

**NATIONAL INFORMAL STEM
EDUCATION NETWORK**

*Report to Partners
2005-2016*



NISE NETWORK

The Nanoscale Informal Science Education Network (NISE Net) created a national community of researchers and informal science educators dedicated to fostering public awareness, engagement, and understanding of nanoscale science, engineering, and technology.

In 2016, NISE Net transitioned to an ongoing identity as the **National Informal STEM Education Network**, leveraging the investment of the National Science Foundation for new projects and collaborations.



2005–2015



Beginning in 2016



“Developing NISE Net was 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 in 2005. And today the NISE Net continues to broaden its impact on professional and public audiences by engaging them in new areas of current science and technology.”

LARRY BELL, MUSEUM OF SCIENCE, BOSTON, MASSACHUSETTS

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



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BUILDING COLLABORATIONS

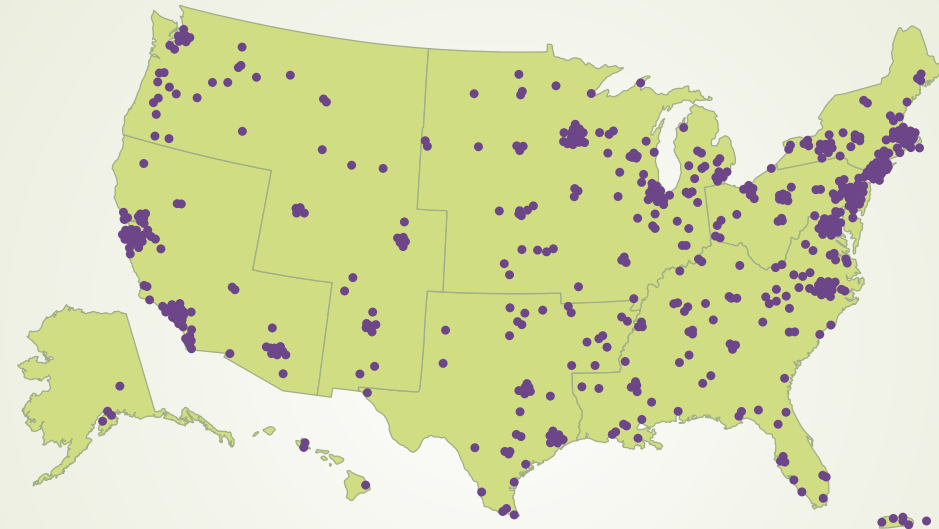
NISE Net has collaborated on an unprecedented scale, effecting nationwide change in public engagement with science, engineering, and technology.

NISE Net includes more than 600 museums, universities, and other organizations. The Network is organized into regions, each with a regional hub leader that serves as primary point of contact and provides advice, encouragement, and support. Professional partners report an increased sense of community after becoming involved in the Network, identifying as part of a broader group that includes scientists and museum professionals.

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

Source: NISE Network Professional Impacts Summative Evaluation (Goss, Auster, Beyer, Mesiti & Kollmann, 2016).

NISE Net created a Network of over
600 ORGANIZATIONS
that regularly participate in Network activities



“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

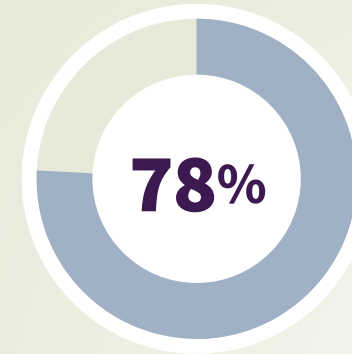


Through participation in the Network, partners create and strengthen valuable relationships. NISE Net encourages national, regional, and local collaborations. After working together on NISE Net activities, partners continue to collaborate on other initiatives, building on and expanding the Network and 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



of professional partners report that they
COLLABORATE
 with other organizations to engage the public in nano

Who are NISE Network partners collaborating with?

Partners that collaborate report working with:

80%
 universities
 or colleges

54%
 K-12 schools

51%
 museums or
 science centers

41%
 community
 organizations

29%
 industry

Source: NISE Network Professional Impacts Summative Evaluation (Goss, Auster, Beyer, Mesiti & Kollmann, 2016).

NISE Net has also encouraged collaborations between museums and community organizations as a way to engage new audiences in learning about nano. *Explore Science: Zoom into Nano* resources have helped Network partners work with national and local youth-serving organizations, libraries, schools, and other community organizations to reach underserved audiences, including low-income, female, and minority groups.

After participating in the Network's Museums & Community Partnerships initiative, 99% of professionals reported that they valued partnerships between museums and community organizations, and 94% of professionals reported being more likely to engage in similar future collaborations.

