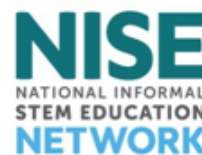


# NISE Net Online Workshop

Working with STEM Experts - If Only There Was A Guide...  
Now There Is!

March 1, 2022



## Today's Presenters:

**Catherine McCarthy**, Arizona State University, Tempe, AZ

**Darrell Porcello**, Children's Creativity Museum, San Francisco, CA

**Christina Leavell**, Science Museum of Minnesota, Saint Paul, MN



## Welcome!

As we wait to get started with today's discussion, please:

**Introduce yourself!** Type your name, institution, and location into the [Chat Box](#)

**Questions?** Feel free to type your questions into the [Chat Box](#) at any time throughout the webinar or use the raise your hand function in the participants list and we'll unmute your microphone.

**Today's discussion will be recorded and shared on nisenet.org at: [nisenet.org/events/online-workshop](https://nisenet.org/events/online-workshop)**



## Future Online Workshops

2pm-3pm Eastern / 11am-12pm Pacific

**Tuesday, April 5, 2022**

Communicating Climate Change  
to Diverse Audiences

**Tuesday, May 3, 2022**

Earth & Space Roundup of NISE  
Network Resources

**Tuesday, June 15, 2022**

Reconnect and Re-engage with the  
NISE Network

Learn more at [nisenet.org/events](https://www.nisenet.org/events)



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# Working with STEM Experts Guide

**Guide is available for free download**

<https://www.nisenet.org/working-with-experts>



The NISE Network has developed a new guide called Working with STEM Experts: A Guide for Educators in Museums and other Informal Learning Settings

The guide is available for free download from [nisenet.org](https://www.nisenet.org)

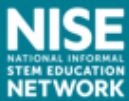
The guide focuses on why you may want to bring STEM experts and the public together, ways to work with experts, how to prepare experts to engage the public, and how to find experts.

**Image Credit:** Noun Project

**Image Description:** Cover page of the guide entitled “STEM Experts: A Guide for Educators in Museums and other Informal Learning Settings” showing an expert working with

<https://www.nisenet.org/working-with-experts>

# Why Bring STEM Experts and the Public Together?



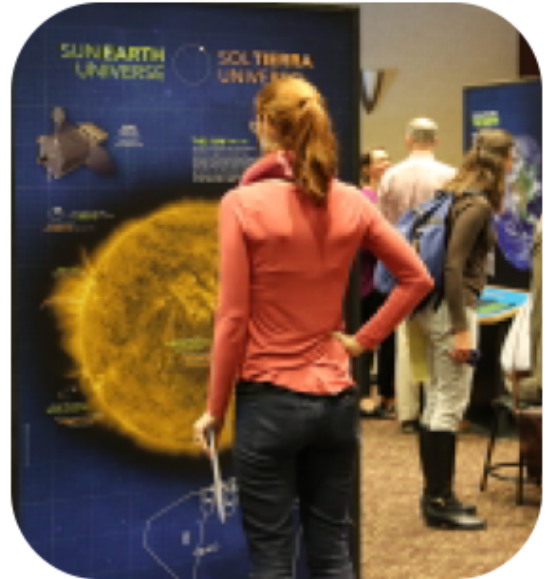
Why would you want to have STEM experts directly participate in public education and engagement activities?



# Why Bring STEM Experts and the Public Together?

Many reasons for having STEM experts directly engage the public.

- **Content knowledge** about a specific topic
- Experts can offer **much more beyond facts and information.**



There are many reasons for having STEM experts directly engage with the public. Of course, experts will have more content knowledge about a specific topic than a typical museum educator or volunteer, but experts can offer much more beyond facts and information.

**Photo credits:** Science Museum of Minnesota for NISE Network

**Photo description:** Experts looking at a museum exhibition component prototype at a professional meeting.

# Why Bring STEM Experts and the Public Together?

## TOP 10

### 10 Potential Impacts of Experts Engaging the Public

- 1 Sharing a Passion for Science
- 2 Providing for Mutual Learning
- 3 Understanding that Science is a Human Endeavor
- 4 Increasing the STEM Workforce and Creating Career Pathways
- 5 Greater Representation of Women and Minorities in STEM Careers
- 6 Changing the Face of STEM – Picture a Scientist, Who Do You See?
- 7 STEM Identity and Providing Role Models and Mentors
- 8 STEM Literacy and Creating Lifelong Learners
- 9 More Trust in Science
- 10 Creating Opportunities for Participatory Democracy

We created a top 10 list of potential Impacts of Experts Engaging the Public. I am going to go through this list quickly and more information about each of these is included in the written guide.

# Why Bring STEM Experts and the Public Together?

## 1

### Sharing a Passion for Science



1 -Sharing a Passion for Science. Specialists are passionate about their subject—that is what makes them an expert! Experts have the potential to convey the excitement, enthusiasm, and a sense of wonder they feel for their subject.

**Image Credit:** Noun Project

**Image Description:** Icon of a heart with a passionate flame.

#### BACKGROUND

##### Sharing a Passion for Science

Having experts engage with the public can be a compelling way for people to learn about a fascinating subject from someone who is personally immersed in the topic. In addition to sharing content and knowledge, experts have the potential to convey the excitement, enthusiasm, a sense of wonder, and passion they feel for their subject. Experts may also share stories about the curiosity that sparked the interest in the work they do. These interactions have the power to provide memorable, meaningful, and fun experiences for members of the public.

# Why Bring STEM Experts and the Public Together?

## 2

### Providing for Mutual Learning



2 Providing for Mutual Learning. Public engagement can create opportunities for two-way communication and mutual learning through conversations between experts and the public. They can listen to each other and learn from one another. Both have valuable perspectives and knowledge to share.

**Image Credit:** Noun Project

**Image Description:** Icons of a left and right arrow below to people with talking bubbles communicating with each other.

#### BACKGROUND

##### Providing Opportunities for Mutual Learning

Public engagement with science can go further than the one-way dissemination of content by including opportunities for two-way communication and mutual learning and conversations.<sup>[1] [2]</sup> Museums and other informal learning spaces can provide a convening place for these kinds of interactions and conversations to occur. Both scientists and publics can listen to each other and learn from one another, and both have expertise, valuable perspectives, and knowledge to contribute to the

development of science and its application to society. This multidirectional learning is especially crucial for topics that lie at the intersection of science and society at a time when scientific and technological breakthroughs have wide-ranging impacts on everyone in our world.

