NISE network™
NANOSCALE INFORMAL SCIENCE EDUCATION

NANOSCALE INFORMAL SCIENCE EDUCATION NETWORK

Report to Partners
2005-2014

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.

By collaborating on an unprecedented scale, the NISE Network has effected nationwide change in public engagement with science, engineering, and technology.

"Developing NISE Net is a project of unprecedented scope in the science and children's museum community. Thanks to the enthusiasm and commitment of our informal education and research partners, the Network has had an even greater impact than we hoped when we started it nearly 10 years ago."

LARRY BELL, MUSEUM OF SCIENCE, BOSTON, MASSACHUSETTS

Museums and scientists collaborate to engage the public in nanoscale science, engineering, and technology

CONTENTS

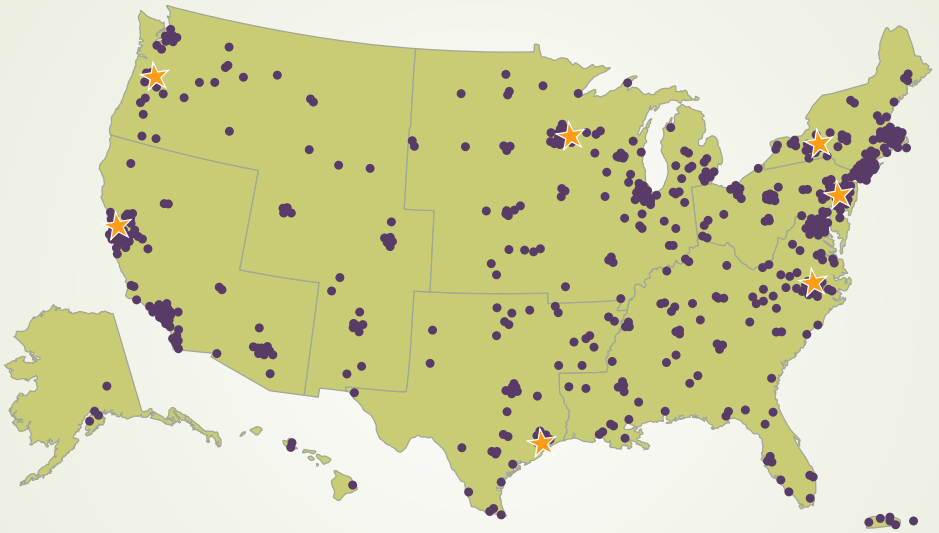
BUILDING COLLABORATIONS

NISE Net is a nationwide community with a common identity, purpose, practice, and set of resources.

NISE Net includes over 500 museums, universities, and other organizations. The Network is organized into regions, each with a regional hub leader that serves as the primary point of contact and provides advice, encouragement, and support to partners.

Network partners work together to engage the public in new topics related to science, engineering, and technology. Collectively, our efforts give the Network broad reach to diverse public audiences across the United States.

555 ORGANIZATIONS
regularly participate in Network activities



322 *museums*

192 *universities*

41 *industry, other*

★ Regional hub

"It's an amazing thing to bring together higher education people, community centers, science centers, and people like me who come from formal education. Everybody seems to have a place and a way to get something very meaningful out of this partnership."

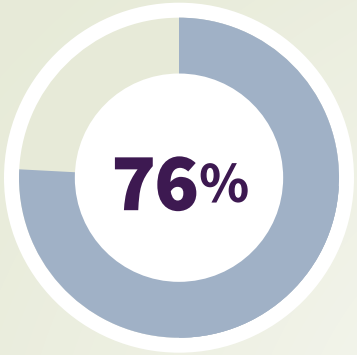
GAIL JONES, NC STATE UNIVERSITY, RALEIGH, NORTH CAROLINA

Through participation in the Network, partners create and strengthen valuable relationships. NISE Net encourages national, regional, and local collaborations. After working together on NISE Net activities, partners continue to collaborate on other initiatives, building on and expanding the Network and its impact. NISE Net also partners with other organizations within the informal learning, science, and engineering communities.

The Network has had particular success fostering museum-scientist partnerships. Thanks to ongoing local efforts, there are many more opportunities for the public to learn about current science and meet researchers. At the same time, scientists and students have more opportunities to develop communication skills, share their work, and build public support for and understanding of research. As Dennis Clougherty (University of Vermont) puts it, "Everyone wins!"

"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



76% of NISE Net partner organizations report

COLLABORATION

with other organizations to engage the public in nano

Who are NISE Network partners collaborating with?

