

NISE NETWORK

NanoDays

A NISE Network Guide to Creating Activity Kits, Building Communities, and Inspiring Learning

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www.nisenet.org

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Introduction

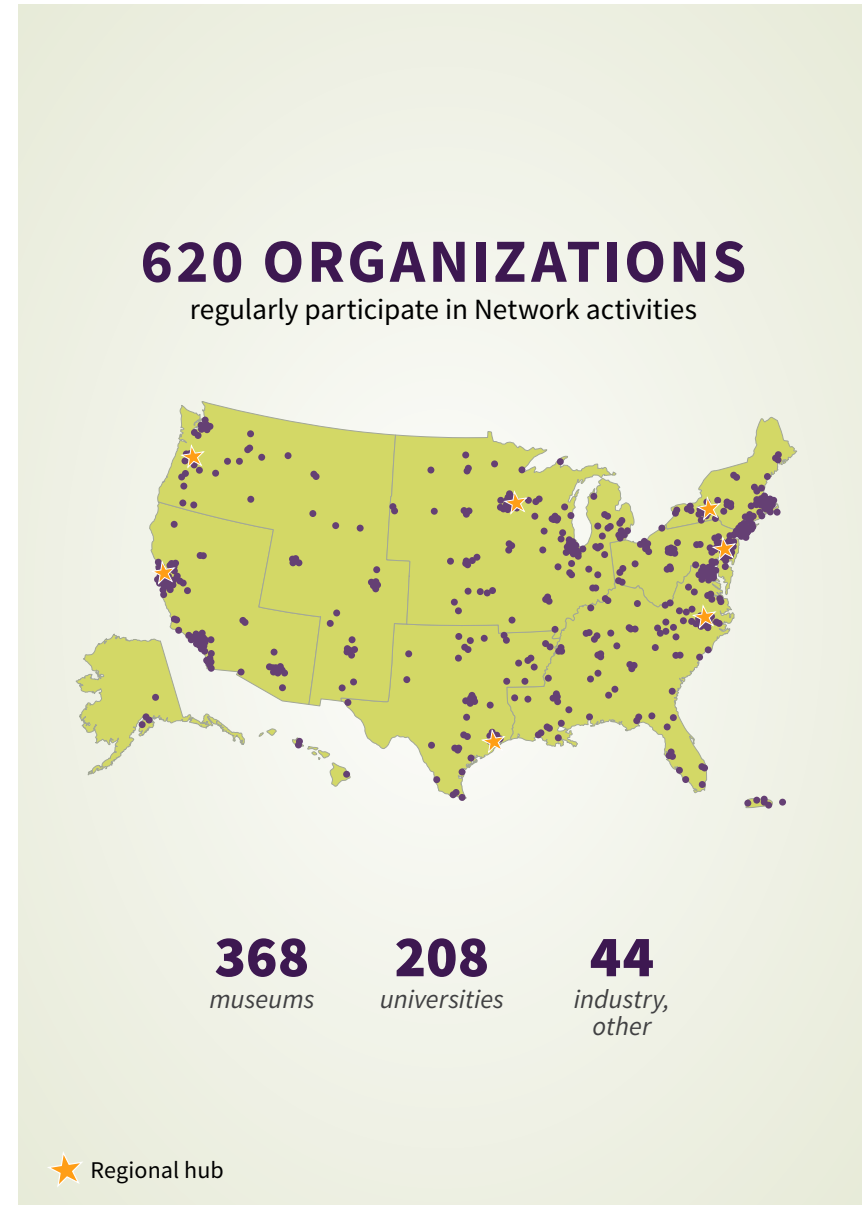
The NISE Network

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). The goals of NISE Net are to create a national community of partners to engage the public in nano, to develop and distribute educational experiences that raise public awareness and understanding of nano, and to generate knowledge about public and professional learning through evaluation and research.

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 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.

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. Our website, www.nisenet.org, offers hundreds of open-source educational resources that suit different educational contexts, engage diverse target audiences, and convey a range of content.



NanoDays is NISE Net’s signature event—an annual celebration that mobilizes hundreds of organizations across the country to engage staff, volunteers, and members of the public in learning about nanoscale science, engineering, and technology. NanoDays kits are the Network’s most widely used set of resources, reaching over a million visitors throughout the year.

About this guide

NanoDays is a complex effort that includes multiple Network teams working together to create resources and coordinate the participation of hundreds of partners. This guide focuses on the tools, ideas, and processes that are specific to creating a nationwide event such as NanoDays, which is supported by physical and digital kits that include professional resources and educational products. The guide describes the planning and development of NanoDays resources by a cross-organizational team, fabrication and distribution of the physical kits, implementation by hundreds of partners across the country through annual NanoDays events, and the impact of the initiative on public audiences. It is a complement to *NISE Network Program Development: A Practical Guide to Creating Effective Learning Opportunities for Public Audiences*, which provides an overview of the approaches, methods, and tools the Network uses to create all of our educational programs for public audiences (Ostman, 2015).



