researchers. Invitations to attend the meeting are extended primarily to Tier 2 partners. The 2011 Regional Meeting included presentations from partners who had received mini-grants, attended a program workshop, or participated in NanoDays.

Partner site visits involve one-on-one interaction between the regional hub leaders and a partner institution. Site visits are usually conducted at Tier 2 sites, but hub leaders may also choose to visit a Tier 3 partner who has potential to become more actively involved in NISE Net. The overarching goal of these visits is to deepen relationships with a small group of museum partners in order to infuse nano further into their institutions. During each series of partner site visits, regional hub leaders travel to three to five museum partner institutions. Visit activities are tailored to meet partners' needs. These visits can include facilitating local connections with researchers, providing resources for engaging diverse audiences, and offering advice on ways to integrate nano into current educational programming. Partner site visits are conducted in order to support partners' efforts to infuse nano into their ongoing programming, as well as creating a stronger sense of community within the Network.

Regional hub structure

The NISE Network community of partners within the United States is organized around seven "regional hubs" based on geographic proximity. Each region has a hub leader who is charged with facilitating primarily Tier 2 partner interaction in the Network, helping museum educators connect with researchers and each other, hosting regional workshops and meetings, and providing support to institutions in their region. The overall goal of the Community working group is to develop and deepen relationships with informal science education institutions and research outreach programs in an effort to increase these institutions' capacity to engage the museum-going public in nanoscale science, engineering, and technology. Efforts early in the project to build the Network and recruit partners have shifted to deepening the relationships with partners in order to infuse nano education into their existing programming.

¹⁰ Annual Meetings took place yearly in Years 1-5. As NISE Net shifted to Years 6-10 these shifted to every two years and the name was changed to Network-wide meeting. Previous Annual Meetings differed yearly in goals and format, but always invited participants from all NISE Net regions.

Regional hub leaders:

- Act as ambassadors and mentors for NISE Network partners in each region
- Be voices in the planning of Network strategies and products by knowing regional partners' needs, wants, constraints, and motivations
- Recruit targeted new researchers and new museums
- Act as matchmakers between researchers and ISE professionals to develop and maintain stronger local connections
- Facilitate partners' participation in NISE Network events, activities and opportunities (such as NanoDays, mini-grants, partner site visits, regional meetings, workshops, etc.)

The NISE Network has also offered a point of contact for international partners located outside of the United States. However, these individuals were not included in the Network Communication Study as the experience of international partners is different from those in the United States due to funding and scope restrictions.

Nisenet.org

As outlined on the website itself, the purpose of nisenet.org is as follows:

- To facilitate communication and collaboration among informal science educators and nano scientists working to engage the public in nano science, engineering, and technology
- To share educational resources and tools with professional educators to increase their capacity to engage their audiences in nano science, technology, and engineering
- To provide the public directly with links to information and activities about nano science, technology, and engineering through our public page www.WhatIsNano.org

The online catalog of products features a variety of educational programs and activities, media, exhibits, evaluation reports, and tools and guides for professional audiences. All products in the catalog created by the NISE Network are reviewed by scientists, educators, and evaluated with visitors. Most products in the catalog created by the NISE Network are available for free digital download and designed to be easily adapted and modified for different formats and audiences. The catalog also includes "Linked Resources," which are nano related programs and activities, exhibits and media, and other tools that have been created with funding outside the NISE Network and have been reviewed for quality and utility for Network partners.

Community-related resources on the NISE Network website include regional hub contact information, a directory of nisenet.org members, blog posts, and an archive of all Nano Bite e-newsletters. The community page also offers information on events of general interest to the Network, such as upcoming conferences in the fields of informal science education and nanoscience.