Source: NISE Net Museum and Community Partnerships Project: Evaluation Report (Todd, King, Cardiel, Ramos-Montañez & Kollmann, 2017).



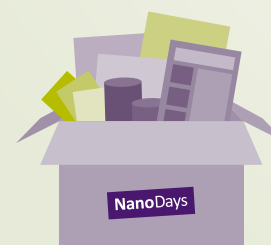
“The ready-made, high-quality products enable us to focus our efforts toward building and maintaining community relationships. Since we began our relationship with NISE Net, our community partnerships have flourished.”

ALEX EILERS, PINK PALACE MUSEUM, MEMPHIS, TENNESSEE

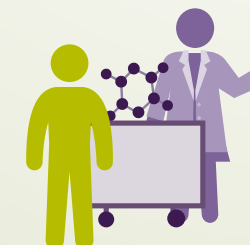
NISE Net offers many ways to **PARTICIPATE** in the Network community

Professional partners agree that NISE Net gives them opportunities to:

99%
receive new educational materials



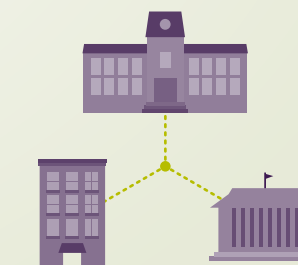
95%
learn from professionals at other organizations



94%
share their work with other partners



94%
foster local partnerships



Source: NISE Network Professional Impacts Summative Evaluation (Goss, Auster, Beyer, Mesiti & Kollmann, 2016).

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).

Each year

OVER 11 MILLION PEOPLE

participate in NISE Net
programs, events, and exhibitions

NanoDays kits

**1 MILLION+ PEOPLE
EACH YEAR**



Nano exhibition

**10 MILLION+ PEOPLE
EACH YEAR**



Source: Public Reach Estimations for the NISE Network (Svarovsky, Goss & Kollmann, 2015).



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 nanoscale science, engineering, and technology. From 2008 through 2015, NanoDays events and programming reached over seven million people.

Source: *Public Reach Estimations for the NISE Network* (Svarovsky, Goss & Kollmann, 2015).

“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 Sciencenter, 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 promotes learning by members of the public and event volunteers. Attendees and volunteers report increased confidence describing nano, and found more connections between nano and their daily lives after participating in NanoDays. High school and college students are more interested in STEM careers after volunteering at NanoDays.

Source: *Summative Study of the NanoDays 2014 Events* (Svarovsky, Tranby, Cardiel, Auster & Bequette, 2014).

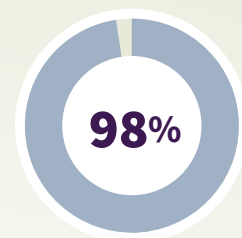


NanoDays kits contain all the necessary materials to plan and host a successful event

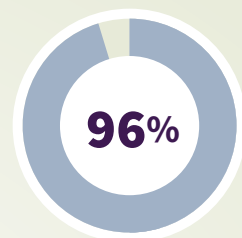
“NanoDays gives us opportunities to partner with local universities, business partners, and science organizations.”

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

NanoDays is
VALUABLE
for partners

100%
of partners who receive
NanoDays kits use the materials
throughout the year

Source: Summative Study of the NanoDays 2014 Events (Svarovsky, Tranby, Cardiel, Auster & Bequette, 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 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. The exhibition is designed to complement other NISE Net products, especially NanoDays activities.

From 2012 through 2015, Nano was hosted by 149 sites across the United States, reaching 23 million people. During this period, the Network increased the number of exhibition copies to meet demand. Today, a total of 93 copies are on display and over 10 million people each year visit the exhibition.

Source: *Public Reach Estimations for the NISE Network* (Svarovsky, Goss & Kollmann, 2015).



Evaluation results show that this mini-exhibition has a big impact. Visitors spend four times as long in Nano than the field-wide average for an exhibition of this size, describing it as interactive, informative, and family-friendly. After visiting the exhibition, guests report increased confidence talking about nano concepts. They also find more connections between nano and their daily lives, especially related to current topics and everyday applications.

Sources: *Summative Study of the Nano Mini-Exhibition* (Svarovsky, Goss, Ostgaard, Reyes, Cahill, Auster, et al., 2013) and *NISE Net Research on How Visitors Find and Discuss Relevance in the Nano Exhibition* (Kollmann, Svarovsky, Iacovelli & Sandford, 2015).