[<sup>1</sup>] Bell, L, Lowenthal, C., Sittenfeld, D., Todd, K., Pfeifle, S., and Kollmann, E. K. (2018) *Public Engagement with Science: A guide to creating conversations among publics and scientists for mutual learning and societal decision-making*, NISE Network. <https://www.nisenet.org/public-engagement-conversations-guide>

[<sup>2</sup>] McCallie, E ., Bell, L., Lohwater, T., Falk, J. H., Lehr, J. L., Lewenstein, B. V., Needham, C., and Wiehe, B. (2009). *Many Experts, Many Audiences: Public Engagement with Science and Informal Science Education. A CAISE Inquiry Group Report*. Washington, DC: Center for Advancement of Informal Science Education (CAISE). <https://www.informalscience.org/many-experts-many-audiences-public-engagement-science>

# Why Bring STEM Experts and the Public Together?

## 3

### Understanding that Science is a Human Endeavor



3. Understanding that science is a human endeavor. Science is not neutral. It is a deeply human process that doesn't happen alone or in a vacuum.

**Image Credit:** Noun Project

**Image Description:** Icon of two people hugging representing teamwork.

#### BACKGROUND

##### Understanding that Science is a Human Endeavor

Science is not neutral; it is a deeply human process. The Next Generation Science Standards remind us that “science and engineering are influenced by society” and that “scientists’ backgrounds influence their findings.”<sup>[1]</sup> We know that systemic injustice is present in the teaching, learning, and practice of science, both historically and today.<sup>[2]</sup> The fact that learning and participating in STEM is not as equitable and inclusive as it should be is a moral problem that needs to be addressed by all of us. Public engagement with science moves us closer to these goals. STEM professionals not representing society as a whole also affects the content and quality of work;

diverse teams have been found to have many benefits, including better problem-solving and more impactful research.<sup>[3]</sup> <sup>[4]</sup>

<sup>[1]</sup> National Research Council. (2013) Next Generation Science Standards: For States, By States. Washington, DC: The National Academies Press.  
<https://doi.org/10.17226/18290>.  
<https://www.nap.edu/catalog/18290/next-generation-science-standards-for-states-by-states>

<sup>[2]</sup> Rifkin, M.(2020) Who Does Science?, NSTA The Science Teacher, July/August 2020 (Volume 87, Issue 9). <https://www.nsta.org/science-teacher/science-teacher-julyaugust-2020/who-does-science>

<sup>[3]</sup> Freeman R.B and Huang W. (2014) Collaboration: Strength in diversity. Nature 513 (7518): 305. <https://www.nature.com/articles/513305a>

<sup>[4]</sup> Stetler, R. L., Kupersmidt, J. B., and Stump, K. M. (2020) Establishing Effective STEM Mentoring Relationships through Mentor Training, Ann. N.Y. Acad. Sci. 1483 (2021) 224-243. New York Academy of Sciences.  
<https://nyaspubs.onlinelibrary.wiley.com/doi/epdf/10.1111/nyas.14470>

# Why Bring STEM Experts and the Public Together?

## 4

### Increasing the STEM Workforce and Career Pathways



4 - Increasing the STEM Workforce and Career Pathways. Diverse experts can help make STEM more inclusive by welcoming people of all backgrounds. Experts can also introduce people to possible pathways toward different STEM careers.

**Image Credit:** Noun Project

**Image Description:** Icon of a person standing on top of four arrows in different directions.

#### BACKGROUND

##### Increasing the STEM Workforce and Creating Career Pathways

In the U.S., there is a high demand for qualified professionals in many STEM fields, and a shortage in some STEM fields.<sup>[1]</sup> In the past, the STEM workforce pipeline was a popular metaphor describing the linear progression of learners interested in STEM topics through a sequence of educational phases toward a career in STEM. The “leaky” pipeline described the disproportionate exit of girls and minorities along the way, leading to their ultimate underrepresentation in the STEM workforce. In recent years people have called for moving beyond the pipeline metaphor toward a more



progressive *pathway* approach. Aspects of this approach focus on finding personal meaning and relevance, and making STEM more inclusive and welcoming to people of all backgrounds—a common goal in many leading examples of public engagement programs. This change from a fixed pipeline may convince more people to stay in STEM programs and careers, offering more flexible opportunities rather than a linear progress, and understanding obstacles and supports necessary in a more equitable system.<sup>[2]</sup> <sup>[3]</sup> A diverse group of experts can help connect with all public audience members.

<sup>[1]</sup> Xue, Y. & R. Larson. (2015) STEM crisis or STEM surplus? Yes and yes. *Monthly Labor Review*. <https://doi.org/10.21916/mlr.2015.14>

<sup>[2]</sup> Lyon, G. H., Jafri, J, St. Louis, K. (2012) Beyond the Pipeline: STEM Pathways for Youth Development, *Afterschool Matters*, n16 p48-57 Fall 2012.  
[http://www.niost.org/pdf/afterschoolmatters/asm\\_2012\\_16\\_fall/ASM\\_2012\\_16\\_fall\\_6.pdf](http://www.niost.org/pdf/afterschoolmatters/asm_2012_16_fall/ASM_2012_16_fall_6.pdf)

<sup>[3]</sup> Gibbs, K. (2014) Beyond "The Pipeline": Reframing Science's Diversity Challenge, *Scientific American*, December 17, 2014.  
<https://blogs.scientificamerican.com/voices/beyond-the-pipeline-reframing-science-s-diversity-challenge/>

# Why Bring STEM Experts and the Public Together?

## 5

### Greater Representation of Women and Minorities in STEM Careers



5- Greater Representation of Women and Minorities in STEM Careers. In the United States, the STEM workforce is not representative of the diversity of the U.S. population. The good news is there have been major gains in earning educational degrees over the past two decades for women, people with disabilities, and underrepresented minority groups. But there is still major under-representation in many fields. Engagement with experts can help encourage diverse learners to start or continue to pursue education or a career in STEM.

**Image Credit:** Noun Project

**Image Description:** Icon of a person breaking a glass ceiling.

#### BACKGROUND

##### Greater Representation of Women and Minorities in STEM Careers

To make science more connected and responsive to our ever-changing society, it is imperative that people of all backgrounds have the opportunity to pursue STEM careers. Currently the STEM workforce is not representative of the diversity of the U.S. population. Although there have been gains in earning educational degrees over

the past two decades, women, people with disabilities, and underrepresented minority groups (African Americans, Hispanics, American Indians, and Alaska Natives) are still underrepresented in science and engineering careers compared with their representation in the U.S. population.<sup>[1]</sup> <sup>[2]</sup> Women are still starkly underrepresented in computing and engineering education and jobs; in 2016, women earned only about 20% of bachelor's degrees in computing, engineering, and physical sciences. Underrepresented minorities comprise 27% of the U.S. population; the share of science and engineering bachelor's degrees awarded to underrepresented minorities in 2016 increased significantly over the prior twenty years, from 14% to 22%; however, doctorate degrees remain at only 9%. Engagement with experts can help encourage diverse learners to start or continue pursuit of a career in STEM.

