Nanoscale Informal Science Education Network
Legacy and Future Plans

NSF Nanoscale Science and Engineering Grantees Conference 2015
Larry Bell, Sr.V.P. for Strategic Initiatives, Museum of Science, Boston
The NISE Net was established with an award in 2005 to the Museum of Science in partnership with the Science Museum of Minnesota and the Exploratorium as a result of a special solicitation issued earlier in the year.

“This effort is intended to foster public awareness, engagement, and understanding of nanoscale science, engineering, and technology through establishment of a Network, a national infrastructure that links science museums and other informal science education organizations with nanoscale science and engineering research organizations.”
Project Goals

Educational Deliverables
Strategically plan, develop, implement, and disseminate educational deliverables of all kinds that foster greater engagement with and understanding of nanoscale science, engineering, and technology in a comprehensive way by the general public, as well as K-12 school groups.

Network Infrastructure
Create a sustainable service-oriented infrastructure that supports long-term efforts to educate the public about nanoscale science, engineering, and technology, as well as builds capacity in the field and within participating institutions.

Knowledge base
Stimulate educational research and evaluation that add to the nanoscale informal science education knowledge base, inform continuous improvement of both products and processes, and guide the development of future deliverables.
Educational Deliverables

- Online library of 272 resources: 146 from NISE Net, 126 others
- 1650 physical NanoDays kits distributed to 468 different organizations across the U.S.

Network Infrastructure

- short activities
- long activities
- forums
- theater & stage presentations
- K-12 lesson plans
Educational Deliverables

- exhibits
  - 93 copies of the *nano* mini-exhibition across the U.S.
  - 38 additional exhibits in online library: 16 NISE Net, 22 others

Network Infrastructure

Knowledge base
Educational Deliverables

- activities/programs
- exhibits
- media

Network Infrastructure

Knowledge base

192 resources: images, videos, audio and podcasts, interactive media and games, websites, print media and posters
Educational Deliverables
- activities/programs
- exhibits
- media
- professional dev.

Network Infrastructure
- Universal Design Guidelines

Knowledge base
- 94 guides and PD resources online for scientists and educators, in addition to workshops and conference sessions
Educational Deliverables

- activities/programs
- exhibits
- media
- professional dev.

Network Infrastructure

- project teams

Knowledge base

Staff of 18 subawardee organizations developed expertise in project work

Year 8 NISE Network Teams

- Network Community
  - Community Leader: Catherine McCarthy
  - NOG: Catherine McCarthy
- Public Engagement
  - NanoDays Leader: Ali Jackson
  - NOG: Brad Herring
  - NOG: Vrylena Olney
- Capacity Building
  - Online Brown-Bags Leader: Vrylena Olney
- Knowledge for the Field
  - Evaluation Leader: Liz Kunz Kollmann
  - NOG: Vrylena Olney
  - Public Impacts Leader: Gina Swankowski
  - NOG: Catherine McCarthy
  - Professional Impacts Leader: Scott Patterson
  - NOG: Vrylena Olney
  - Team-Based Inquiry Leader: Scott Patterson
  - NOG: Vrylena Olney
  - Inclusive Audiences Leader: Veronica Garcia-Luis
  - NOG: Vrylena Olney
  - Universal Design Workshop Leader: Anna Urdy-Schroeter
  - NOG: Vrylena Olney
- Network Leadership
  - NEG NOG: Project Coordination Leader: Larry Bell
  - NOG: Brad Herring
  - Administration Leader: Kari Jensen
  - NOG: Brad Herring
Seven regional hubs provided hundreds of partners with friendly and helpful connections with the Network.
Hundreds of organizations nationwide include nanoscale science, engineering, and technology in their offerings.
Educational Deliverables
- activities/programs
- exhibits
- media
- professional dev.

Network Infrastructure
- project teams
- regional hubs
- partners
- communications

Knowledge base

Face-to-face meetings, professional conferences, newsletter, website, social media, regional hubs, and kits provided network-wide communication

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-Hinelly, and Christine Reich
April, 2012

NanoBite: December 2015
Welcome to the December Nano Bite, the monthly e-newsletter for the Nanoscale Informal Science Education Network (NISE Net) and community.