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

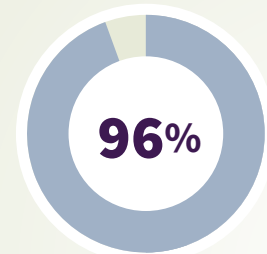
KAREN KNECHT, DA VINCI SCIENCE CENTER, ALLENTOWN, PENNSYLVANIA

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.

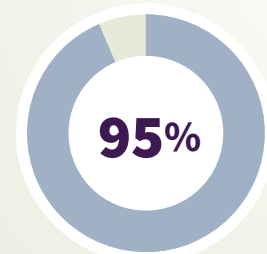
“Combined with ongoing professional development, NISE Net resources, and capped with the Nano exhibition, COSI team members across the institution have seized the opportunity to mainstream nanotechnology into their programs.”

JOSHUA SARVER, COSI, COLUMBUS, OHIO

Nano is
ENGAGING
for visitors

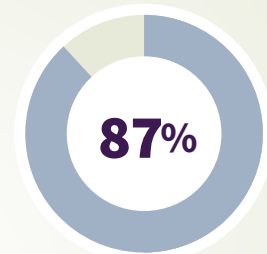


of visitors say the exhibition is enjoyable

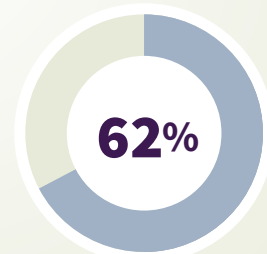


of visitors say the exhibition is interesting

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, Goss, Ostgaard, Reyes, Cahill, Auster et al., 2013).



NISE Net partners have also embraced the challenge to engage their audiences in conversations, games, and exhibits that explore the societal dimensions of nanotechnology. The Network has offered comprehensive staff training workshops and materials to prepare educators to effectively facilitate these experiences. By 2015, 83% of NISE Net professional partners reported they were offering learning opportunities related to nano and society.

Source: NISE Network Professional Impacts Summative Evaluation (Goss, Auster, Beyer, Mesiti & Kollmann, 2016).

“The nano and society activities have created opportunities for amazing conversations between interpreters and guests. The workshops and the training materials included with the kit are awesome.”

REI CAMERON, ARIZONA SCIENCE CENTER, PHOENIX, ARIZONA

INCREASING CAPACITY

NISE Net has created widespread motivation and capacity to engage public audiences in current science and emerging technologies.

NISE Net has established communication, collaboration, and a sense of shared purpose among professionals in several fields, including informal education, science, and engineering. Participation in the Network has had a transformative effect on individual practitioners, organizations, and the field of informal science learning.

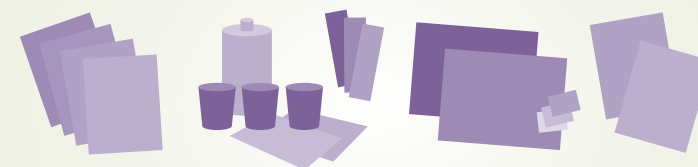


Nano & Society workshop



Working together, Network partners have created new formats and effective approaches to engage the public in complex topics. The Network has 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 NANO 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



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

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. Network mini-grants have provided partners with financial support for new projects to engage diverse audiences. 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 mini-grant allowed us to dedicate exhibit space to an exciting and progressive topic.”

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

IMPACT OF THE NETWORK

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

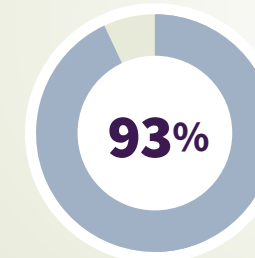
NISE Net has had a major impact by incorporating current science into regular museum exhibits and programs, improving the practices and skills of educators and scientists, generating and disseminating new knowledge related to informal learning, and creating lasting, valuable relationships among individuals and organizations. The relationships that NISE Net has fostered, and the practices and resources the Network has disseminated, will benefit partners for years to come.

Professional partners have integrated broader lessons learned from NISE Net into other work they do. For many partners, Network products and resources serve as general models for informal education. Network approaches help them communicate a variety of STEM topics with the public (91%) and develop other partnerships and collaborations (83%).

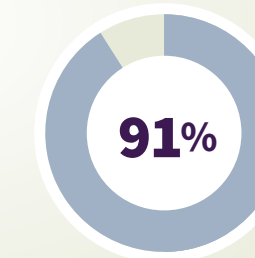
Source: NISE Network Professional Impacts Summative Evaluation (Goss, Auster, Beyer, Mesiti & Kollmann, 2016).