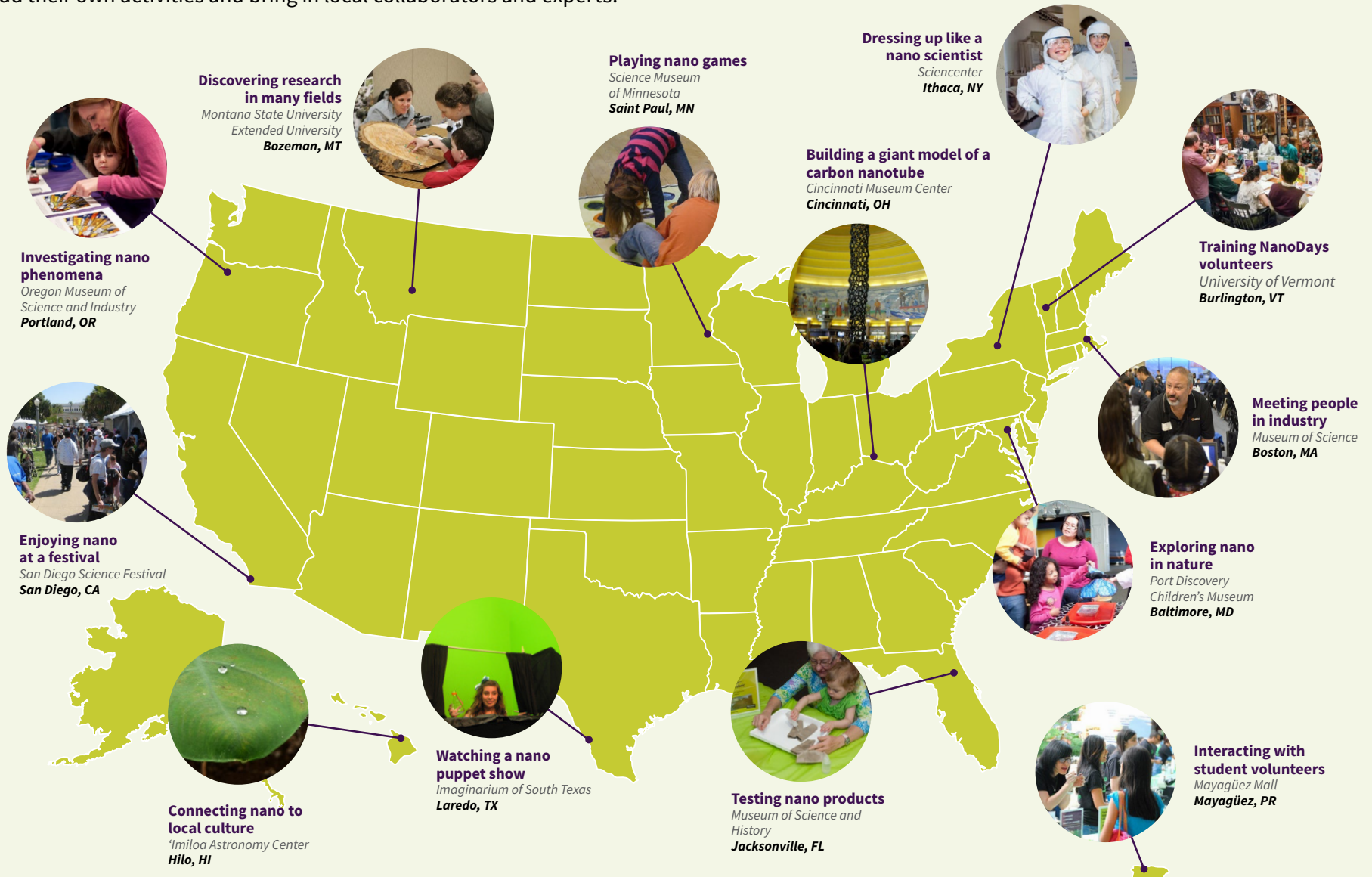
NanoDays Events and Kits

NanoDays is both an annual event celebrating nanoscale science, engineering, and technology, and a suite of programming and professional resources that NISE Network partners use year-round to provide hands-on activities for multiple and diverse audiences, from families and school groups who visit museums to outreach to underserved communities. Hundreds of NanoDays events are held at museums and universities each spring. There is great variation in local NanoDays events, as partners participate in ways that work best for their organization and community, but they have in common a core set of educational materials with hands-on activities produced by the NISE Net NanoDays team. These are distributed as both physical kits and digital kits.



NANODAYS EVENTS

Each year, NISE Net partners hold NanoDays events across the United States, in all 50 states and Puerto Rico. In addition to using the NanoDays kit materials, partners add their own activities and bring in local collaborators and experts.



PHYSICAL AND DIGITAL KITS

NanoDays physical kits contain all the necessary materials to plan and host a successful event: a host guide for planning; marketing and promotional materials; a set of individually boxed activities that include all needed supplies; posters, media, and other kinds of programming; staff and volunteer training materials; tablecloths and signage to give the event a unified look and feel...and more! Meanwhile, the digital version of the kits allow free download of open-source materials.



TOOLS FOR PLANNING AND IMPLEMENTING NANODAYS EVENTS

NanoDays kits include many resources to help plan and implement successful educational events, such as a planning guide, promotional materials, and staff and volunteer training resources.



MATERIALS FOR ENGAGING PUBLIC AUDIENCES

NanoDays kits include a variety of educational materials, such as hands-on activities, public programs, games, videos, books, and posters.



Goals

The goals of NanoDays are directly related to and aligned with overall NISE Network goals to build a national network, increase capacity in the field to engage the public in nano, and reach large and broad public audiences across the country. NanoDays goals include:

1. Cultivate a national network of museums and research institutions working together to engage the public through common participation in a national event related to nanoscale science, engineering, and technology (“nano”).
2. Provide a tangible opportunity for NISE Net partners to develop and strengthen local partnerships between museums and scientists or research centers.
3. Increase capacity in the informal science field to engage the public in nano content, building on and contributing to best practices in informal education.
4. Engage diverse public audiences in learning related to nano at NanoDays events.



Planning, Developing, and Fabricating Kits

The most essential part of the NanoDays kits—and events—are the branded NanoDays learning experiences. NanoDays activities are simple yet powerful. Many allow visitors to explore the unusual properties of nanoscale materials and technologies, such as a tiny teacup that won't spill water, a mysterious magnetic fluid, red-colored gold, and glass objects that seem invisible. Very young visitors enjoy experiences such as whole-body games, extra-large puzzle blocks, and giant models of carbon nanotubes made from balloons. Adults appreciate contextual information such as posters that provide information on the societal and ethical implications of nanotechnology and videos that “zoom in” to provide a nanoscale view of natural and human-made objects, such as butterfly wings and computer chips.