<sup>[1]</sup> National Science Foundation, National Center for Science and Engineering Statistics. 2019. Women, Minorities, and Persons with Disabilities in Science and Engineering: 2019. Special Report NSF 19-304. Alexandria, VA.  
<https://nces.nsf.gov/pubs/nsf19304/>

<sup>[2]</sup> Kennedy, B, Richard Fry, R. and Funk, C. (2021) 6 facts about America's STEM workforce and those training for it, Pew Research Center.  
<https://www.pewresearch.org/fact-tank/2021/04/14/6-facts-about-americas-stem-workforce-and-those-training-for-it/>

# Why Bring STEM Experts and the Public Together?

## 6

### Changing the Face of STEM – When You Picture a Scientist, Who Do You See?



6 - Changing the Face of STEM – When You Picture a Scientist, Who Do You See? Scientists we see in the media, movies, online, and in person become the face of science for the public. This influences our perception of who does science, whom science is for, and who can become a scientist. Experts engaged with the public have the power to change children’s and adult’s impressions of science and scientists.

**Image Credit:** Noun Project

**Image Description:** Icons of four different people including a caricature of Einstein, a person in lab coat and goggles, and female looking people in sunglasses and glasses.

#### BACKGROUND

##### Changing the Face of STEM – When You Picture a Scientist, Who Do You See?

Scientists we see in the media, movies, online, and in person become the face of science for the public. This influences our perception of who does science, whom science is for, and who can become a scientist. A 2018 study analyzing five decades of studies of U.S. school-age children’s drawings of scientists found that the children's depictions of scientists have become more gender diverse over time. In

some of the 1960s and 1970s studies on this issue, less than 1% of children drew a picture of a woman. Typically, when asked to draw a picture of a person, usually 70% or more of both boys and girls draw their own sex. Recent Draw-A-Scientist studies found that 58% of girls and 13% of boys drew pictures of women. Recent studies also show that as children grew older, both girls and boys drew male scientists more often, reflecting their increased gender-science stereotypes as they age.<sup>[1]</sup> Public engagement can have an impact on perspectives on gender and science. The following are a few recent powerful examples of how people are working to change public perceptions of scientists.

- The 2020 documentary film “Picture a Scientist” chronicles the path of several women in science and offers perspectives on how to make science itself more diverse, equitable, and open to all.

<https://www.pictureascientist.com>

- The 2021 documentary “Not the Science Type” explores the negative impact stereotypes can have on STEM diversity, equity, and inclusion, and is meant to inspire hope and a sense of possibility.

[https://www.3m.com/3M/en\\_US/state-of-science-index-survey/not-the-science-type/](https://www.3m.com/3M/en_US/state-of-science-index-survey/not-the-science-type/)

- The IF/THEN<sup>®</sup> initiative is designed to shift cultural perceptions of who works in STEM and to interest girls in the possibility of a STEM career. Resources include the This Is What A Scientist Looks Like<sup>™</sup> campaign, AAAS Ambassadors, and a collection of royalty-free images.

<https://www.ifthenshecan.org>

- “I Am A Scientist,” digital tools, images, and posters to make STEAM careers technically and psychologically accessible to all students.

<https://www.iamascientist.info>

[1] David I. Miller, Kyle M. Nolla, Alice H. Eagly, David H. Uttal (2018) The Development of Children's Gender-Science Stereotypes: A Meta-analysis of 5 Decades of U.S. Draw-A-Scientist Studies, Child Development,

November/December 2018, Volume 89, Number 6, Pages 1943-1955

<https://doi.org/10.1111/cdev.13039>

# Why Bring STEM Experts and the Public Together?

## 7

### STEM Identity and Providing Role Models and Mentors



7 - A STEM identity is how people think about themselves as science learners and as a person who knows about and uses science; research has found that this sense of STEM identity affects how people learn and the educational pathway they pursue. Role models and mentoring can play a significant role in fostering STEM identity, education choices, and career pathways.

**Image Credit:** Noun Project

**Image Description:** Icon of a female adult and a younger similar looking person side by side.

#### BACKGROUND

##### STEM Identity and Providing Role Models and Mentors

STEM Identity is how people think about themselves as science learners and how they develop an identity as someone who knows about, uses, and can contribute to science. A science identity increases the likelihood that participants “continue to develop science literacy or even follow an educational pathway toward a science career or profession that requires or benefits from education or training in STEM.”<sup>[1]</sup>

Having a STEM identity influences a learner's expectations of how interesting and successful the experience will be and if they choose to participate in STEM-related activities in the future.

With the exception of medical practitioners, many members of the general public have little personal familiarity with STEM experts and many have never met or conversed with a scientist or engineer. In-person public engagement interactions provide opportunities for public audiences to meet and talk with approachable people.

Role models and mentoring play a role in fostering STEM identity and the pursuit of STEM careers. Early interest in a STEM career does not always translate into the pursuit or retention in a STEM career. Having a close mentoring relationship with a trusted adult with a similar STEM interest can play an instrumental role in fostering and retaining an interest in pursuing a STEM career. Near-age peer mentors can also foster feelings of support, connectedness, and belonging.<sup>[2]</sup>

<sup>[1]</sup> Bell, J., Besley, J., Cannady, M., Crowley, K., Grack Nelson, A., Philips, T., Riedinger, K., & Storksdieck, M. (2018). The Role of Identity in STEM Learning and Science Communication: Reflections on Interviews from the Field. Washington, DC: Center for Advancement of Informal Science Education.  
[https://www.informalscience.org/sites/default/files/CAISE%20Identity%20Overview\\_0.pdf](https://www.informalscience.org/sites/default/files/CAISE%20Identity%20Overview_0.pdf)

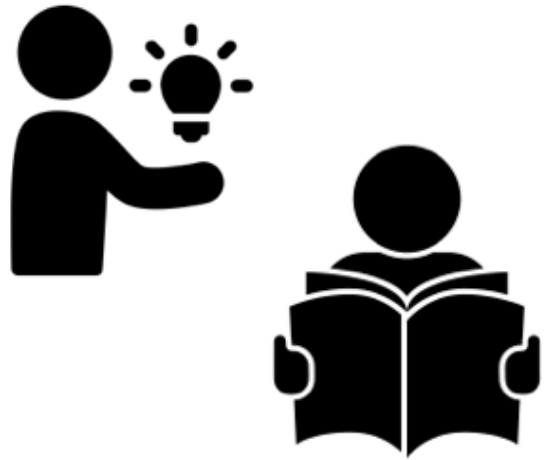
<sup>[2]</sup> Stetler, R. L., Kupersmidt, J. B., and Stump, K. M. (2020) Establishing Effective STEM Mentoring Relationships through Mentor Training, Ann. N.Y. Acad. Sci. 1483 (2021) 224-243. New York Academy of Sciences.  
<https://nyaspubs.onlinelibrary.wiley.com/doi/epdf/10.1111/nyas.14470>



# Why Bring STEM Experts and the Public Together?

## 8

### STEM Literacy and Lifelong Learning



8- STEM literacy is the knowledge and understanding of basic science, technology, and math concepts and processes required for personal decision-making and participation in modern society. Lifelong learning of STEM can help all of us make choices both big and small that can affect our happiness, health, and homes.