NISE Net is
VALUABLE
to professional partners



say the Network is valuable to their organization



say the Network is valuable to them individually

Source: NISE Network Professional Impacts Summative Evaluation (Goss, Auster, Beyer, Mesiti & Kollmann, 2016).

NISE Net's clear organizational structure, defined guiding frameworks, and inclusive and flexible philosophy were key to building a community capable of working together, sharing practices, following best practices, and adapting to meet individual institutional needs.

NISE NET YEARS 6-10 EVALUATION SUMMARY (BEQUETTE, BEYER, KOLLMANN, SVAROVSKY & WRIGHT, 2016).

SUSTAINING THE NETWORK

The National Informal STEM Education Network brings together educators, scientists and engineers, and diverse public audiences to talk and learn about a wide range of STEM topics.

The Network has increased capacity in the fields of informal learning and science communication by engaging our partners in collaboration. NISE Net has transitioned to an ongoing identity as the National Informal STEM Education Network. The Network's new projects leverage the capacity and relationships of hundreds of organizations across the United States, built in over a decade of working together on nanoscale science, engineering, and technology.



Building with Biology creates opportunities for conversations between scientists and members of the public about the cutting-edge field of synthetic biology.



Explore Science: Chemistry encourages public audiences to develop a sense of self-efficacy related to chemistry, and to find it interesting and relevant to their lives.

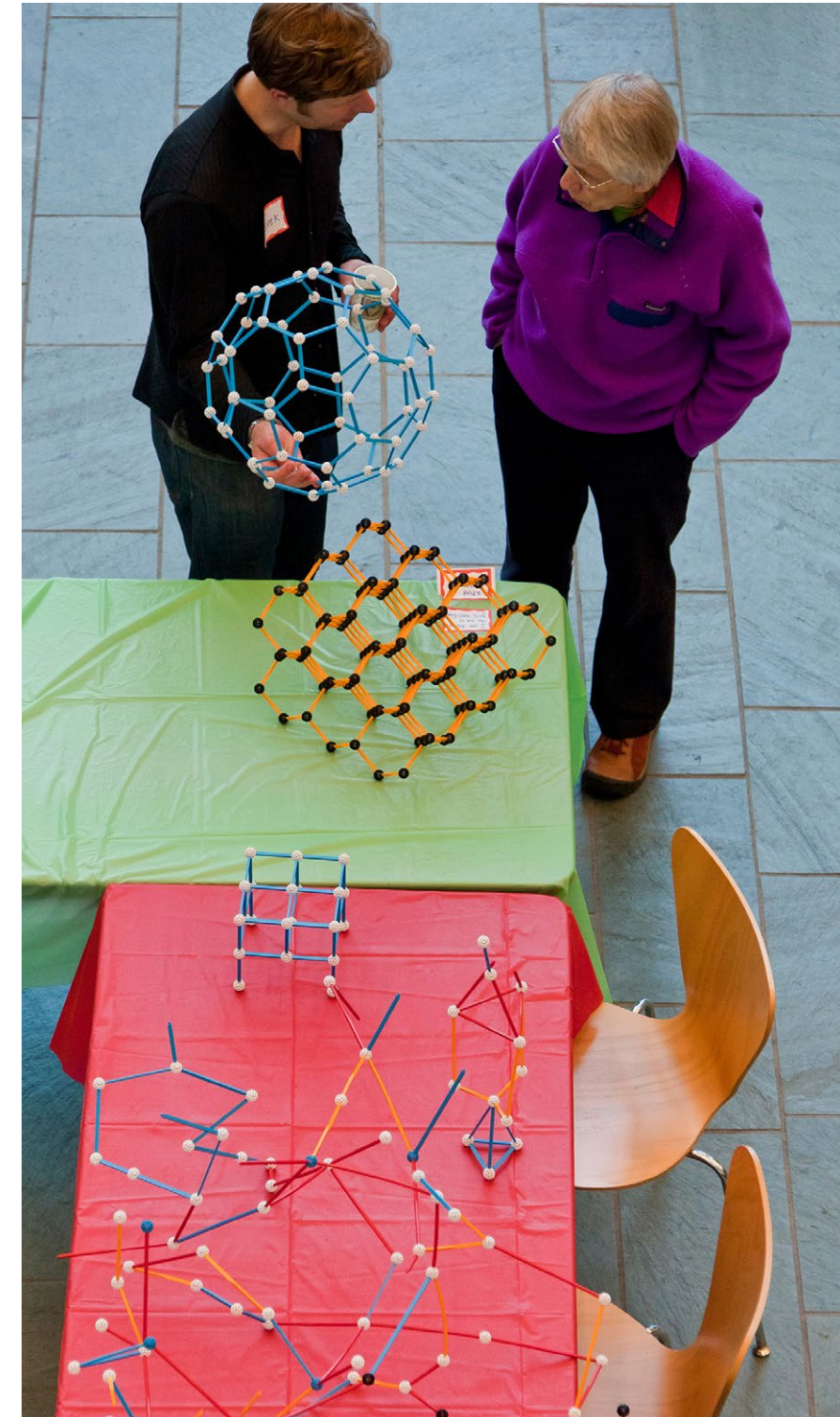


Explore Science: Earth & Space promotes learning about our planet and the universe through hands-on activities, exhibitions, and professional development.