NanoDays reports, mini-grant reports, annual partner surveys, database systems supported additional feedback for leaders
Partners learned by working together and built what they learned into the educational resources.
Five front-end studies informed the project.

Hundreds of formative evaluation studies informed development and design.

Twenty summative evaluation reports are currently online with others in development.

Their do-it-yourself form of formative evaluation called Team-Based Inquiry is being disseminated beyond the project.

Multi-institutional evaluation team has developed new ways of working.
Educational Deliverables
- activities/programs
- exhibits
- media
- professional dev.

Network Infrastructure
- project teams
- regional hubs
- partners
- communications

Knowledge base
- embedded
- evaluation
- guides

Guides and recorded webinars online
Partnerships in the Nanoscale Informal Science Education Network (NISE Net):

A study of partnerships between university scientists and museum professionals

SRI Education

Nano and Society
Case Study of a Research-to-Practice Partnership between University Scientists and Museum Professionals

Nano Online: Tracking NISE Net’s Digital Footprint
Final Report
Dietram A. Scheufele (scheufele@wisc.edu) and Leona Yi-Fan Su (su28@wisc.edu)
Life Sciences Communication, University of Wisconsin-Madison

NISE Net Research on How Visitors Find and Discuss Relevance in the Nano Exhibition
Research Report
By Elizabeth Kunz Kollmann, Gina Svarovsky, Stephanie Iacovelli, and Maggie Sandford
September 2015

Research on Organizational Change currently underway
Impacts

- Professional
- Organizational
- Public
NISE Net built community and collaboration among university scientists and museum professionals.

We’re part of this much bigger network that is a nationwide outreach on nanotechnology….I think it brings a level of credibility to what we do. It shows that we’re engaged in something much bigger than our little community.

-ISE professional

I always identified with a community of scientists. But never had any interactions with people associated with the museum side of things. Through NISE Net, I became involved with our local children’s museum.

-University researcher
ISE and university professionals gained confidence from NISE Net in communicating to public audiences about nano

I learned a lot about how to communicate the idea of a nanometer to these students and not only just about the idea of a nanometer, but also how nano affects what we do in real life.”
- University professional

[NISE Net] greatly expanded my personal knowledge and actually made me more aware of nano in the news and just daily life.
- ISE professional

Please rate the extent to which you agree.
I feel confident in my ability to explain to another adult...

How much has NISE Net affected your confidence in explaining to another adult...

Eight nano concepts used for both survey questions:

a. The size of a nanometer.
b. How nano-sized materials behave compared to macro-sized materials.
c. How scientists work at the nanoscale.
d. Examples of nano in nature.
e. Innovations that are possible because of nanotechnology.
f. Ways that nanotechnology improves existing products.
g. Risks or potential risks of nanotechnology.
h. How the future of nanotechnology may be influenced by political, economic, and personal values.
Professionals are significantly more likely to engage the public in learning about nano than they were prior to NISE Net involvement.

every week, every person in this department uses a direct activity from the NISE Net either in the lab or on the floor or something even in the science theater

ISE professional

I think that’s one of the things that’s really great about NISE Net is that they have, you know, different iterations with different lengths of times, different set ups, for different aged people.... the NanoDays kit in particular, we were just so impressed that it had everything, including the little plastic standup stand and the tablecloth!

-University researcher

![Chart showing engagement and use of NISE Net materials](chart.png)
As of year 10, professionals are confident in their ability, and using NISE Net resources, in a variety of ways, especially: engaging young children, engaging adults, engaging audiences with nano & society content, and communicating nano research findings to the public.

It’s just my go-to place for knowledge... if I want to talk about nano and society, science and society, [NISE Net is] the first place I’m going to go.

-ISE professional

The fact that each of the activities comes with a series of resources, pictures, slides, presentation aids, models, that makes it so much easier for people to get the concept ....even when you have people having difficulty understanding what you are saying.

-ISE professional
Professionals reported that NISE Net has been valuable to them because it provided models they can emulate, and because it helped them increase partnerships on, and communication of, other STEM topics beyond nano.