**Image Credit:** Noun Project

**Image Description:** Icons of a person holding a lightbulb representing an idea and another person reading a book.

#### **BACKGROUND:**

##### **STEM Literacy and Creating Lifelong Learners**

STEM literacy is the knowledge and understanding of basic science, technology, and math concepts and processes required for personal decision-making and participation in modern society. Being familiar with basic scientific concepts and processes and having the ability to apply this knowledge in various contexts is thought to be essential to functioning in our modern technology-based economy and civic society.<sup>[1]</sup> Given the rapid pace of change in STEM, the need for learning extends

well beyond the time spent in K-12 formal education settings.

The world is a complex place, and everyone needs some understanding of STEM to navigate decision-making in their own lives. Public engagement with science can help increase STEM literacy for everyone, not just for those on a pathway to careers in the STEM workforce. Lifelong learning of STEM can help all of us make choices both big and small that can affect our happiness, health, and homes. Substantial evidence indicates that the majority of learning for both children and adults is a result of out-of-school learning opportunities.<sup>[2]</sup>

<sup>[1]</sup> National Research Council. (1996). National science education standards. Washington, DC: National Academy Press.  
<https://www.nap.edu/catalog/4962/national-science-education-standards>

Falk, J. H., Storksdieck, M., and Dierking, L. D. (2007). Investigating public science interest and understanding: Evidence for the importance of free-choice learning. *Public Understanding of Science*, 16(4), 455-469.  
<https://doi.org/10.1177/0963662506064240>

<sup>[2]</sup> Falk, J.H., Storksdieck, M., Dierking, L.D., Babendure, J., Canzoneri, N., Pattison, S., Meyer, D., Verbeke, M., Coe, M. & Palmquist, S. (2017). The learning SySTEM. In R. Ottinger (Ed.). STEM ready America. Flint, MI: Charles Stewart Mott Foundation.  
<http://stemreadyamerica.org/the-learning-system/>

# Why Bring STEM Experts and the Public Together?

## 9

### More Trust in Science



9 - More Trust in Science. Meaningful, thoughtful, and well-implemented public engagement programs have the potential to change public attitudes and increase trust. Public trust in science is linked to both factual knowledge about science and familiarity with scientists as people.

**Image Credit:** Noun Project

**Image Description:** Icon of two people in a trust fall activity.

#### BACKGROUND

##### More Trust in Science

Meaningful, thoughtful, and well-implemented public engagement programs have the potential to change attitudes, increase trust, and develop mutual respect between experts and members of the public. Public trust in science is linked to their factual knowledge about science and familiarity with scientists as people.<sup>[1]</sup> Many different factors including personal values, beliefs, culture, and experiences affect a person's trust in science as well as the person or institution communicating. More scientific information alone is often not enough to build trust. It is essential to

remember that the audience is who decides whether communicators of information and the institutions they represent are trustworthy and credible.<sup>[2]</sup> Meaningful public engagement does have the potential to foster public trust, but it is only one of many factors. For example, recent studies of public views on a variety of science policy issues found that age, gender, race and ethnicity, religious affiliation, educational attainment of science knowledge, and political affiliation all play a role in how an individual judges an issue.<sup>[3]</sup>

<sup>[1]</sup> Pew Research Center (2019). Trust and Mistrust in Americans' Views of Scientific Experts, August 2019. <https://www.pewresearch.org/science/2019/08/02/trust-and-mistrust-in-americans-views-of-scientific-experts/>

<sup>[2]</sup> National Academies of Sciences, Engineering, and Medicine. (2017). Communicating Science Effectively: A Research Agenda. Washington, DC: The National Academies Press. <https://doi.org/10.17226/23674>

<sup>[3]</sup> Pew Research Center (2015). Americans, Politics and Science Issues, July 2015. <https://www.pewresearch.org/science/2015/07/01/americans-politics-and-science-issues/>

# Why Bring STEM Experts and the Public Together?

## 10

### Creating Opportunities for Participatory Democracy



10 - Creating Opportunities for Participatory Democracy. While science contributes to new technology and solving problems, scientists alone cannot make the decisions about new technology or how to solve societal challenges. STEM experts need to get input and feedback from the public.

**Image Credit:** Noun Project

**Image Description:** Icon of a three outstretched hands representing desire to be involved.

#### BACKGROUND

##### Creating Opportunities for Participatory Democracy

Another aspect of public engagement in STEM is as a form of participatory democracy. As a broader field, STEM experts need to get input and feedback from the public. After all, it is the taxpayers who fund much research and who indirectly as voters set the national research agenda. While science contributes to solving many problems, scientists alone cannot make the decisions or solve the problems. The public will ultimately be affected by new advances in STEM, and in many cases

become consumers of new technology. Since these new discoveries and technologies have an impact on society, scientists should take broad perspectives into account when thinking about their own research. Public engagement with science programs can provide a way to gain input and feedback from the public as well as increase the public's capacity to effectively participate in discussions and decision-making.

# Understanding Experts' Motivations

## Altruistic

- Give back
- Inspire
- Create a more inclusive welcoming space



## Workplace & Professional

- Requirements
- Encouragement from professional society
- Broader impacts incentives



## Personal & Intrinsic

- Joy from interactions
- Passion to share
- Connect, feel part of community

## Professional Learning

- Be more relevant
- Get feedback from public
- Attract public participants

Understanding experts' motivations to participate in public engagement helps to ensure positive and productive experiences for your institution, the experts, and public audiences. An individual expert may hold many motivations::

**Altruistic** - a desire to give back to their community,

**Personal or Intrinsic** - joy from connecting with people and connecting with community,

**Workplace or Professional** service requirements or incentives, and

**Professional Learning** - a desire to get feedback and input from the public.

**Image Credits:** Museum of Science

**Image Descriptions:** Photo of an expert talking with a member of the public one-on-one and a photo of volunteer experts at a public engagement event.