Process

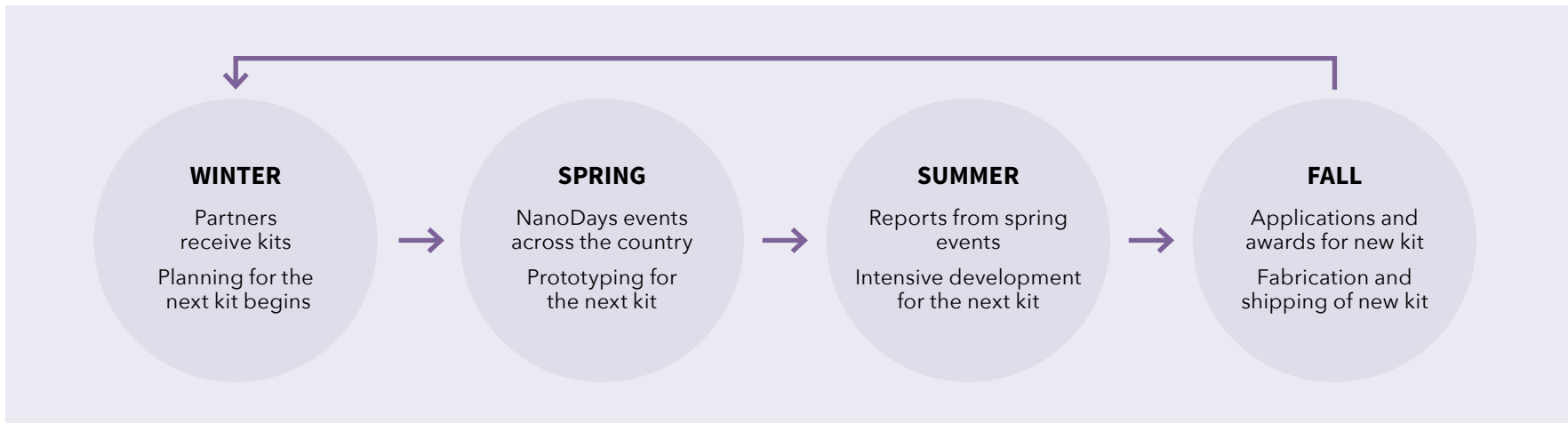
NanoDays activities and other educational products and resources are planned, developed, and disseminated by a team that includes members from museums and universities across the country. The ability to draw on educators and evaluators from many different organizations has given the NanoDays team great flexibility and depth of expertise in developing products. In addition, the integration of many different organizations into the development teams provides insight into what kinds of programs, resources, and documentation are useful for our diverse partner organizations. The NanoDays team works closely with other NISE Net development teams, including the

program group, the Network community group (including the regional hub leaders), and the evaluation team.

NanoDays program development is an annual project, with new educational activities and professional resources (such as training materials) produced each year. The rigorous NanoDays development process includes formative evaluation with museum visitors, peer review by museum staff and volunteers, and scientist and expert review to ensure accurate content (in both English and Spanish). The team uses principles of universal design to ensure that the activities are inclusive and accessible to broad public audiences, and a universal design review is part of the development process as well (see Museum of Science, 2010).

Following each annual NanoDays event, educators who received a physical kit report on their local programming events and partnerships, and make suggestions for improving NanoDays resources in the future. The NanoDays team is diligent about incorporating their advice. For example, we have included more activities appropriate for very young children, and more training materials for staff and volunteers based on partner feedback, and have also improved specific activities based on their suggestions. There are now over 100 NanoDays educational products and accompanying educator resources.





Annual cycle

WINTER Planning for the new kit begins. NanoDays kits are distributed to partners in January, and the event occurs a few months later. But the development team is already looking ahead to the event 15 months down the road, because we prototype next year’s activities at this year’s event.

SPRING NanoDays events are held over a 9-day period in the spring, spanning two weekends. The official NanoDays event period is typically at the end of March/beginning of April. NISE Net partners are free to schedule their events (and use their kits) at other times of the year, but it is exciting to have a common activity that almost the entire Network participates in simultaneously.

SUMMER Each partner receiving a NanoDays kit is required to fill out a report explaining how they used the kit. The reports also provide an opportunity for partners to share feedback on the resources and suggestions for the next kit. The NanoDays team uses the reports to make decisions about what to include in the next kit, and the Network community team uses this information to make decisions about how the next kits will be awarded. Meanwhile, the development process for next year’s NanoDays is most intensive during the summer.

FALL NanoDays development wraps up in early fall, and the fabrication team goes to work ordering supplies, putting together the kits and shipping them out. Meanwhile, the Network community group is coordinating applications and making award decisions for the kits.

Planning

NanoDays public engagement products are informed by front-end research performed at the beginning of the NISE Net project (Flagg, 2005), which indicated that public audiences were likely to have little familiarity with nano and its potential applications. As a result, NanoDays activities focus on providing foundational knowledge, creating links to everyday life and to other STEM topics, and explaining the potential of nanotechnologies to address major societal issues that are interesting and relevant for broad public audiences.

The development of NanoDays public engagement products is also shaped by the NISE Network content map. This tool was created through an extensive process of consultation with experts in informal education and in nanoscale science, engineering, and technology (Bequette et al., 2012 and Sciencenter, 2011).

The NISE Net content map identifies 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 weren't 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.

Recommendations for planning kits

To provide a comprehensive treatment of a topic that can be used with a wide range of audiences:

- Focus on a few clear main concepts, and provide more than one way to explore each one.
- If your kit is intended for an event, it should include a critical mass of things to do. NISE Net usually includes around 10 hands-on activities, plus videos, posters, books, and other learning opportunities.
- Provide a variety of activities suitable for different audiences. Be sure to include some activities that are appropriate for young children.
- At least one activity should have a take-home product. People also like inexpensive, promotional giveaways like temporary tattoos.
- Messy activities can be especially fun and memorable, but don't include too many. Some sites are unable to use them or have limited areas where they can do them, and some audiences will avoid them.
- A big, showy display of some kind can help make audiences aware of your event and create excitement for it. (NanoDays events often use a large model of a carbon nanotube made of balloons.)
- Decide on a reasonable number of consumable supplies. For NanoDays kits, we include supplies for at least 100 uses of each activity.

Professional resources help partners plan and implement a successful event:

- Provide a planning guide that walks host sites through the process of planning and implementing their event. A timeline checklist is very useful, indicating what to do when. Links to other resources are also helpful.

- Providing ready-to-use marketing and promotional materials makes a big difference for organizations with limited resources.
- Simple supplies can help create the impression of an exciting event. For example, brightly colored disposable tablecloths are practical, inexpensive, and help signal that a set of activities form a unified event.
- Table signs make it easy for visitors to navigate an event and figure out what to do at each station.

Staff and volunteer training materials are essential:

- Ideally, training materials should be included in physical kits (for on-site use) and online (for advance use).
- Training should include an overview of your event and its goals, top-level learning objectives for public audiences, and the schedule of activities. Activity facilitators will also need to familiarize themselves with and practice their activities.
- Each activity should be fully documented, so that volunteers can figure out how to use it on their own, if necessary. Even for very simple activities, staff and volunteer educators appreciate video training tools in addition to written guides.
- Simple, fun activities make good use of volunteers. Events often rely on one-time volunteers, and they will be happier and do a better job if they are deployed in activities that require relatively little training.

Development and fabrication

To develop our educational materials, the Network consistently uses a rigorous process that includes peer review, expert review, visitor testing, and partner feedback.



PEER REVIEW

NISE Net program team members and Network partners offer suggestions on content, audience, and design of NanoDays materials.