I teach undergrad classes and ...I’m an active researcher in the field, so involved in nano at highest research level but NISE Net been extremely valuable providing me outlook, [that it’s] not enough to just to research in lab, role as professor is to get work out to students and community. We want to ... interest next generation of scientists just like we are doing. So NISE Net been very valuable for providing information on how to reach out to young students and how to motivate them? NISE Net’s been very helpful to me.

-University researcher
NanoDays not only helps us to attract and retain talented students, but also enables us to enrich the volunteer experiences of our student volunteers....The program has had a significant positive impact not only on our chemistry department, but on the university as a whole.

- University professional

I would say that we’re a relatively new museum... we have more of a science focus now than 7 years ago and because NISE Net resources are so strong...it strengthens our partnerships and how we do partnerships and has helped us structure our partnerships in a way that are successful.

- ISE professional

**NISE Net has been valuable for organizations in a variety of ways**

<table>
<thead>
<tr>
<th>How valuable has the NISE Network been to your organization? (n=319)</th>
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<tbody>
<tr>
<td>A great deal</td>
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<tr>
<td>A lot</td>
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<tr>
<td>Somewhat</td>
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<td>Very little</td>
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<tr>
<td>Not at all</td>
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<table>
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<tr>
<th>To what extent has NISE Net increased the amount of ANY partnerships or collaborations between your organization and another?</th>
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<tbody>
<tr>
<td>A great deal</td>
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Partners report a wide variety of ways in which NISE Net has had a broad impact upon their organizations

We all work together to create something bigger than ourselves, and something that’s not just institutionally changing, but also community changing.

NORA MOYNIHAN, PORT DISCOVERY CHILDREN'S MUSEUM, BALTIMORE, MARYLAND

Combined with ongoing professional development, NISE Net resources, and capped with the Nano exhibition, COSI team members across the institution have seized the opportunity to mainstream nanotechnology into their programs.

JOSHUA SARVER, COSI, COLUMBUS, OHIO

It’s really been a wonderful relationship. Informal science education has become such an important part of MRS that after a few years we incorporated it into our mission. It’s critical for scientists to get across their research and the value of it to the general public, so the public can be better decision-makers.

RICHARD SOUZA, MATERIALS RESEARCH SOCIETY

The mini-grant allowed us to dedicate exhibit space to an exciting and progressive topic. In the past two years, the number of visitors to our museum has increased significantly. The Nano Lab is one of the changes that we think has contributed to our recent successes.

SARAH VON WILLIAMSEN, IMAGINARIUM SCIENCE CENTER, FORT MYERS, FLORIDA

The kits are also great models for researchers who would like to create new outreach activities on their research. We have had 4-5 researchers in the past two years develop activities that are modeled on the pedagogical aspects of the NanoDays kits.

KATHRYN HOLLAR, HARVARD SCHOOL OF ENGINEERING AND APPLIED SCIENCE
NanoDays events are successful in providing event attendees with an engaging experience and in promoting learning of nano concepts.

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

Volunteering at NanoDays positively impacts interest in STEM activities/careers and confidence around engaging the public in nano.
The *Nano* mini-exhibition is successful in providing visitors with an engaging experience and in promoting visitor learning of nano concepts.

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<th>Indicator of Success</th>
<th>Evidence at Science Centers</th>
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<td>Sustained Use</td>
<td>Visitor dwell times were nearly 4 times greater than field wide average.</td>
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<tr>
<td>Interest and Enjoyment</td>
<td>Almost all visitors reported high levels of interest/enjoyment for themselves (95% and 96%); the vast majority reported high levels for the children in their group (79% and 87%).</td>
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<tr>
<td>Social Interaction</td>
<td>The vast majority of groups (87%) were observed interacting with <em>Nano</em> as a group.</td>
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<tr>
<td>Broad Age Range</td>
<td>Observed ages of visitors ranged from 0-70+; 53% were children; the most common age range was 30-39 at 18%.</td>
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<tr>
<td>Further Exploration</td>
<td>A majority of groups (75%) used at least one of these elements; over half (52%) used the <em>Where Can You Find Nano?</em> panel.</td>
</tr>
<tr>
<td>Learning About Nano Content</td>
<td>There were statistically significant increases in visitor confidence about nano; 59% mentioned at least one area of the NISE content map when asked to describe what they learned.</td>
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In addition:

- *Nano* is successful with different types of institutions
- *Nano* shows promise for being successful for Hispanic visitors and visitors with disabilities
- Network partners say *Nano* is catalyzing new and enhanced programming
NISE Net’s public reach has grown over the ten years of its work.