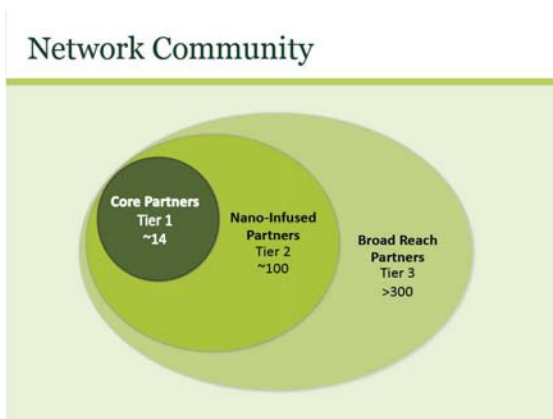
Appendix B

Focus group protocol with Tier 1 partners

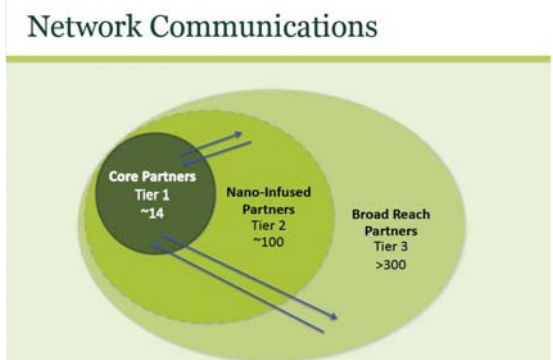
I. OPENING & INFORMED CONSENT

II. CLARIFICATION OF TERMS USED IN STUDY

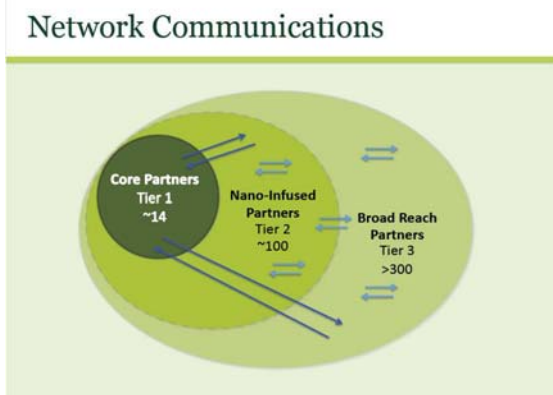
Before we dive into the questions, I just want to make sure we're all on the same page regarding what we mean by "Network Communication" as we start our discussion.



I'm sure this graphic is quite familiar to most of you – the "olive" diagram that represents the Network.

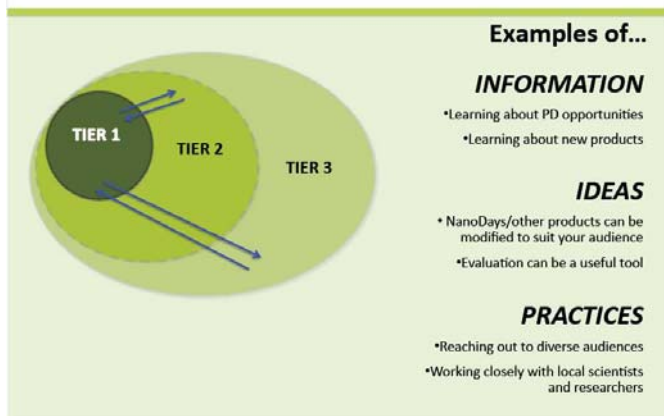


In this part of the Communications study, we are primarily interested in looking at what, and how, NISE Net information, ideas, and practices travel across the Tier 1 – Tiers 2&3 boundaries, in both directions, as depicted by these arrows.



The second stage of the study, where we conduct interviews with partners from Tiers 2&3, will also explore in more depth how NISE NET information, ideas, and practices travel between, and within, Tiers 2&3. But, for today, we're just focusing on the communication between Tier 1 and Tiers 2&3.

Network Communications



Finally, I should clarify what I mean when I say “NISE Net Information, ideas, and practices.”

When you hear me say “information,” I mean things like learning about professional development offerings such as the subawardee meeting and finding out about new programs and activities that have been developed by the Network through browsing nisenet.org.

When I say “NISE Net Ideas,” I mean things like the NanoDays kit and other products can be modified to meet the needs of your audience or that evaluation is a useful tool when developing nano education experiences.

And when I say “NISE Net Practices,” I mean things like reaching out to diverse audiences and working closely with local scientists and researchers.

Of course, it might be hard to identify something specifically as a piece of information, an idea, or a practice, because in real life these things tend to be intertwined and connected. For example, “learning to work closely with local scientists and researchers” can be considered information, an idea, and a practice all at the same time.

That’s completely fine – don’t get hung up on trying to pin something down as one of those three things. We’re just giving you those examples as the types of things that are communicated throughout the network in order to frame our discussion.

Are there any questions about any of these terms or definitions before we start diving into the questions?

III. QUESTIONS FOCUSED ON TIER 1 COMMUNICATING OUTWARD

Q1. As Tier 1 partners, what NISE Net information, ideas, and practices do you, or your working group, feel responsible for communicating to Tiers 2&3 partners?

[If needed, reiterate that you are not asking about what products (NanoDays kits, mini-exhibition, etc.) communicate to Tiers 2&3, but the INFO, IDEAS, and PRACTICES.]

In what ways – or, through what mechanisms – do you attempt to communicate NISE Net information, ideas, and practices to partners in Tiers 2&3?