Partners that collaborate report working with:

64% *museums or science centers*

55% *universities or colleges*

22% *K-12 schools*

13% *community organizations*

10% *industry*

Source: 2013 NISE Net Annual Partner Survey. Results will be reported in the NISE Net Professional Impacts Summative Evaluation (Goss et al. forthcoming).

ENGAGING THE PUBLIC

NISE Net's educational materials are designed to engage a wide range of audiences in learning about complex scientific content—in ways that are fun and easy to understand.

The NISE Network creates high-impact, high-quality exhibits, events, programs, and media. Working together, the Network's national team of educational product developers and scientists overcame the significant challenges of nano as a topic for interactive, informal learning experiences. Our website offers hundreds of open-source educational resources that suit different educational contexts, engage diverse target audiences, and convey a range of content.

"NISE Net has provided turnkey science demonstrations and experiences that allow us to plug and play into our demos, camps, and classes. It's been an invaluable resource to our education team and staff."

RAY VANDIVER, TULSA CHILDREN'S MUSEUM, TULSA, OKLAHOMA

Network partners use our educational materials in a variety of settings, including museums, universities, schools, and out-of-school-time programs. Partners also adapt, integrate, build on, and improve NISE Net materials to fit their needs.

KEY CONCEPTS

NISE Net has identified four key concepts for engaging the public in nano:

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

2. Nano is studying and making tiny things: Scientists and engineers have formed the interdisciplinary field of nanotechnology by investigating properties and manipulating matter at the nanoscale.

3. Nano is new technologies: Nanoscience, nanotechnology, and nanoengineering lead to new knowledge and innovations that were not possible before.

4. Nano is part of our society and our future: Nanotechnologies—and their costs, utility, risks, and benefits—are closely interconnected with society and with our values.

Source: Engaging the Public in Nano: Key Concepts in Nanoscale Science, Engineering, and Technology (Sciencenter, 2011).

By the end of 2015

30 MILLION PEOPLE

will have participated in NISE Net programs, events, and exhibitions

NanoDays kits
8 MILLION PEOPLE

Nano *exhibition*
22 MILLION PEOPLE

Source: NISE Net Public Reach Memo (Svarovsky et al., forthcoming).

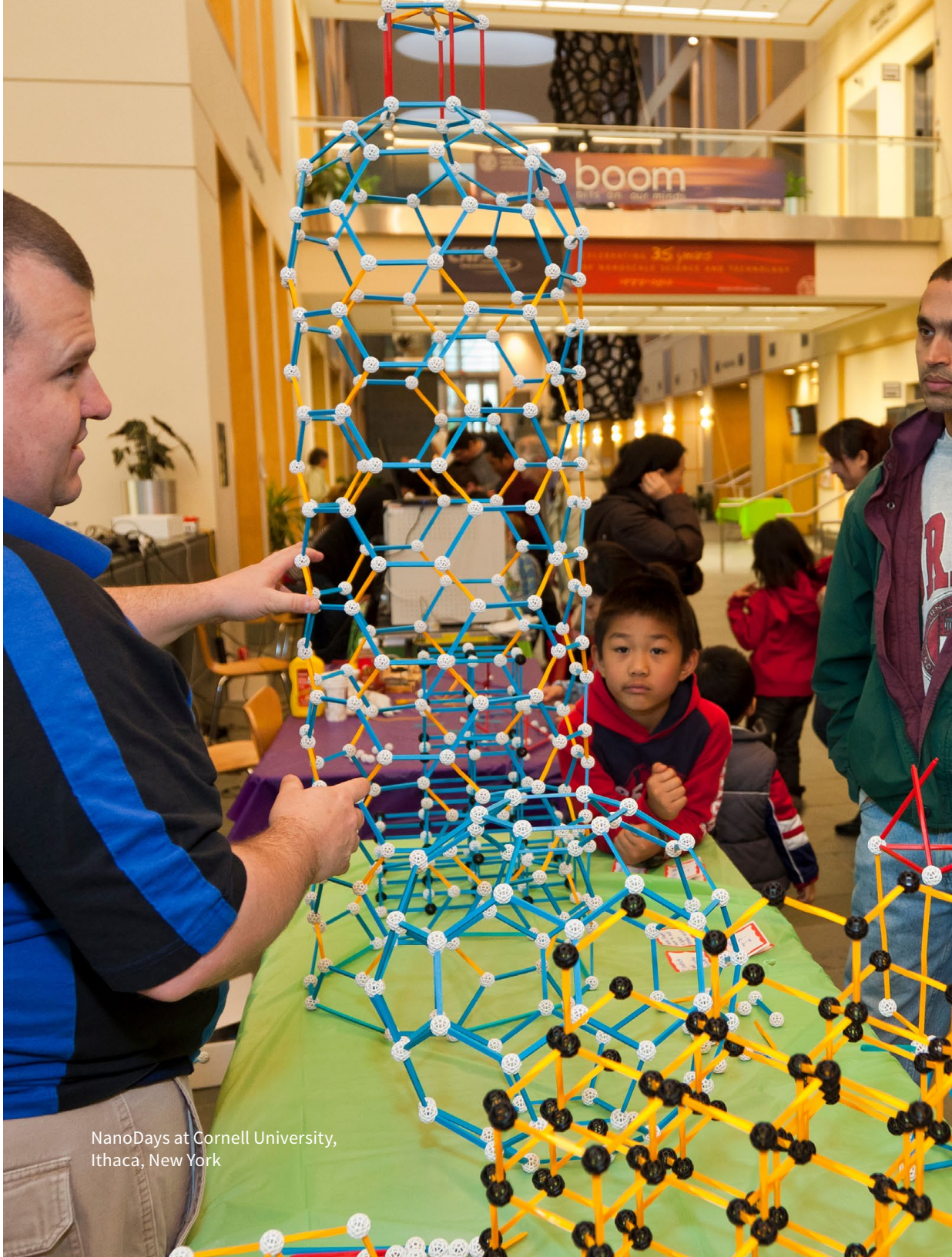
The *Nano* exhibition at the Science Museum of Minnesota, Saint Paul, Minnesota