By the end of 2015, it is estimated that the NISE Network will have reached over 30.5 million people over its lifetime.

In NISE Net’s final year of funding it reached members of the public at a rate of 10.6 million per year.

Annual reach in 2015:
- NanoDays events: 183,555
- Other use of kits: 917,774
- Nano exhibition: 9,536,940

Estimated Number of People Reached, in millions

Public Reach of the NISE Network

Public Reach Estimations for the NISE Network
Gina Navoa Svarovsky, Juli Goss, and Elizabeth Kunz Kollmann
January 16, 2015
Future Plans
As long as all of the exhibit copies are on display and the kit materials are still used by all as much as in 2015, NISE Net continues to reach over 10 million people each year, but exhibits will eventually be retired and materials depleted, and staff turnover will reduce public reached.
• NISE Net’s ten years of NSF funding ended Aug 31, 2015
• A six-month supplement and one-year no-cost extension brings final closing date to Feb 28, 2017
• Only Administrative and Evaluation Teams still in operation
• Completion of studies, guides, and reports
• Maintenance of [www.nisenet.org](http://www.nisenet.org) website

NanoDays dates for next five years
- 2016: March 26-April 3
- 2017: March 25-April 2
- 2018: March 31-April 8
- 2019: March 30-April 7
- 2020: March 28-April 5
Museum & Community Partnerships

100 kits with hands-on activities designed to facilitate collaborations that engage underserved audiences in nanoscale science, engineering and technology

Create new or expanded collaborations between NISE Net partners and a local community partner such as:

• A local community group, afterschool program, library, or summer camp
• A local chapter of a national youth-serving group such as 4-H, Boys & Girls Clubs, Boy Scouts, Girls Inc., Girl Scouts, National Girls Collaborative Project, Parent Teacher Association (PTA), Y (YMCA), and YWCA

HANDS-ON ACTIVITIES

1. Zoom into Nano
   • Get in Order
   • Powers of Ten
   • Measure Yourself

2. Small and Surprising
   • Gravity Fail
   • Ready, Set, Fizz
   • Smelly Balloons
   • UV Bracelets

3. Labs and Tools
   • Draw a Circuit
   • Gummy Shapes
   • Mystery Shapes

4. Tech and Nature
   • I Spy Game
   • Invisible Sunblock
   • Morphing Butterfly
   • Rainbow Film

5. Nano and Our Lives
   • Mystery Sand
   • Stained Glass Art
   • You Decide!
Building with Biology
Advancing Informal STEM Learning (AISL) award to MOS, in collaboration with AAAS, NISE Net partners, MIT, SynBerc, and others to create conversations in museums among scientists and public audiences about the emerging field of synthetic biology and its societal implications.

200 Kits of hands-on activities and other materials to support conversations between scientists and public audiences through the U.S. in 2016 built on NanoDays and public forum models developed in NISE Net.

A few of the educational activities:

Microbe Match Game
This is a card game exploring microbes that synthetic biologists use in their research and the ways that they engineer them to make new things.

Kit of Parts
This is a hands-on activity where visitors design a model cell that can solve a current problem being tackled by synthetic biologists.

Should We Engineer the Mosquito?
Consider two case studies and share your views on the future of mosquito engineering.
Sustainability in Science Museums

A new opportunity for new and existing NISE Network partners to engage the public in sustainability through the educational power of science centers and museums. ASU’s Sustainability in Science Museums program will create trainings, activity toolkits, and other resources to promote sustainability science and practice in museums.

50+ kits nationwide to engage the public and professional development and collaboration materials and support

Sustainability Solutions Festivals in February 2017 and 2018
Space & Earth Science Informal STEM Education

NASA award to Science Museum of Minnesota to use the network built by the ten-year NSF investment for space and science education. $14.5 million for five years renewable for additional five.