Q2. What NISE Net information, ideas, and practices do you think are currently being shared successfully from Tier 1 to Tiers 2&3?

How are these information, ideas, and practices shared?

Is there something about that piece of information/idea/practice that you think makes it easily shareable between tiers?

Is there something about the way that the information/idea/practice is shared that makes it easily shareable?

Q3. What NISE Net information, ideas, and practices tend to be challenging to share from Tier 1 to Tiers 2&3?

How are these information, ideas, and practices shared?

Is there something about that piece of information/idea/practice that you think makes it easily shareable between tiers?

Is there something about the way that the information/idea/practice is shared that makes it easily shareable?

Q4. Are there any specific NISE Net information, ideas, and practices that you wish were shared to a larger number of Tier 2&3 partners?

For example, things that might be shared, but currently aren't?

IV. QUESTIONS ABOUT HOW TIERS 2&3 COMMUNICATE WITH TIER 1

Q5. What NISE Net information, ideas, and practices do typically hear about from Tiers 2&3?

How do you hear about it?

Q6. What do you wish you knew about Tiers 2&3 that you don't typically hear about now?

Is there any information from Tiers 2&3 that would make your work, or the work of your work group, easier? Or better?

V. QUESTIONS ABOUT THE FOUR COMPONENTS

Q7. Now, we'll shift to talking in a more targeted way about how information flows within the Network through the use of four specific components:

Four Network Components

- NanoDays kits and events
- nisenet.org website
- Face-to-face meetings
- Regional hub structure

NanoDays kits and events, the NISEnet.org website, face-to-face meetings (like the regional meetings, Network-wide meetings, etc.) and the regional hub structure.

I will ask you to think about each of these components, one at a time, and describe what NISE Net information, ideas, and practices you believe the component communicates to Network partners.

Let's start with NanoDays. What information, ideas, and practices do you think are communicated between the tiers with the kits and events?

What do you see as the strengths and weaknesses of NanoDays as a tool for communication between and within Network tiers?

Just to clarify – we are NOT asking about the strengths and weaknesses about the product itself.

Q8. Let's move on to the nisenet.org website. What information, ideas, and practices do you think are communicated between the tiers as a result of the website?

What do you see as the strengths and weaknesses of the website as a tool for communication between and within Network tiers?

Q9. Let's move on to the face-to-face meetings. What information, ideas, and practices do you think are communicated between the tiers as a result of these events?

What do you see as the strengths and weaknesses of the website as a tool for communication between and within Network tiers?

Q10. Finally, let's move on to the regional hub structure. What information, ideas, and practices do you think are communicated between the tiers as a result of this structure?

What do you see as the strengths and weaknesses of the website as a tool for communication between and within Network tiers?

Q11. Beyond the four components, do you feel there are other ways or activities that promote the communication of NISE Net information, ideas, and practices within the Network? If so, can you describe them for us?

Possible probes: How does it work, who is in contact with it, what are its strengths and weaknesses, etc.

MODERATOR: LOOK AT THE CLOCK

Q12: In the last X minutes, is there anything else we missed about Network communications, or that you didn't get a chance to say earlier?

Appendix C

Interview protocol with Tier 2 and 3 partners

I. OPENING & INFORMED CONSENT

II. PARTNER CONTEXT

Q1. From our Network records, it looks like you've participated in (INSERT GENERAL QUICKBASE INFO HERE - several meetings, NanoDays, site visits, etc.) over the years. What has your role been in those activities?

REDIRECT/REFOCUS (if needed): Were you the overall organizer or an on-the-floor facilitator?

USE GRAPHIC ORGANIZER: Fill in what partner shares in the first column.

III. WHAT DO YOU KNOW? – Tier 1 communication to Tiers 2 & 3

So, I'm interested in hearing about your experience with the Network and how you interact with the Network.

Q2: If you had to describe NISE Network overall to a colleague at another museum, how would you describe it?

Q3: (If not addressed in previous answer) You mentioned that you would describe the Network as (fill in with answer from Q2). How did you come to understand that this is what the Network is all about?

IV. CLARIFICATION OF TERMS USED IN STUDY

Before moving on to the next question, I just want to make sure we're all on the same page regarding what we mean by "messages" that the Network shares with you. When you hear me say NISE Net "messages" I don't mean the content messages of Network activities or products. "Messages," for the purpose of this interview, mean information and practices that are shared with professionals and institutions throughout the Network. These messages might be about professional development offerings, modifying products like the NanoDays kit, using evaluation as a tool for developing nano education experiences, or reaching out to diverse audiences and working closely with local scientists and researchers.

Q4: What are one or two messages you feel NISE Net has communicated to you?