NanoDays is NISE Net's signature event—an annual celebration of nanoscale science, engineering, and technology.

NanoDays mobilizes hundreds of NISE Net partners across the country to engage staff, volunteers, and members of the public in learning about nano. NanoDays reaches over a million visitors throughout the year, at the annual event, and during other programming.

"The collaboration between our research center and NISE Net really broadens the impact of our scientific discoveries and our innovations."

GABRIEL LOPEZ, DUKE UNIVERSITY, DURHAM, NORTH CAROLINA



NanoDays at Cornell University, Ithaca, New York

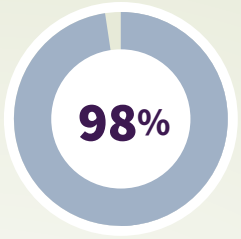
NanoDays activities are simple yet powerful, allowing visitors to explore the unusual properties of nanoscale materials and technologies. Favorite activities include a tiny teacup that won't spill water, a mysterious magnetic fluid, red-colored gold, and glass objects that seem invisible!

NanoDays kits contain all the necessary materials to plan and host a successful event

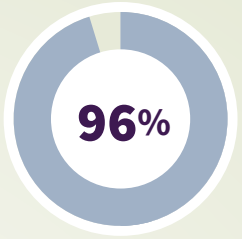
"NanoDays gives us opportunities to partner with local universities, business partners, and science organizations."

REGINA HALL, MUSEUM OF NATURAL HISTORY & SCIENCE, CINCINNATI, OHIO

NanoDays is
ENGAGING
for visitors



of adults say NanoDays is enjoyable



of children say NanoDays is fun

Both adults and children learn nano concepts
Almost all adults say they would come to NanoDays again

NanoDays is
VALUABLE
for partners

100%

of partners who receive NanoDays kits use the materials throughout the year

Event volunteers learn nano concepts
Student volunteers become more interested in STEM careers

Source: Summative Study of NanoDays 2014 Events (Svarovsky et al., 2014).

NanoDays at OMSI, Portland, Oregon

"NanoDays kits are fantastic. I love that they work with a lot of different ages. The activities center around a really interesting and engaging visual or hands-on demo. They make difficult content intelligible to the public."

ELYSA CORIN, NC STATE UNIVERSITY, RALEIGH, NORTH CAROLINA

The Nano *exhibition has a small footprint and a big impact!*

Nano will be hosted by over 100 sites across the United States, reaching millions of people each year. The exhibition is only 400 square feet, but it engages visitors in all four of NISE Net's key concepts for nanoscale science, engineering, and technology through interactive components and real phenomena. *Nano* is designed to complement other NISE Net products, especially NanoDays activities.