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<thead>
<tr>
<th>ACTIVITY</th>
<th>PURPOSE</th>
<th>INTERFACE / DISTRIBUTION</th>
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<tbody>
<tr>
<td>Leadership and management</td>
<td>• Project direction, management, and execution</td>
<td>• Project meetings and telecons</td>
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<tr>
<td></td>
<td>• Coordination and collaboration with NASA and other selected projects</td>
<td>• NASA meetings and telecons</td>
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<td>• Reporting to NASA</td>
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<tr>
<td>STEM educational products</td>
<td>• Engage public audiences, including families, K-12 students and teachers, and lifelong learners</td>
<td>• Activity toolkits to 250 network partners in years 2, 3, 4, and 5</td>
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<td></td>
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<td>• Exhibitions to 50 network partners in years 2-4</td>
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<tr>
<td>Educator professional development</td>
<td>• Increase capacity of professional audiences, including museum educators</td>
<td>• Six-week online workshops for 250 network partners in Jan. and Sept., years 2, 3, 4, and 5</td>
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<td></td>
<td>• Guides, slides, and videos with Toolkits and Exhibitions</td>
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<td>National network</td>
<td>• Promote institutional engagement and facilitate participation in SEISE Net</td>
<td>• Four regional hubs, located in the Northeast, South, West, and Midwest</td>
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<td></td>
<td>• Support partner relationships on national, regional, and local levels</td>
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<tr>
<td>Evaluation</td>
<td>• Inform planning and decision-making</td>
<td>• Reports and findings from front-end, formative, and summative evaluation</td>
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<td>• Provide data and metrics for NASA reporting and data calls</td>
<td>• Reports to NASA related to SMD objectives</td>
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<tr>
<td>Dissemination</td>
<td>• Share resources, results, and findings with network and NASA stakeholders</td>
<td>• Monthly project newsletter and annual report</td>
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<tr>
<td></td>
<td>• Share resources, results, and findings with the broader STEM education field</td>
<td>• Digital versions of project resources available on project website, NASA Wavelength, and other commonly-accessed repositories</td>
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Transmedia Engagement by the Public in Science-in-Society Activities

that involve current and enduring science-in-society themes, as first presented in Mary Shelley's novel, Frankenstein, which was published in 1818, nearly 200 years ago

1) an online digital museum with active co-creation and curation of its content by the public;
2) 50 activities kits for table-top programming; and
3) a set of Making activities. The project will also produce professional development deliverables: workshops and associated materials to increase practitioners' capacity to engage multiple and diverse publics in science-in-society issues.

ChemAttitudes: Develop & Disseminate Strategies & Materials to Support Chemistry Interest, Relevance, and Self-Efficacy

To build knowledge about, and create innovative approaches to, delivering informal science learning activities about chemistry using design-based research. A guide written for practitioners and activity materials will be packaged into a kit that will be replicated and distributed for use by informal science educators, chemists, and chemistry students at 250 sites across the U.S.

Planned first step in a larger project in collaboration with the American Chemical Society
With NISE Net’s funding for nanoscale informal science education funding ended the NISE Net is re-purposing the infrastructure as the

**National Informal STEM Education Network**

NISE Net leaders intend to continue to provide strategic leadership, support and coordination across multiple projects, consistent points of contact for Network partners, communication among Network partners and with leaders in the field, and maintenance of online resources to support continued development and dissemination of public engagement resources, professional development and capacity building, and further opportunities for collaboration and networking.
ECAST partners at ASU, MOS, and Woodrow Wilson Center became engaged with each other through our work in nano. Recent and upcoming projects:

- US participation in World Wide Views on Biodiversity
- US participation in World Wide Views on Climate and Energy
- Informing NASA’s Asteroid Initiative: A Citizen Forum
- NOAA Science Center Public Forums: Community Engagement for Environmental Literacy, Improved Resilience, and Decision-Making
- Climate Leadership Workshop for White House Office of Presidential Personnel

Science communication training for graduate students, REU students and others is another spin-off of nano ISE work over the last decade, Carol Lynn will say more after the break.
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