## BACKGROUND

**Understanding experts' motivations** to participate in public engagement helps to

ensure positive and productive experiences for your institutions, the experts, and public audiences. Tailoring the experience to the needs of all stakeholders will help ensure a successful partnership that is more likely to continue in the future.<sup>[1]</sup>

An individual expert may hold several or even all of these motivations:

- Altruistic:
  - Desire to give back to their community
  - Inspire and foster interest in young people
  - Create a more inclusive and welcoming professional environment
- Intrinsic/Personal:
  - Genuine enjoyment of interactions; intrinsic joy from connecting with people
  - Passion to share knowledge
  - Build a culture of interest and excitement about STEM
  - Connect and feel like a part of their community
- Workplace/Professional:
  - Service requirements or incentives
  - Encouragement from a membership group or professional society
  - Broader impacts funding incentives
- Professional Learning:
  - Desire to improve their communication skills
  - Desire to make their work more relevant to society
  - Interest in getting feedback and input from the public

Opportunity to attract project participants such as for a citizen science project or health study

<sup>[1]</sup> For more on scientists motivations see:

Portal to the Public (2018), Implementation Manual, Pacific Science Center and Institute for Learning Innovation.

<https://popnet.instituteforlearninginnovation.org/resources/>

Martin Storksdieck, Cathlyn Stylinski, and Nicolette Canzoneri. (2017)*The Impact of Portal to the Public: Creating an Infrastructure for Engaging Scientists in ISL - Summative Evaluation*. Corvallis, OR: Oregon State University.

Photo Credits:



Expert An expert talking with an event participant CREDIT Museum of Science  
Student experts facilitating activities with museum visitors CREDIT Museum of  
Science

# Understanding Your Institution's Motivations



## Organizational

- Fulfill mission and goals
- Authenticity
- Expert knowledge and perspectives
- Staff & volunteer professional development



## Community

- Offer relevant STEM content
- Be seen as a valuable part of the community
- Be seen as a place for science and/or a convener for science policy topics
- Strengthen relationships with local experts & institutions

It is also important to understand your own institution's motivations for providing opportunities for experts to engage with the public. These motivations usually fall into two buckets:

**Organizational** (fulfilling your mission and goals) and

**Community** (providing relevant STEM content, and being seen as a place for science, and making community connections).

**Image Credits:** Children's Creativity Museum

**Image Descriptions:** Photo of a museum building

**Image Credits:** Marbles Kids Museum

**Image Descriptions:** Photo of people at a museum interacting with experts and activities.

## BACKGROUND

In addition to the potential beneficial impacts of expert engagement with the public described previously, there are some additional motivations museums and other

informal education institutions have for working with experts to engage the public.

Organizational:

- ○ Fulfill institutional mission and goals to achieve impacts (see the Impacts summary earlier in this section)
- Increased authenticity by having more experts involved in programming
- Include expert knowledge and varied perspectives for a project or program
- Build staff professional development about a topic
- Meet project or grant requirements

Community:

- Offer relevant STEM content to the community by connecting with local academic or industry expertise and institutions
- Be seen as a valuable part of the community
- Be seen as a “place for science” and/or a “convener for science policy topics”
- Strengthen relationships with local STEM experts and institutions

# Ways to work with STEM Experts



Depending on your institution's capacity to find, prepare, and coordinate with a local expert, there are many ways to partner on public engagement programming. In general, it is good practice to start with shorter, simpler engagement formats with the potential to have the working relationship between the institution and the expert grow over time. The level of expert involvement with your institution and the public will of course vary depending on their interest, abilities, and capacity.

# Formats for Public Engagement

## Hands-On Activities



## Guest Lectures, Talks, and Presentations



**Photo description (left):** An expert conducting a hands-on demonstration with young children.

**Photo description (right):** An expert giving a presentation to a museum audience.

**Photo credits (left, right):** Emily Maletz for NISE Network, Museum of Science

## BACKGROUND

### Hands-On Activities

A great place to begin with experts is to have them facilitate an existing hands-on activity or demonstration. Training with and using popular hands-on activities at your institution will help experts become more familiar with the style of interaction between your educators and public audiences. Many NISE Network hands-on activities include recommended conversation starters and reflection questions for learners; these prompts help activity facilitators avoid relying on one-way communication while facilitating an activity. Helpful preparation for activity facilitators includes modeling the existing activity in person or with a training video,

practicing the activity together with an experienced informal science educator, giving feedback to the facilitator, and preparing them for common questions. Please see the “Tips for Leading Hands-On Activities” tips sheet later in this guide for more helpful suggestions to share with activity facilitators.

### **Guest Lectures, Talks, and Presentations**

Another one-time format is an in-person or virtual guest presentation. This presentation format may be the most familiar and comfortable for many experts. With extra preparation and support, guest presentations can provide a great experience for both the speaker and the audience. Presentation format and content should be tailored for the audience; a presentation to a public audience that includes young children should be quite different from a lecture typically delivered to undergraduates or academic colleagues. There are many other presentation formats away from a stage to consider for experts including: an “Ask Me Anything” Meet-A-Scientist session that allow for small group conversations, tours and field trips, and guided lab tours.

Please see the “Tips for Planning Guest Presentations” tips sheet later in this guide for some suggestions for staff or volunteers coordinating a guest presentation. Also, consider sharing the “Tips for Guest Speakers” tips sheet with new guest speakers presenting at your events.

# Formats for Public Engagement

**Science Cafés**



**Forums**



**Photo description (left):** An expert talking with an event participant.

**Photo description (right):** A group of forum participants seated around a table gesturing to make a point during a group discussion. **Photo credits:** Museum of Science

## BACKGROUND

### Science Cafés

Science cafés are casual and welcoming gatherings that encourage conversations and interactions between experts and the public. Science cafés tend to be lively events and typically often take place in popular locations in the community, like a restaurant, bar, or coffeehouse. This format often includes a short presentation by an expert(s), followed by two-way interactions between the experts and the attendees.<sup>[1]</sup>

### Forums

The purpose of a public dialogue or forum is to promote conversation about the societal implications of science and technology. Forums create a place for mutual learning on behalf of both the public and experts. Dialogue and deliberation forums

usually require a fairly high investment of time for preparation—by participating experts and organizers alike. Sometimes forums may be designed intentionally as a way to gather public feedback and input on a plan or policy. <sup>[1]</sup>

<sup>[1]</sup> NISE Network forum resources: <https://www.nisenet.org/forums> and Public Forums Manual: <https://www.nisenet.org/catalog/public-forums-manual>