Again, we're not talking about content messages here.

PROBE/REWORD: Is there anything you feel like the Network really wants you, as a professional, to know?

Q5: (If not addressed in previous answer) How do you hear about these messages?

Q6: Other than what you've mentioned, how else do you learn about the Network?

REQUIRED PROBE: Who do you hear about that from?

Q7: Is there any information about NISE Net's products, work, or operations that you wish the Network shared more with you?

PROBE/REWORD: Is there any information that would make your work easier?

V. WHAT DO YOU SHARE? – Tiers 2 & 3 communication within the Network

We've talked about how you find out about NISE Net information, but now I'm interested in learning what *you* share with the rest of the Network.

Q8: What information do you communicate to others in the Network?

[NOTE TO INTERVIEWER: USE GRAPHIC ORGANIZER. Plan to spend some time here. We're trying to get at partners communicating with Tier 1 and partners communicating with Tiers 2& 3. Here are some probes that talk about What they share; How they share it, and; Who they share it with. How, who and what are the required portion of probing. Interviewer should look back at the role of interviewee in NISE Net activities and probe for that.]

Involvement in NISE Net activities	What info do you communicate? Probe for -Modifications -Partnerships -NanoDays events -Diverse audiences -Etc.	How do you share that information?	With whom do you share that information? <i>Do you ever share with universities or other museums?</i>	Notes (interesting things that came up during the discussion)

REQUIRED PROMPT: (Try to restate main points from grid, then follow with:)

Does that sound like I captured what you were saying or did you have anything else to add?

Q9: Is there anything you wish you could share with others in the Network that you currently don't?

REQUIRED PROMPT: Is there anything that prevents you from sharing that? (Ask clarifying follow ups as needed)

REQUIRED PROMPT: Do you feel that you can communicate honestly and effectively through the mechanisms that are available to you? (Ask clarifying follow ups as needed)

VI. QUESTIONS ABOUT THE FOUR COMPONENTS/COMMUNICATION OVERALL

There are some Network components that partners use to learn things about the Network. These components include NanoDays, face-to-face meetings, the nisenet.org website, and our regional hub structure.

I'd like to talk through these components one at a time and the messages you feel NISE Net is communicating through these different components. Again, by messages I mean information or practices that the Network communicates to you as a professional. There may be some repetition in this next section, but it's important that we talk about each component individually.

Q10: Let's start with NanoDays, what messages do you feel the NanoDays kit is communicating to you or your institution?

[Clarify if necessary that this is not asking about their NanoDays event or about specific programs, but instead about the Network function of forming a programmatic kit, disseminating to partners, and having nation-wide events.]

REQUIRED PROMPT: What are the strengths or weaknesses of using NanoDays to communicate that message?

PROMPT: IF NOT COVERED IN Q8, ASK: Have you ever used NanoDays as a way to share feedback or other messages with the Network?

Q11: Let's move on to the website. Have you ever visited the website?

(If no, just move on to Question 12)

(If yes) **What messages do you feel the nisenet.org website is communicating to you or your institution?**

REQUIRED PROMPT: What are the strengths or weaknesses of using the website to communicate that message?

PROMPT: IF NOT COVERED IN Q8, ASK: Have you ever used the website as a way to share feedback or other messages with the Network?

Q12: Let's move on to face-to-face meetings. Have you ever talked with someone from the Network in-person, or been to a Network meeting?

(If no, just move on to Question 13)

(If yes) **What messages do you feel the face-to-face meetings are communicating to you or your institution?**

PROMPT: What are the strengths or weaknesses of using face-to-face meetings to communicate that message?

PROMPT: IF NOT COVERED IN Q8, ASK: Have you ever used face-to-face meetings as a communication mechanism to share feedback or other messages with the Network?]

Q13: Finally, let's move on to the regional hub structure. What messages do you feel the regional hub structure is communicating to you or your institution?

[Clarify if necessary that this is not asking about their regional hub leader, but instead about the Network's division into seven regions and communicating to partners through that structure.]

PROMPT: What are the strengths or weaknesses of using the regional hub structure to communicate that message?

PROMPT: IF NOT COVERED IN Q8, ASK: Have you ever used the regional hub structure as a communication mechanism to share feedback or other messages with the Network?]

Q14: Now that we've talked about these four components (NanoDays, nisenet.org, face-to-face meetings, and the regional hub structure), are there any other ways or activities that currently promote communication within the Network that we haven't talked about yet?

MODERATOR: LOOK AT THE CLOCK

Q15: In the last X minutes, is there anything else we missed about Network communications, or that you didn't get a chance to say earlier?