EXPERT REVIEW

Experts review NanoDays materials to ensure the content is accurate and to provide feedback on pedagogy, universal design, cultural relevancy, and other aspects of their design.

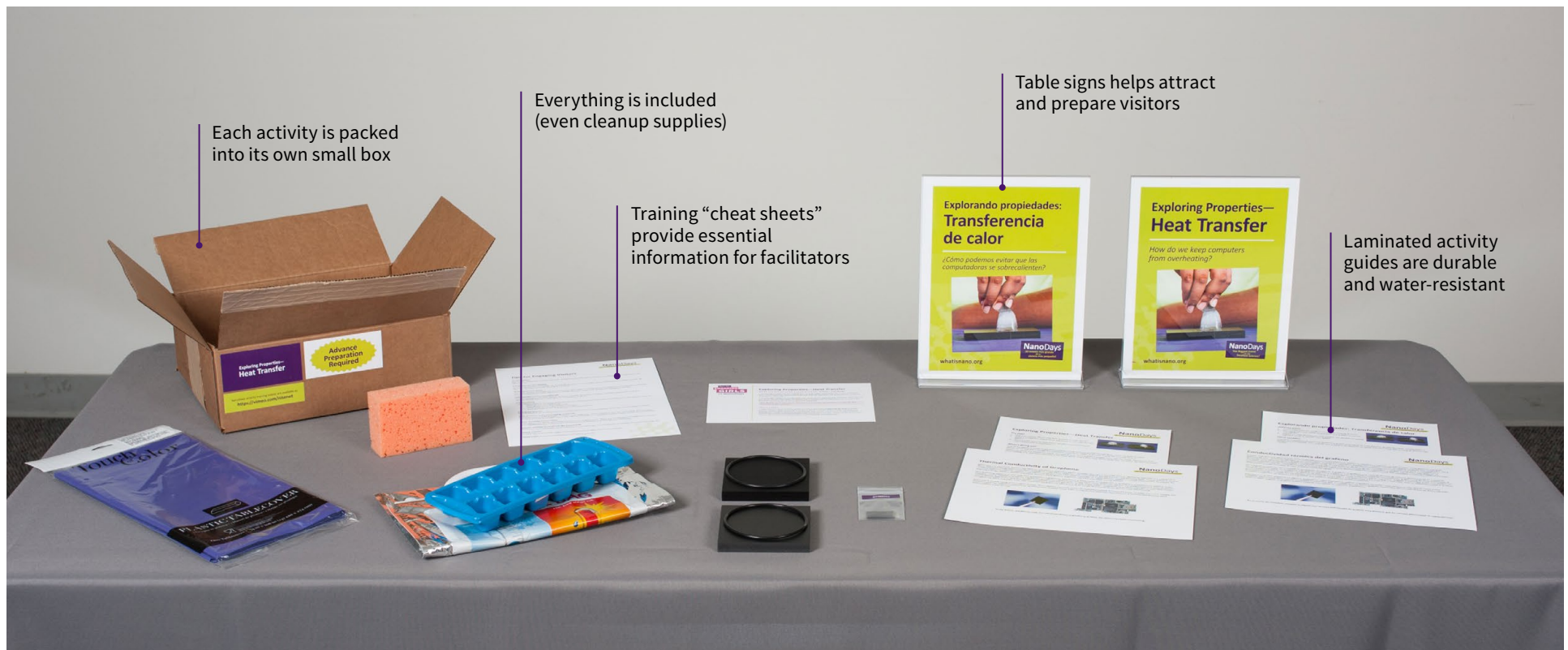


VISITOR TESTING

NanoDays activities are tested with visitors at more than one site to ensure that they work in different settings and can be implemented easily by staff and volunteers.

NANODAYS DEVELOPMENT AND FABRICATION

The production and distribution of physical and digital kits is a complex process. For NanoDays, this involves: *ordering supplies* (from basic cardboard boxes to specialty items such as ferrofluid), *making materials* (from liquid crystal goo and pinwheel holders to digital zip files), *assembling individual elements* of the kits (from activities to educator packets), and finally, *packing the boxes and shipping them* (from Hawaii to Maine!).



Each activity is packed into its own small box

Everything is included (even cleanup supplies)

Training “cheat sheets” provide essential information for facilitators

Table signs helps attract and prepare visitors

Laminated activity guides are durable and water-resistant

Recommendations for developing and fabricating kits

Activity kits can be an ongoing resource for all different kinds of programming:

- Short hands-on activities are fun and effective learning experiences for many audiences, and they're easy to incorporate into all kinds of programs.
- Including a variety of additional resources such as longer programs, posters, and videos provides lots of options for using materials for different audiences in different contexts.
- Include everything in the kit, even the most basic supplies, such as pencils and paper. If an activity kit is fully stocked, it is much more likely to be used.
- Consumable materials and supplies should be readily available and inexpensive. If the kit is easy to restock, it is much more likely to get ongoing use. Be sure to indicate where to get more supplies.
- All materials (consumable and durable) should be easy to store and retrieve.

As you develop individual components of a physical kit, think ahead to fabrication and shipping:

- Keep an eye on overall costs. You can balance out cheap and expensive activities to stay within your budget, so if you're aware of the costs for each activity you can factor that into your decisions about what goes into the kit.
- Price out everything early on. Researching different sources for materials can save a lot of money, especially when you are making a large number of kits. Some services, such as printing, can be

surprisingly expensive, so price them out ahead of time so you can weigh their costs and value.

- Keep in mind that you'll need to order more of each material than the total number of kits you intend to make. Some items will arrive damaged, the manufacturer may inadvertently send fewer items than you ordered, or two of the same item may be accidentally packed into one kit. Over-ordering safeguards against coming up short on materials.
- Always think about what (and how much) will fit in the box! Early on, you'll need target and maximum dimensions for individual supplies and individual elements. Shipping costs will go up when the box is bigger and heavier, and many sites find it difficult to move and store very large boxes.
- It is a logistical challenge to get all the pieces to fit in the kit and to be sure you have the correct number of everything you need in every box. Your fabrication team should be detail oriented and accustomed to complex tasks!
- As you order materials and assemble the kits, you will need a lot of space—much more than you may expect. If you are making 100 or more kits with multiple components, you will need a warehouse or similar large space.
- To avoid having all of your materials spread out everywhere awaiting final pieces, try to have all materials on hand before you begin packing.
- Plan your shipment in advance. Call ahead to your shipping company of choice, and be sure to schedule the correct size truck, according to how many and how large your boxes are.