<sup>[1]</sup> Science Café resources: <https://www.sciencecafes.org> and NISE Network Science Café Guide <https://www.nisenet.org/catalog/science-cafe-guide>



# Formats for Public Engagement

## Special Events



## Science Festivals



**Photo description (left):** Experts staffing tables with activities at a museum event arranged in a large oval.

**Photo description (right):** Outdoor view of a science festival in front of a museum.

**Photo Credits (left, right):** Museum of Science, The Franklin Institute/Kyle Gronostajski

## BACKGROUND

### Special Events

Inviting an expert to participate in a one-time special event is a simple way to get to know an expert and begin to build a relationship. Special events are a good first step since they typically require a short commitment taking place on one day. Larger special events are also a great opportunity to bring in a local professional society, enthusiast volunteer groups, or student groups that are interested in public service and direct public engagement. You can find a calendar of STEM-related seasonal events and holidays and related public engagement resources at:

<https://www.nisenet.org/seasons>

**Science Festivals**

Science festivals are community-based celebrations about science and technology that bring the public into direct contact with hands-on activities, advocacy groups, and experts. Festivals tend to be one-time or annual events, large in scale, and bring together many community organizations and individuals.

<https://sciencefestivals.org/>

# Formats for Public Engagement

## Virtual Formats



**Photo description (left):** A crew filming a training video for a hands-on activity.

**Photo description (right):** A crew filming an interview of an expert.

**Photo Credits (left, right):** Brad Herring for NISE Network, Nic Beery for NISE Network

## BACKGROUND

### Virtual

In-person engagement is not always possible due to public health safety guidelines, transportation barriers, time constraints, and geographic distances. In recent years, institutions have become more familiar and skilled at offering virtual engagement programs—creating virtual alternatives to many of the opportunities to involve experts listed above. The major advantage of virtual programs is the increased opportunities for both public audiences and experts to participate in anything from large events to small experiences, with no travel and few expenses. This may provide access for individuals in rural communities or other isolated areas who otherwise might not have a chance to interact in person with experts. Another advantage is the

ability to asynchronously share a virtual program with much larger audiences after an event through recordings. Creative virtual engagement can go beyond a slideshow presentation and can include hands-on activities, demonstrations, tours, and meaningful interaction with attendees. Another benefit is having hybrid or blended experiences with experts in different locations—even astronauts!<sup>[1]</sup>

<sup>[1]</sup> For best practices and advice for virtual online engagement, see:

*Virtual Programs Featuring Scientists: Scientists, Science Centers, and Public Libraries working together to facilitate high-quality virtual programming for public audiences* guide developed by STARnet and Portal to the Public:

[https://ncil.space science.org/images/papers/Virtual%20Programs%20Featuring%20Scientists\\_FINAL\\_small.pdf](https://ncil.space science.org/images/papers/Virtual%20Programs%20Featuring%20Scientists_FINAL_small.pdf)

Night Sky Network virtual stargazing event resources:

[https://nightsky.jpl.nasa.gov/download-view.cfm?Doc\\_ID=669](https://nightsky.jpl.nasa.gov/download-view.cfm?Doc_ID=669)

How to Present Virtually to Students for NASA video:

<https://www.youtube.com/watch?v=egSe81sIIDk>

# More Ways to Work with STEM Experts

- Mentoring
- Joint Collaborative Projects
- Professional Development for Staff and Volunteers
- Ongoing Advisory Roles
- Liaison Roles



**Photo credit:** Marbles Kids Museum

**Photo description:** Large group at a museum event watching two experts conduct a demonstration.

## BACKGROUND

### Mentoring

Many informal education institutions offer ongoing youth programming through afterschool programs and clubs with sustained long-term interactions with the same youth. Mentoring an individual or small group of youth through an existing program is a great way to develop deeper collaborations with experts. This level of involvement can build lasting, influential relationships that support young people as they explore their passions and discover possible career paths.<sup>[1]</sup>

### Joint Collaborative Projects

Your institution may want to form a deeper collaboration with a scientist or a

research center by pursuing the development and implementation of joint grant proposals and projects. Examples could include jointly creating a citizen science or community science project,<sup>[2]</sup> broader impacts outreach to share ongoing research in the community, a youth workforce development project,<sup>[3]</sup> collaborating on the development of hands-on activities or an exhibition, or using the museum as a living laboratory<sup>[4]</sup> for data collection. These types of mutually beneficial partnerships take time and commitment, but can have significant benefits.<sup>[5]</sup>

### **Ongoing Advisory Roles**

Many informal education institutions seek out experts for ongoing advisory roles that may (or may not) include direct public engagement. Examples of roles can include:

- participating in an ongoing advisory capacity on a project or program
- providing ongoing technical review for draft exhibit signage and program content
- participating on a committee or board
- serving as a competition judge or reviewer on a panel
- helping to answer “Ask a Scientist” questions from local audiences

### **Professional Development for Staff and Volunteers**

Experts may also be an invaluable professional development resource for your institution’s staff and volunteers. A common example is offering one or a series of in-person talks or virtual presentations for staff and volunteers about the topic of a traveling museum exhibition. This can be a motivating start to a new initiative or project at your institution.

### **Liaison Roles**

Another valuable role experts can play is acting as a liaison with your institution and their colleagues, students, friends, employers, and membership groups. Examples include: alerting undergraduate students looking for community service opportunities, suggesting appropriate specialists who may help you with content review, and connecting you to members of an enthusiasts group. Although these individuals may not be directly interacting with the public themselves, their advice and connections may be invaluable.

[1] Mentoring resources: <https://www.mentoring.org> and STEM Mentoring resources: <https://www.mentoring.org/campaigns/stem-mentoring-month/>

[2] Cavalier, D., Hoffman, C., and Cooper, C. (2020). *Field Guide to Citizen Science: How You Can Contribute to Scientific Research and Make a Difference*. New York, NY: Workman Publishing. p. 188. <https://www.workman.com/products/the-field-guide-to-citizen-science>

[3] Resources for youth programs in museums include:  
ASTC (2009) A Handbook for Youth Programs in Science Centers and Museums (retrieved September, 2021)  
<http://www.astc.org/wp-content/uploads/2014/11/Full-Doc.pdf>

Sneider, C. and M. Burke (2010): The Legacy of YouthAlive! January 28, 2010) (retrieved September, 2021)  
[https://www.informalscience.org/sites/default/files/SneiderandBurke\\_LegacyofYouthAlive.pdf](https://www.informalscience.org/sites/default/files/SneiderandBurke_LegacyofYouthAlive.pdf)