“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

Research and evaluation reports

Bequette, M., Beyer, M., Kollmann, E.K., Svarovsky, G., & Wright, L.R. (2016). *NISE Net Years 6-10 evaluation summary report*. Boston, MA: NISE Network.

Goss, J., Auster, R., Beyer, M., Mesiti, L.A., & Kollmann, E.K. (2016). *NISE Network professional impacts summative evaluation*. Boston, MA: NISE Network.

Kollmann, E.K., Svarovsky, G., Iacovelli, S., & Sandford, M. (2015). *NISE Net research on how visitors find and discuss relevance in the Nano exhibition*. Boston, MA: 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.N., Goss, J., & Kollmann, E.K. (2015). *Public reach estimations for the NISE Network*. Saint Paul, MN: NISE Network.

Todd, K., King, Z., Cardiel, C., Ramos-Montañez, S., & Kollmann, E.K. (2017). *NISE Net Museum and Community Partnerships project: Evaluation report*. Boston, MA: NISE Network.

Guides and other 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.

Bell, L. & Olney, V. (2017). *Leading and managing the NISE Network: Practical solutions for creating a flexible national network*. Boston, MA: NISE Network.

Herring, B. (Ed.). (2010). *NISE Network public forums manual*. Durham, NC: NISE Network.

Jensen, K., Nuñez, V., Garcia-Luis, V., Ostman, R. & Lindgren-Streicher, A. (2011). *Translation process guide*. Portland, OR: NISE Network.

Kollmann, E.K., & Beyer, M. (Eds.) (2016). *Evaluating the NISE Network: Reflections from the evaluation workgroup*. Boston, MA: NISE Network.

McCarthy, C. & Herring, B. (2015). *Collaboration guide for museums working with community youth-serving organizations*. Saint Paul, MN: 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.

Ostman, R. (2016). *NanoDays: A NISE Network guide to creating activity kits, building community, and inspiring learning*. Saint Paul, MN: NISE Network.

Ostman, R. (2016). *NISE Network program development: A guide to creating effective learning experiences for public audiences*. Saint Paul, MN: NISE Network.

Ostman, R., Maletz, E., Jensen, K., & Jackson, A. (2012). *Bilingual design guide*. Ithaca, NY: 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.

Science Museum of Minnesota (2015). *NISE Network Nano exhibition: Creating a small footprint exhibition with big impact*. Saint Paul, MN: NISE Network.

Sciencenter. (2011). *Engaging the public in nano: Key concepts in nanoscale science, engineering, and technology*. 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



This report was based on work supported by the National Science Foundation under award numbers 0532536 and 0940143. The section entitled “Sustaining the Network” references additional work supported by the National Science Foundation under award numbers 1421179 and 1612482. 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.

The section entitled “Sustaining the Network” references work supported by NASA under cooperative agreement number NNX16AC67A. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the view of the National Aeronautics and Space Administration (NASA).

January, 2017

IMAGE CREDITS:

Casa Roig Museum, University of Puerto Rico at Humacao: page 27 (top left, top right)

Children’s Museum of Houston: page 21 (bottom)

Danville Science Center: page 21 (top right)

Farrell, Tierney: front cover, page 10 (bottom right), 28

Hodges, Gary: page 4, 10 (top), 12, 13 (top, bottom left), 16, 21 (top left), 23 (bottom), 25 (top right), 29, 31 (bottom left), 33 (left, bottom right), 34 (left)

Imaginarium Science Center: page 27 (bottom)

Maletz, Emily: page 3, 7, 8, 10, (bottom left), 17, 19, 20, 23 (top left, top right), 24, 25 (top left), 26, 30, 31 (right), 32, 33 (top right), 34 (top right)

McCabe, Ashley, Ashley Daubenmire Photography: page 31

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

Reynolds, Josh: page 34 (bottom right)

Science Museum of Minnesota: page 15

Stanek, Ken: page 13 (bottom right)