Evaluation results show that this mini-exhibition has a big impact. Visitors describe *Nano* as interactive, informative, and family-friendly. Nearly all visitors describe the exhibition as interesting and enjoyable. The design promotes social interaction, with 87% of groups playing, talking, and learning together. After their experience, 62% of visitors can name one or more key concepts and 59% can describe the relevance of nanotechnology to their lives.

Sources: Summative Study of the Nano Mini-Exhibition (Svarovsky et al., 2013) and NISE Network Public Reach Memo (Svarovsky et al., forthcoming).

"The Nano *mini-exhibition has immediately become one of our visitor favorites in visitor surveys."*

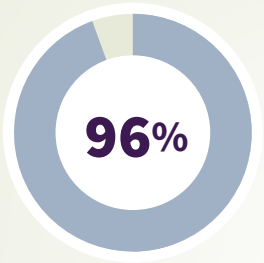
KAREN KNECHT, DA VINCI SCIENCE CENTER, ALLENTOWN, PENNSYLVANIA

Nano is designed to fit in a variety of environments. The exhibition at Sciencenter, Ithaca, New York (top left); Danville Science Center, Danville, Virginia (top right); and Children's Museum of Houston, Houston, Texas.

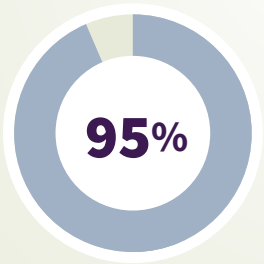
"Combined with ongoing professional development, NISE Net resources, and capped with the Nano *exhibition, COSI team members across the institution have seized the opportunity to mainstream nanotechnology into their programs."*

JOSHUA SARVER, COSI, COLUMBUS, OHIO

Nano is
ENGAGING
for visitors

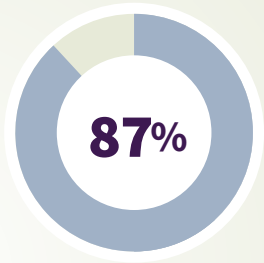


of visitors say the exhibition is enjoyable

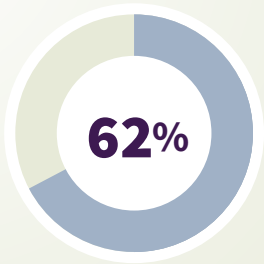


of visitors say the exhibition is interesting

Nano
CATALYZES
other Network activities



of partners report new or enhanced programming



of partners report new or strengthened partnerships

Source: Summative Study of the Nano Mini-Exhibition (Svarovsky et al., 2013).


Where can you
find nano?
Where can you find nano?
Nano is all
us, in nat
technolog
Nature provide
nano phenome
color of some b
"sticky" feet of g
caused by tiny n
Nanotechnology is in
use all the time, inclu
chips with nano-size
EAGLE EYE
Settlers
CRANIUM

INCREASING CAPACITY

NISE Net has provided the rationale, resources, and support to transform informal STEM learning in museums.

NISE Net has established communication, collaboration, and a sense of shared purpose across partners in several fields—including informal education, science, and engineering—to create widespread motivation and capacity to engage public audiences in current science and emerging technologies. Participation in the Network has had a transformative effect on individual practitioners, organizations, and the field of informal science learning.

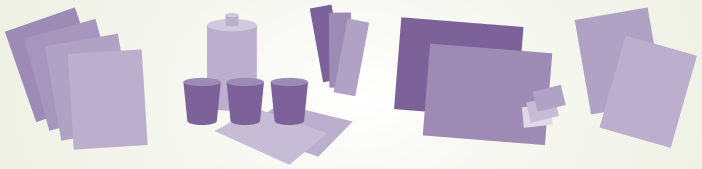
Nano & Society workshop, October 2012

Working together, we have created new formats and effective approaches to engage the public in nanoscale science and engineering. We have also addressed a significant need for professional development among informal learning organizations and scientific research institutions. NISE Net has modeled, improved, and shared best practices for creating partnerships, training staff, and reaching diverse public audiences.

NISE Net's online library includes

OVER 500 PRODUCTS

free to download and use



200

NISE Net programs, activities, exhibits, and media

50

NISE Net professional development and training resources

+250

Plus another 250 products shared from other sources

"The professional development opportunities have given us a model of what good informal science programming looks like, as well as helping us to build the background knowledge and content knowledge that we need to do that well."