New York Hall of Science Science Career Ladder program  
<https://classic.nysci.org/learninglab/youth-development/science-career-ladder/>

[4] Learn more about Living Laboratory research programs and how museums can partner on research studies and serve as locations for scientific studies and data collection: <https://livinglab.org>

[5] To learn more about partnering with a research center please see: *A Guide to Building Partnerships Between Science Museums and University-Based Research Centers*: <https://www.nisenet.org/riseguide>

For general collaboration advice see:  
*NISE Network Museum & Community Partnerships: Collaboration Guide and additional resources*: <https://www.nisenet.org/collaboration-guide>





# More Ways to Work with STEM Experts

## Including Experts in the Development Process

- Brainstorming
- Helping to create content
- Participating in iterative prototyping
- Technical content review



**Photo credit:** Science Museum of Minnesota for NISE Network

**Photo description:** Experts discussing a museum exhibition component prototype at a professional meeting.

## BACKGROUND

### Development Process Content Experts

You may want to involve experts in the development process when creating a new educational program or exhibition. Consider partnering with relevant content experts at multiple stages of the process, including brainstorming, helping to create content, participating in iterative prototyping, and providing technical content review. Your development work might also include a collaboration and co-creation process with local audiences and scientists. Content experts may be able to provide resources and advice when creating or choosing existing photos, video, and other multimedia—especially scientific imagery.

# More Resources

## Annotated list of resources:

- Science communication
- Broader Impacts
- Broadening Participation



There are lots of great existing resources out there: Portal to the Public, CAISE [informalscience.org](http://informalscience.org), Science Festival Alliance, IF/THEN® initiative, National Girls Collaborative Project (NGCP), and more. A detailed annotated list is included in the guide.

# How to Prepare Experts



## BACKGROUND

Specialists are passionate about their subject—that is what makes them an expert!

It is essential to prepare experts for success so that their public engagement efforts are effective and enjoyable for both experts and the public audiences. Effective science communication conveys both complexity and nuance, and does so in a way that is understood by and useful to the audience.

Scientists are often trained to communicate their work with their peers via publications, posters, and presentations that may include research questions, hypotheses, methods, data analysis techniques, and conclusions. While this approach may work for peers within their field, it does not work well for most of the public.

Even if a learner is extremely interested in the STEM topic, most people are easily overwhelmed by the depth of content and jargon that characterize most professional presentations. Experts need to meet the public where they are to connect in a meaningful way. This means being aware of their audiences' experience level, needs, interests, and

potential reactions.

# How to Prepare Experts to Engage Public Audiences

## Strategies for Program

### Design and Implementation

#### Relevant, effective, and inclusive

- Include societal and ethical implications of science and technology
- Encourage Community Collaboration
- Employ Diversity, Equity, Accessibility, and Inclusion (DEAI) practices
- Foster conversations



**Photo credit:** Kayla Berry for NISE Network

**Photo description:** A group of education and STEM experts gathered around a table observing an oil cleanup experiment.

## BACKGROUND

### Strategies for Program Design and Implementation

- Program Design
  - Design programs to be relevant, effective, and foster conversations<sup>[1]</sup>
  - Incorporate societal and ethical implications of science and technology<sup>[2]</sup>
- Community Collaboration
  - Collaborating locally with youth-serving community organizations to reach diverse audiences<sup>[3]</sup>
- Finding and Preparing Experts
  - Work with professional associations, higher-education institutions, and other networks to find and prepare experts for engaging with local audiences
  - When possible, work with minority-serving professional associations to seek experts with diverse backgrounds
  - When possible, seek college and graduate students who may be closer in age to children and youth participating in a program
- Inclusion and Relevance

- Employ Diversity, Equity, Accessibility, and Inclusion (DEAI) practices in program design and structure<sup>[4]</sup>
- Go beyond Public Understanding of Science (PUS) to Public Engagement with science (PES)  
Design public engagement to create two-way conversations among publics and scientists for mutual learning<sup>[5]</sup>

<sup>[1]</sup> NISE Network *Program Development: A NISE Network Guide to Creating Effective Learning Experiences for Public Audiences*: <https://www.nisenet.org/catalog/nise-network-program-development-guide>

<sup>[2]</sup> NISE Network *Nanotechnology and Society Guide: A Practical Guide to Engaging Museum Visitors in Conversations*: <https://www.nisenet.org/catalog/nanotechnology-and-society-guide>

<sup>[3]</sup> NISE Network *Museum & Community Partnerships: Collaboration Guide and additional resources*: <https://www.nisenet.org/collaboration-guide>

<sup>[4]</sup> For more Diversity, Equity, Accessibility, and Inclusion (DEAI) resources please see: NISE Network Inclusive Audiences: <https://www.nisenet.org/audiences>

<sup>[5]</sup> *Public Engagement with Science: A guide to creating conversations among publics and scientists for mutual learning and societal decision-making*: <https://www.nisenet.org/public-engagement-conversations-guide>

# How to Prepare Experts to Engage Public Audiences

## ★ Start with existing hands-on activities and training materials

*Be prepared!  
Many experts will want to create  
experience from scratch.*



A good way to start is with existing hands-on activities and training materials

NISE Network kits and activities typically include orientation materials including staff and volunteer training slides, tips sheets, facilitator guides, and facilitation training videos. Training videos are designed to show facilitation strategies for specific hands-on activities, share specific activity content and background information, and model best practices in public engagement.

**Photo credit:** Science Museum of Minnesota for NISE Network

**Photo description:** Materials laid out for an activity including two balls of playdough, a rod, string, table signs, and instructional materials.

# How to Prepare Experts for a Public Event

- **Before the event**
  - Logistics, expectations,
  - Training and background materials
- **Day of the Event**
  - Orientation: goals, audience, expectations, facility, logistics
  - Beverages & snacks
  - Practice activities
- **After the event**
  - Follow up, thank, ask for their feedback



**Photo credit:** Gary Hodges for NISE Network

**Photo description:** A speaker points to a slide during a presentation for an audience.

## BACKGROUND

### Prepare Experts to Facilitate Hands-On Activities at an Event

- Before the event
  - Provide logistical details in advance
  - Be clear about their role and type of experience you're seeking
  - If you have a training video or written materials about an activity, you could share them before the event
- Host a short orientation training before or on the same day of the event
  - If possible, provide beverages or snacks
  - Provide a short orientation (event purpose and goals, audience background and expectations, facility, event logistics)
  - Model an existing activity (in-person or with a training video)
  - Give new facilitators the opportunity to practice the activity
  - Give facilitators constructive feedback and ask questions



- Provide suggestions for how to respond to common questions
- After the event
  - Follow up with experts, thank them, and ask for their feedback

# How to Prepare Experts for a Public Event

## At a Practice Training Session

- Model an existing activity (in-person or with a training video)
- Practice the hands-on activity
- Give constructive feedback and ask questions



**Photo credit:** Catherine McCarthy for NISE Network

**Photo description:** Volunteers review training materials and activity instructions in preparation for a special event.