Physical and digital kits are complementary:

- Physical kits make the resources easy to use, removing barriers of time and money to pull together supplies and helping encourage staff and volunteers to try things they might not otherwise.
- Downloadable digital kits cost less to produce, and can be widely accessible beyond the distribution of the physical kit.
- Digital kits are also a handy way to share across an institution, allowing people to go online to access the various educational, planning, and marketing materials, so that the physical kit can stay intact in one place until it's ready to be used.
- Keep in mind that if you are creating both physical and digital kits, you may need different versions of some digital files: a print-ready version for a professional printer to use to create resources for the physical kit, and a print-your-own version for the digital kit that is suitable for regular office printers and standard office paper sizes and types.

Implementing National Events

NanoDays has been essential to the Network's identity and is a key means of participating in it. The Network and NISE Net grew together: when NanoDays began, NISE Network partners numbered in the dozens, and almost no informal science education organizations were engaging public audiences in learning about nano. After just a few years, NanoDays had helped the Network grow to a point where hundreds of organizations were involved, and we were no longer focusing on recruiting new participants, but rather working to build capacity and strengthen relationships among partners.

NISE Net strategies related to NanoDays have changed through the years in response to the overall trajectory of the Network. As a result, some of the following sections offer contrasts between the early years of NanoDays and its maturity. Overall, however, this guide focuses on strategies that we found successful and that seem promising for other projects.

Communication and coordination

NISE Net has a Network community based on a regional hub system. Each region of the US has a hub leader that coordinates and supports partner participation in Network activities. While the specifics of this structure have shifted over time, the community group has remained the mechanism through which the Network builds relationships and increases capacity (resources and knowledge) to engage the public. The hub leaders recruit partners, encourage their participation



in NanoDays and other Network initiatives, and coordinate the applications, awards, and reports associated with Network activities. The hub leaders coordinate closely to ensure that potential partners receive consistent messages and equitable opportunities to participate in Network activities. Other national events could certainly use a different organizational structure, systems, and tools than we used in NISE Net, but based on our experience we do recommend centralized and coordinated communications.

The NanoDays application and award process is based on Network goals for the initiative. NISE Net strives to be clear about our eligibility requirements and our criteria for awarding kits, to award kits according to those requirements and criteria, and to focus on minimizing the reporting burden by collecting only information we will use.

Applications and awards

NISE Net produces two kinds of NanoDays kits: physical kits and digital kits. Both kits provide the same information and resources, including educational products for public audiences and resources

for professionals. Physical kits contain all materials, supplies, and digital files for each NanoDays product, while digital kits include digital files only.

Physical kits are distributed annually on an application basis to educators based at museums, universities, and other informal learning organizations in the United States. The digital kit is available for free download to other educational organizations, including international locations outside the US, K-12 educators, and libraries. Physical kit eligibility guidelines are determined by the mandate and requirements of NISE Net's funding through the National Science Foundation.

NISE Net has recruited organizations to participate in NanoDays through the personal and professional relationships of existing Network partners; through presentations and exhibit hall booths at national conferences, such as the Association of Children's Museums (ACM), the Association of Science-Technology Centers (ASTC), and the Materials Research Society (MRS); and through the leadership and structure of allied initiatives such as the National Nanotechnology Infrastructure Network (NNIN). As NISE Net grew and partners became more invested in Network activities, our NanoDays recruiting strategy shifted to targeting partners for specific reasons, such as achieving geographic distribution across the entire country. We have also been able to use the kits as incentives and resources to encourage activities beyond participation in NanoDays itself.



The NanoDays application takes about 20 minutes to complete. It focuses on ascertaining an organization's eligibility for a physical kit, determining whether an organization's goals for NanoDays are aligned with Network goals, identifying the potential impact of an organization's anticipated event, and clarifying reporting responsibilities and other commitments of host sites.

Reporting and evaluation

Each organization that receives a physical NanoDays kit is required to fill out a simple report about their local event. A link to an online survey can be found on our website, and regional hub leaders also communicate directly with kit recipients about the reporting process. Kit recipients have about a month to fill out their reports after the nationwide NanoDays event period.

While the NanoDays report changes slightly from year to year, the Network is generally interested in learning more about NanoDays events, including local goals, partnerships, activities offered, and participating public audiences. The report takes 20-30 minutes to fill out. Responses are not anonymous, as this information is used to ensure responsible use of Network resources, and are taken into account when we award future activities. In addition to the mandatory questions, the NanoDays report has often included optional questions to help the Network improve future NanoDays kits and other NISE Net efforts and resources. Responses to the optional

questions of the online survey are anonymous and do not affect the award of future kits.

NISE Network evaluators also contact partners receiving NanoDays kits to ask for feedback about Network educational products, to learn about the reach of other NanoDays activities, and to determine the impact of Network activities. Participation in project evaluation is optional and anonymous, and does not directly affect kit awards.

Scheduling and promotion

The national NanoDays event period is in late March/early April. This time of year was chosen to be feasible for both museum and university partners; to avoid other existing, similar events (such as National Chemistry Week in the fall); and to fit within the Network's overall program of activities. The Network promotes a nine-day event period, though local hosts can vary from this schedule if necessary. The Network tries to avoid major holidays such as Easter and Passover when scheduling the national event, while individual host sites decide whether and how to coincide with or avoid school breaks and other local events.

On the national level, the NISE Net promotes the nationwide event primarily to partner organizations, but not to national media outlets. The Network uses our website, blog posts, and social media platforms to communicate broadly. We also leverage professional societies to spread the word and encourage participation. NanoDays kits include marketing and promotional materials that host sites can customize and use locally.



Recommendations for implementing national events

Establish clear goals for national events and communicate them widely:

- A nationwide event will be strongest if participating partners are working toward the same goals. That said, each local or individual host may have somewhat different goals, or may only focus on a subset of goals.
- Understand the motivations and incentives for local participation from the very beginning. Seek input and feedback from potential and existing partners.
- Create an identity that reflects and supports event goals. Branding is a powerful way to communicate with both professional and public audiences.

Distinguish between public and professional audiences, their roles, and your intended outcomes:

- NanoDays achieves its impact on public audiences through the efforts of our local partners. As a result, we find it essential to support the professionals who plan and implement NanoDays events, and to meet the specific needs of local organizations and communities.
- Local partners are an important source of knowledge about potential and actual audiences and the best ways to support their participation. Again, seek input and feedback from participants.