HARDIN ENGELHARDT, MARBLES KIDS MUSEUM, RALEIGH, NORTH CAROLINA

"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

University student volunteers and members of the public investigate the properties of nanoscale gold at the Sciencenter, Ithaca, New York

SUSTAINING THE NETWORK

NISE Net has had a major impact by incorporating current science into regular museum exhibits and programs, by improving the practices and skills of educators and scientists, and by creating lasting, valuable relationships among individuals and organizations.

NISE Net has built capacity in the fields of informal learning and science communication by engaging our partners in doing work together. The Network has demonstrated the benefits of widespread collaboration and sharing of best practices among organizations and practitioners. The relationships that the NISE Net has fostered, and the practices and resources the Network has disseminated, will be a benefit to partners for years to come.

The *Nano* exhibition with added components at Casa Roig Museum, Humacao, Puerto Rico (top) and Imaginarium Science Center, Fort Myers, Florida (bottom)

Network mini-grants provide partners with financial support for new projects to engage diverse audiences. Mini-grants support sustainable efforts to infuse nano into ongoing activities. Projects have included exhibits, demonstration carts, summer camps, field trip programs, outreach to underserved audiences, teacher professional development, staff and volunteer training—and much more.

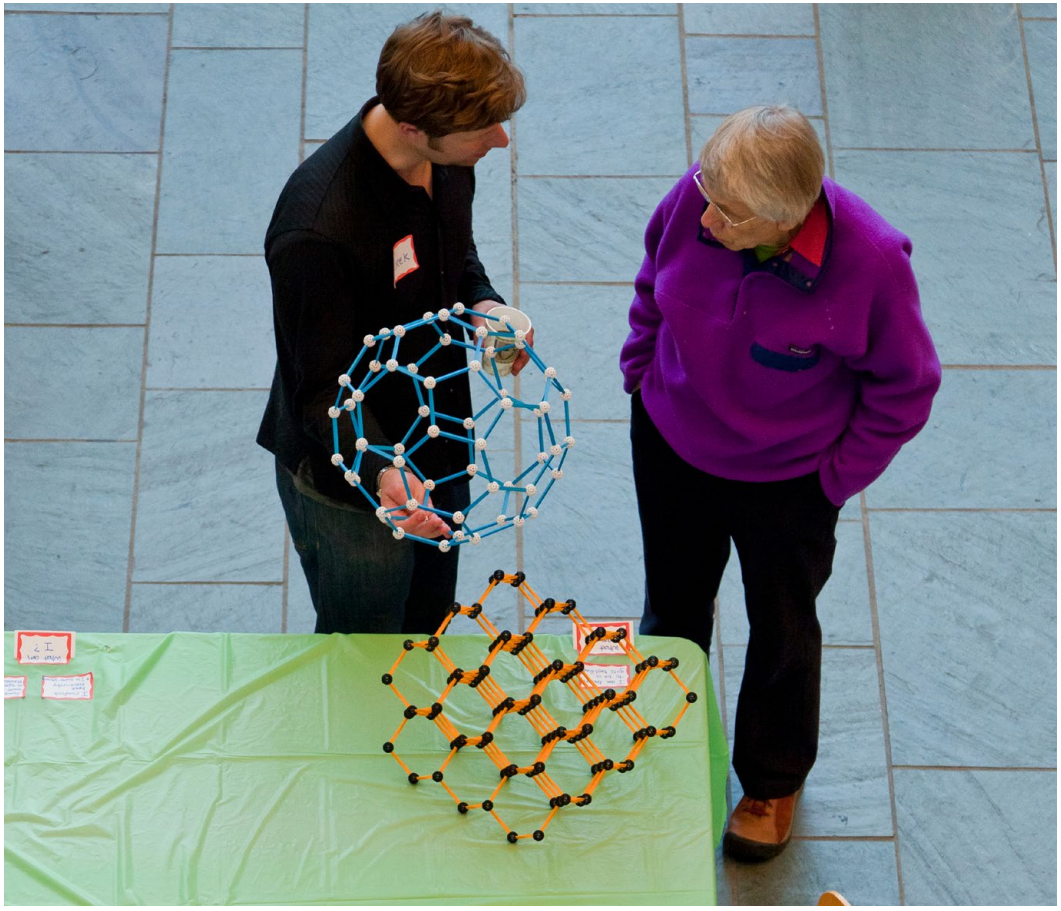
The interdisciplinary nature of nanoscale science and engineering makes it possible for motivated NISE Net partners to incorporate nano content into almost any public engagement effort. Partners have also applied Network methods, tools, and approaches to their other public engagement work, extending the benefits of the NISE Network beyond nano.