Support and take advantage of your community:

- Use existing networks of individuals, organizations, and professional associations. A recommendation from a trusted source is still an important way to encourage participation—by both public and professional audiences.
- Participation in a national event can help create a national Network with a common identity and purpose.
- National events can provide visibility, support, and validation for local efforts. Help partners leverage that potential.
- To build relationships and stay in contact with partners, create an organizational structure and communication and documentation systems that can grow over time and be accessed by many different people.
- NISE Net allows partner organizations to take ownership of their NanoDays events. We encourage host sites to customize their events, and provide the tools and ability to adapt and modify specific materials to serve local audiences.
- By offering a variety of other ways for Network partners to interact and contribute beyond NanoDays, NISE Net created a foundation for NanoDays and then built on it.

Impact of NanoDays

NanoDays is a successful model of public engagement that works for many different kinds of organizations, including museums and universities. NanoDays is relatively easy for individual organizations to implement, but has a great collective impact. Each year, the program involves hundreds of organizations nationwide, thousands of staff members and volunteers, and over a million members of the public.

NISE Net leadership and partners agree that the growth of the Network is directly related to the success of NanoDays. When NISE Net began in 2006, it faced numerous challenges. The content and pedagogy of nano education was only just emerging, along with this new field of research itself. Little was known about how to design informal education resources to effectively communicate nano science to public audiences in informal settings. Informal educators had scant knowledge of nanoscale science, engineering, and technology, and fieldwide, there were few opportunities to gain the content knowledge, skills, comfort, and confidence they needed to engage the public in this cutting-edge field. And finally, at the institutional level there was little expertise, experience, or incentive to do nano education for the public (St. John et al., 2009).

NanoDays gave potential partners an incentive and a relatively low-risk commitment to join the Network: a physical kit of valuable programming resources in exchange for a commitment to host a NanoDays event. When the Network was planning the first NanoDays event for 2008, we hoped to fabricate 35 kits and convince around 20 organizations beyond the funded Network partners to host NanoDays. We were surprised by the interest and demand across the country—especially among science museums and children’s museums—and



were able to launch NanoDays with 100 participating sites in 2008. The eighth and final NanoDays kit was developed in 2015. Physical kits were shipped to 250 sites, and additional sites participated through online digital kits. NanoDays events are continuing across the country, as NISE Net partners continue to collaborate locally to engage the public in learning about nano.

NISE Net summative evaluation and research studies indicate that NanoDays is successful in achieving all of its goals, as presented above. Highlights of our ongoing evaluation and research studies are shared here, as well as reflections from our partners on the impact of NanoDays on their organizations.

Building collaborations

GOAL:

Cultivate a national network of museums and research institutions working together to engage the public through common participation in a national event related to nano.

NanoDays fosters a sense of Network identity by providing partners with meaningful opportunities to take part in a common, nationwide effort. Participation in NanoDays introduces partners to NISE Net and gives them an active role in achieving our goals related to both public engagement and collaborations. Ongoing participation in NanoDays encourages increasing investment in the Network and in our public engagement efforts (Alexander et al., 2010; Goss et al., 2016).

Our partners also report that NanoDays helps them to achieve their organization's goals, and reflect on the ways that engaging the public in nano has become part of their museum's identity:

"NanoDays events have rallied our students, postdocs, and staff scientists to share their love of science with the general public. Outreach events provide creative and engaging opportunities for our Center members to put their research into a larger social context and make it relevant to the community. They have been able to improve their science communication skills and see the bigger picture of their work."

– Maria Wang, Stanford University

"NanoDays events and kits have had a profound impact on our museum. NanoDays is an annual event for us and the kits make it so easy to conduct. The nano materials have made their way into almost all that we do: afterschool programs, outreach, scouts, homeschool, teacher workshops, and exhibits."

– Michael Rathbun, Discovery Center Museum

"Initially, I didn't get a lot of support to bring nano to the museum. But now it's a very different thing. Nobody wants nano to stop. It has become embedded in our museum. It is our niche. It is what we do."

– Nora Thompson, Port Discovery Children's Museum



GOAL:

Provide a tangible opportunity for NISE Net partners to develop and strengthen local partnerships between museums and scientists or research centers.

NanoDays has provided NISE Net partners with opportunities to form and sustain partnerships. The Network includes hundreds of invested organizations that continue to build on and expand national, regional, and local collaborations. Nearly all of these relationships began with NanoDays, but many have proven so beneficial that they are being leveraged to engage the public in different topics related to science, engineering, and technology. NanoDays relationships have also helped partners to reach new audiences and find new ways of engaging local communities. NanoDays has created and facilitated relationships among organizations and individuals in the ISE field that will be beneficial for years to come (Beyer, Guberman & Iacovelli, 2016).

Partners also reflect on the ways that NanoDays has led to new and stronger collaborations with other organizations:

“The NanoDays event and kit continues to bolster our institution’s connection to current science and technology. We have been able to find and leverage new partners, especially among our state universities. These connections have led to new and expanded participation in other national projects. The resources and support made accessible by the NISE Network have been a catalyst for institutional growth and networking opportunities that we previously struggled with.”

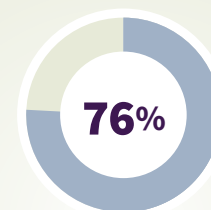
– Joe Schwanebeck, Science Center of Iowa

“NISE Net and the NanoDays kits have benefited my immediate program, the university, area partnerships, and interpersonal relations. In the four years I have received the kits, my outreach collaboration has grown immensely. My events draw volunteers from many different disciplines, increase collaboration among staff, and increase participation by museums.”

– Heather Armstrong, University of New Mexico

“NanoDays created an opportunity for collaboration between many new partners at Penn State. The impact on our organization resulted from the positive and successful experience of working on a large project with these groups for the first time. New foundations were created, existing professional relationships were deepened, and doors were opened for future collaborations.”

– Kristin Dreyer, Penn State University, Materials Research Science & Engineering Center (MRSEC)



76% of NISE Net partner organizations report

COLLABORATION

with other organizations to engage the public in nano

Source: NISE Network professional impacts summative evaluation (Goss et al., 2016).

Increasing capacity

GOAL:

Increase capacity in the field to engage the public in nano content, building on and contributing to best practices in informal education.

When NISE Net began, almost no museums or universities were engaging general public audiences in nanoscale science, engineering, and technology. In the early years of the Network, NanoDays gave educators and scientists confidence that they could facilitate effective learning opportunities about nano, and provided them with a complete set of resources to do so on an ongoing basis. The success of the annual event and the high quality of the NanoDays kits helped to commit museums and universities to participate in the Network and engage their public audiences in nano.

Through the years, as NanoDays has become institutionalized at hundreds of museums across the United States, the Network has been able to leverage the program not only to increase capacity related to nano education, but also to introduce best practices and help advance the field more generally. For example, in 2010, through the kit application and award process, we began to encourage and incentivize partnerships among museums and scientists in delivering their NanoDays events. In 2011, we introduced bilingual Spanish-English NanoDays materials and began encouraging partners to host bilingual events. In 2012, we introduced activities and materials to encourage open-ended conversations about the relationships of

nanotechnology and society. And in 2015, we introduced resources to help partners better engage girls with NanoDays.

The longitudinal Network professional impacts study is extending past NanoDays project work, and preliminary results are not available to include in this guide. However, Network research and evaluation studies have found that:

- NISE Net partners report increased confidence, knowledge, and skills in engaging a variety of public audiences in nano content, and attribute this increase to their participation in the Network
- Partners report that they draw on information and professional development from the NISE Network in work that is unrelated to nano, including best practices and resources disseminated through the NanoDays kit
- Of all the resources NISE Net offers, NanoDays is the top-rated in terms of value for partner organizations

(Beyer, Guberman & Iacovelli, 2016; Goss et al., 2016).



Partners are eloquent about the impact NanoDays has had on their capacity to engage the public in nano specifically, and STEM topics more generally:

“NanoDays and the NISE Net provides our organization with a wonderful opportunity to reach out to our community with exciting and cutting-edge science. The kits are so well created that they empower our staff and volunteers—many of whom have little science knowledge—to talk about challenging concepts.”

– Kerri Jackson, formerly of Alaska Museum of Science & Nature

“It is hard to overestimate the positive impact that participation in NanoDays has had on our campus. The kit materials have inspired us to create new exhibits for our permanent collection and have really changed the way we train volunteers. The undergraduate students who have volunteered for our NanoDays event thoroughly enjoy the event; they return year after year and have spread the word amongst their friends so that we have no trouble recruiting facilitators for our events.”

– Kelly Gallagher, AJ Read Science Discovery Center of Oneonta

“The impact of the kit and the events has been phenomenal. They have made a significant impact on how people here not only engage in and perceive nano science, but also just how they perceive engaging with and understanding the world. We were thrilled to see our volunteers shifting from telling and holding objects to facilitating authentic experiences. This is a shift we have been working toward for a while now, and the activities supplied in the kits advanced the volunteers’ knowledge and comfort in practicing inquiry.”

– Heather Paulsen, formerly of Thanksgiving Point Institute



“The NanoDays training materials, event, and kits have had a tremendous impact on helping improve how we engage and interact with the public and our outreach programs. The training materials and kits have allowed us to increase our volunteer pool, educate them, and ease their apprehension.”

– Bernadette Hernandez-Sanchez, Sandia National Laboratories

“During my time at the Science Spectrum museum, NanoDays kits were instrumental in revitalizing and restructuring what and how we taught at the museum. It wasn’t just the activities that were important, but being able to see how the events were put together, how well the activities were researched, and how they were structured to make difficult concepts easier to teach to young children. NanoDays empowered us to be able to create other new programming of higher standards and quality.”

– Jacie Hood, formerly of Science Spectrum

Engaging the public

GOAL:

Engage diverse public audiences in learning related to nano at NanoDays events.

NanoDays has established that diverse public audiences—including families with young children—can be successfully engaged in this emerging field of current science. NanoDays has had a significant impact on the public engagement activities of both museums and universities across the United States. NanoDays activities are flexible building blocks that partners use year-round, incorporating them into many different kinds of learning experiences, in a variety of settings, for diverse audiences (Svarovsky et al., 2015).

Evaluation results indicate that NanoDays is successful in reaching a large and diverse audience. Conservative estimates show that 1.25 million members of the public participated in NanoDays activities in 2015, both at the annual event and in other programming throughout



the year. Because the activities are flexible, brief, and related to many different disciplines and basic concepts in STEM, 100% of NISE Net partners report that they use NanoDays resources throughout the year.

Cumulatively, 8 million members of the public engaged in NanoDays between 2008 and 2015 (Svarovsky et al., 2015).

Partners describe how NanoDays helps their organizations engage multiple and diverse audiences in effective learning opportunities:

“We utilize NanoDays kits and other materials from NISE Net in almost every program we run here at the museum, including demonstrations, camp-in programs, overnights, summer camp, special events, and various workshops. The information and support (in various ways) from NISE Net and our NanoDays kits overall has been instrumental to our education department!”

– Emily Alexander, formerly of Milton J. Rubenstein Museum of Science and Technology

“I love my NanoDays kits and we’ll probably use them forever. I use them in teacher education for my pre-service teachers. I use them in my graduate teaching programs. I use them when I go out and do workshops with teachers. I use the NISE Net materials when we do outreach with the public. The kits are stand-alone and everything is well designed and highly engaging, so we’re able to use them in a whole array of things—everything from the state fair to going to one of our local science centers to going to a school.”

– Gail Jones, North Carolina State University

“Over the years, NanoDays kits have given the staff tools used for outreach and family learning experiences. Thanks to NanoDays, we have been privileged to touch the lives of many, including various sectors of underserved audiences, with science activities that are attractive, easy to teach, and fun to do and learn!”

– Jill Kary, Arkansas State University Museum

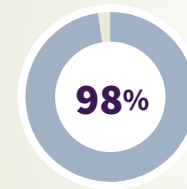
“Having nano content ready to go from the NanoDays kits has also helped new initiatives to reach new audiences. Because the activities and training materials are so well-developed and ready to train and deliver, we can focus our energy on reaching out to new communities knowing that we have content and programs at our fingertips.”

– Jayatri Das, The Franklin Institute

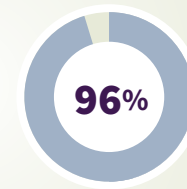
“NanoDays materials are very interactive and that is appealing to the parents and young children who participate. The materials provided are so professionally developed, clever, and thorough, it enhances the experience of our visitors. The diversity of the material provided is rich, giving visitors a greater awareness of nanoscience and its presence in their world.”

– Mary Breen, Fernbank Science Center

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).