"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 NISE Network is a community of people who are passionate about making the world a better place. We're using science as the way to do it, because it has the power to change the world and the potential to impact all of our lives. We've created this really remarkable way of working in the field, of collaborating with scientists, with educators. Through all the partners of the NISE Network, we can take these great products and disseminate them to an audience that we've never been able to reach before. There's incredible power in that."

JAYATRI DAS, THE FRANKLIN INSTITUTE, PHILADELPHIA, PENNSYLVANIA



REFERENCES

Works cited

Goss, J., Auster, R., Beyer, M., Mesiti, L.A., Grack Nelson, A. Guberman, S. & Kollmann, E.K. (forthcoming). **NISE Net Professional Impacts Summative Evaluation.** Boston, MA: NISE Network.

Sciencenter. (2011). **Engaging the Public in Nano: Key Concepts in Nanoscale Science, Engineering, and Technology.** Ithaca, NY: NISE Network.

Svarovsky, G., Goss, J., Ostgaard, G., Reyes, N., Cahill, C., Auster, R., et al. (2013). **Summative Study of the Nano Mini-Exhibition.** Saint Paul, MN: NISE Network.

Svarovsky, G., Tranby, Z., Cardiel, C., Auster, R. & Bequette, M. (2014). **Summative Study of the NanoDays 2014 Events.** Saint Paul, MN: NISE Network.

Svarovsky, G., Goss, J., Bequette, M. & Kollmann, E.K. (forthcoming). **NISE Net Public Reach Memo.** Saint Paul, MN: NISE Network.

2013 Annual Partner Survey. Context document and summary results from close-ended questions. [Data file.] Portland, OR: NISE Network.

Additional resources

Alpert, C. L. (2010). **A Guide to Building Partnerships Between Science Museums and University-Based Research Centers.** Boston, MA: NISE Network.

Alpert, C. L. (2011/12). **Research Experience for Undergraduates Science Communication Workshop: A NISE Network Professional Development Guide.** Boston, MA: NISE Network.

Alpert, C. L. (2011). **Sharing Science: Communication, Education and Outreach Workshop and Practicum.** Boston, MA: NISE Network.

Herring, B. (Ed.). (2007). **NISE Network Public Forums Manual.** Durham, NC: NISE Network.

Museum of Science. (2010). **Universal Design Guidelines for NISE Network Exhibits.** Boston, MA: NISE Network.

Museum of Science. (2010). **Universal Design Guidelines for Public Programs in Science Museums.** Boston, MA: NISE Network.

Pattison, S., Cohn, S. & Kollmann, L. (2013). **Team-Based Inquiry: A Practical Guide for Using Evaluation to Improve Informal Education Experiences.** Portland, OR: NISE Network.

Sciencenter. (2011). **Nano Mini-Exhibition Educator Guide.** Ithaca, NY: NISE Network.

Sciencenter. (2014). **NanoDays Planning Guide.** Ithaca, NY: NISE Network.

Wetmore, J., Bennett, I., Jackson, A. & Herring, B. (2013). **Nanotechnology and Society: A Practical Guide to Engaging Museum Visitors in Conversations.** Tempe, AZ: NISE Network.

References are available at **www.nisenet.org**

www.nisenet.org

This report was based on work supported by the National Science Foundation under Award Numbers 0532536 and 0940143. Any opinions, findings, and conclusions or recommendations expressed in this report are those of the authors and do not necessarily reflect the views of the Foundation.

November, 2014

IMAGE CREDITS:

Gary Hodges: front cover, pages 4 (left), 10, 11 (top and bottom left), 14, 19 (top left), 23 (top right), 25, 29 (bottom right), 30 (left)

Museum of Science, Boston: page 4 (top and bottom right)

Emily Maletz: page 3, 7, 8, 15, 17, 18, 21,22, 23 (top left), 24, 26, 28, 29 (top right), 30 (top right)

Ken Stanek: page 11 (bottom right)

Science Museum of Minnesota: page 13

Danville Science Center: page 19 (top right)

Children's Museum of Houston: page 19 (bottom)

Casa Roig Museum: page 27 (top)

Imaginarium Science Center: page 27 (bottom)

Sciencenter: page 29 (left)

Josh Reynolds: page 30 (bottom right)