2008-2015

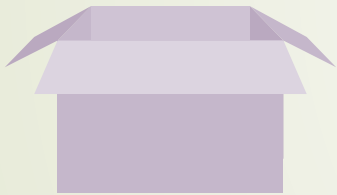
NanoDays

Eight years of kits

468

PARTNERS
received

1650
KITS



NanoDays kits have reached



8 MILLION
VISITORS

Most NanoDays events are a
PARTNERSHIP
of at least two organizations

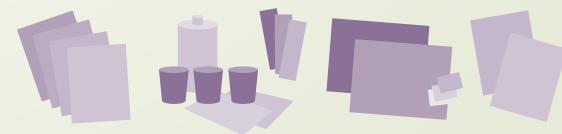
NISE Net has distributed
900 PAIRS
of tiny nano fabric pants!

100%

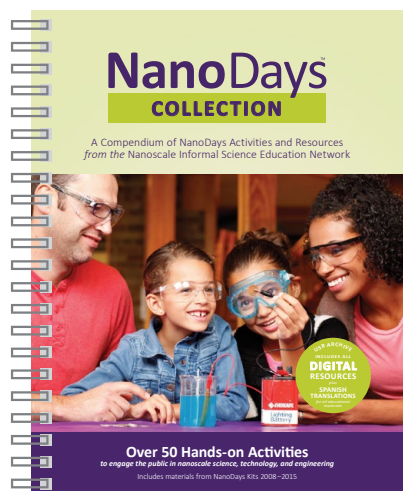
of kits are USED THROUGHOUT THE YEAR

THE NANODAYS TEAM DEVELOPED
100+ RESOURCES
including

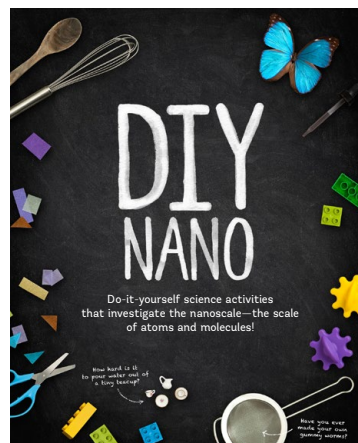
- ★ HANDS-ON ACTIVITIES
- ★ STAGE PRESENTATIONS
- ★ NANO GAMES



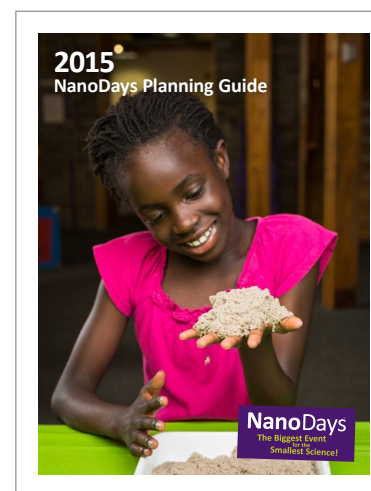
NanoDays Tools and Resources



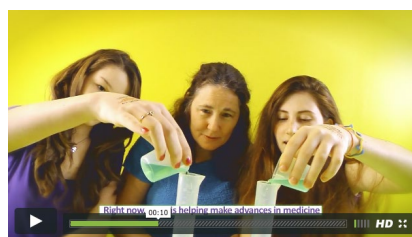
NanoDays Collection Book



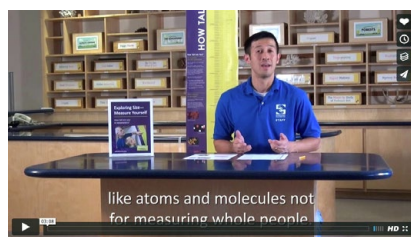
DIY Nano Book



2015 NanoDays Planning Guide



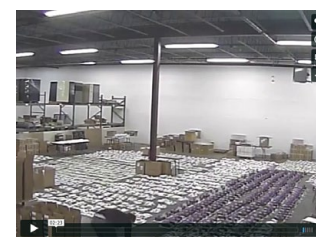
NanoDays Promotional Video
www.vimeo.com/20892289



Nanodays Training Videos
www.vimeo.com/album/2292889



**Museum-Scientist Partnerships
NanoDays and Beyond Video**
www.vimeo.com/112783689

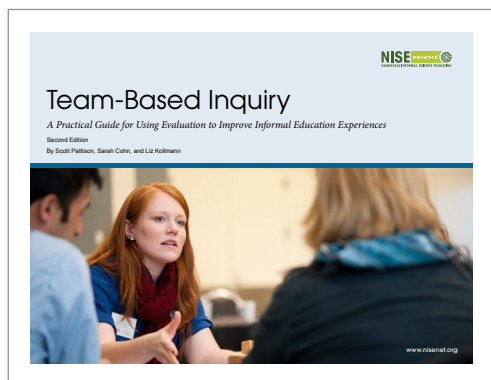


**2014 NanoDays Kit Fabrication
Time Lapse Video**
www.vimeo.com/89432550

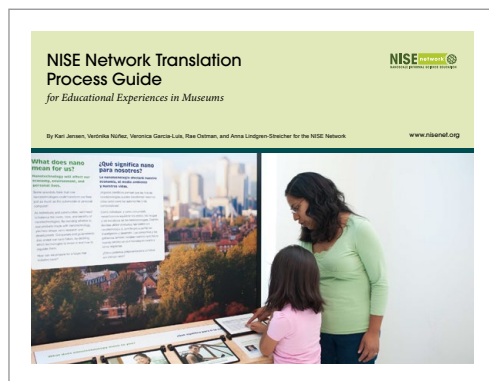
Additional Tools and Resources



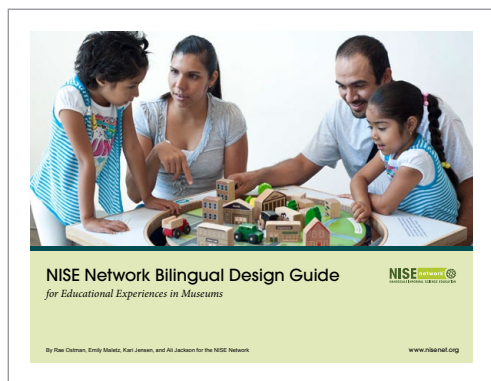
Program Development:
A Guide to Creating Effective Learning Experiences for Public Audiences



Team-Based Inquiry:
A Practical Guide for Using Evaluation to Improve Informal Education Experiences



Translation Process Guide
for Educational Experiences in Museums



Bilingual Design Guide
for Educational Experiences in Museums



Universal Design Guidelines for Public Programs in Science Museums

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Additional resources

See nisenet.org for a variety of additional resources, including NISE Net educational products, professional resources, and tools for staff and volunteer training.