# How to Prepare Experts to Engage Public Audiences

## Tips Sheets

- Planning Guest Presentations
- Guest Speakers
- Leading Hands-On Activities
- And more!

<https://www.nisenet.org/catalog/tips-sheets-engaging-public-audiences>

### Tips for Guest Speakers

Public audiences find emerging science and technology interesting. Keep in mind, however, that only a small percentage of the population knows much about this topic. Here are a few pointers for communicating with the public about science, engineering, and technology.

#### Know your audience

The more you know about your audience, the better you can adapt your presentation to their interests. Keep in mind the diversity of your audience's experience and backgrounds. Many visitors attend in family groups, which can include a wide range of ages and abilities. Also keep in mind that there are many "publics" rather than one monolithic general public.

#### Keep the message simple

Come up with one "big idea" you want the audience to take away from the experience, and make sure your presentation reiterates and reinforces this idea in different ways. Define your terms, avoiding jargon and acronyms as much as possible. Check in with your audience periodically to see if they're following you.

#### Use familiar analogies

Use comparisons to everyday experiences. Explain how the topic relates to something that's basic to the mass or in popular culture.

#### Use relative size and scale

Focus on relative size and scale rather than exact measurements. Consider using parts of the human body to explain relative scale.

#### Use visuals

Simple images and models will reinforce and clarify your message.

#### Use several modes of presentation

In addition to talking, you can include demonstrations, videos, and pictures. You can involve the audience by providing objects to pass around, asking questions, doing brief experiments, providing hands-on activities, and playing games.

#### Involve the audience in the processes of science

Encourage your audience to observe, predict, and explore by asking them questions: "What do you think will happen when...?" "Were you surprised?" "Why do you think that happened?" "What if you tried...?" "Can you think of any practical uses for this?" "What about unintended consequences?"

#### Be friendly and approachable

Remember to make eye contact, smile, and let the audience know who you are. If you're a scientist, consider including personal stories about your work life and your career decisions.

#### Be prepared to answer common questions

But don't be afraid to let your audience know if you don't know the answer to their question.

#### Share ways to learn more

Remember that your presentation is only one exposure that people will have to this topic—it's not the end of their learning. Help the audience connect to other opportunities for more exploration.

NISE

www.nisenet.org

The NISE Network has developed a collection of Tips Sheets for engaging public audiences in hands-on STEM activities. Tips sheets cover a range of specific topics, including girls, young learners, bilingual audiences, preparing guest speakers, creating conversations, difficult concepts, and accessibility and inclusion.

The content for several of the tips sheets has been included in the guide. Additional tips sheets are available for download:

<https://www.nisenet.org/catalog/tips-sheets-engaging-public-audiences>

- "Tips for Planning Guest Presentations" for museum staff and volunteers
- "Tips for Guest Speakers" for presenters
- "Tips for Leading Hands-On Activities" designed for facilitators

# How to Find Experts



The NISE Network strongly encourages institutions to collaborate with local experts. Partnering with experts is a key ingredient to many successful public engagement efforts. It is up to your institution to select how and when you would like to involve experts.

One of the best ways to find experts is to seek people and organizations in your community that are already involved in and committed to a STEM topic. Volunteers may offer their expertise and time, and some of them may have their own educational activities and information that are appropriate for your program.

- Identify experts you might like to work with and begin to build and grow your relationship over time
- Work with professional associations, higher-education institutions, and other networks to help you find and prepare experts to engage with local audiences

# Where to Find STEM Experts

## STEM Professional Societies

Examples with local databases:

- American Chemical Society
- Society for Neuroscience

## Diversity-Serving Professional Societies

Examples with local chapters:

- Society of Women Engineers (SWE)
- National Society of Black Engineers



**Photo Credit:** Science Museum of Minnesota for NISE Network

**Photo Description:** Expert showing molecular models to young children as part of chemistry hands-on activity.

## BACKGROUND

### STEM Professional Societies

Many STEM professional societies have regional chapters, sections, or groups that can help direct you to local experts in your geographic region. These local chapters are often associated with colleges and universities.<sup>[1]</sup> Many STEM professional societies encourage their members to participate in local outreach and public engagement activities. In the next section of this guide, we provide examples of professional societies with regional chapters or searchable outreach databases.

### Diversity-Serving Professional Societies

When possible, work with minority-serving professional associations to seek experts

with diverse backgrounds. Connecting with STEM professionals from different ethnic and demographic backgrounds gives public audiences the opportunity to see and meet experts who might look more like themselves. Members of these societies tend to be passionate about public engagement and some have local or regional chapters:

- AAAS IF/THEN® Ambassadors: <https://www.aaas.org/page/ifthen-ambassadors>
- American Indian Science and Engineering Society: <https://www.aises.org>
- National Action Council for Minorities in Engineering:  
<https://www.nacme.org>
- MAES – Latinos in Science and Engineering: <http://mymaes.org>
- National Society of Black Engineers (NSBE): <https://www.nsbe.org>
- National Organization for the Professional Advancement of Black Chemists and Chemical Engineers (NOBCChE):  
<https://www.nobcche.org/chapters>
- National Organization of Gay and Lesbian Scientists and Technical Professionals: <https://www.noglstp.org>
- Society of Asian Scientists and Engineers: <https://saseconnect.org>
- Society of Hispanic Professional Engineers: <https://www.shpe.org>
- Society of Nonbinary Scientists: <https://isnbs.org/>
- Society of Women Engineers (SWE):  
<https://swe.org/membership/sections/>
- Society for Advancement of Chicanos and Native Americans in Science (SACNAS): <https://www.sacnas.org>

<sup>[1]</sup> There are hundreds of professional scientific societies in the US, a list affiliated with the American Association for the Advancement of Science (AAAS) can be found at: <https://www.aaas.org/group/60/list-aaas-affiliates>

# Where to Find STEM Experts

## Colleges and Universities

★ The number #1 source for finding experts in your community.

*Consider both 4 and 2-year institutions. Many students will have requirements to fulfill from classes or larger outreach program.*



**Photo Credit:** Museum of Science

**Photo description:** Student volunteers helping a child with museum hands-on activity

## BACKGROUND

### Colleges and Universities

Community colleges, four-year colleges, and universities typically have a wide variety of STEM experts who are interested in reaching local audiences. Once you connect with a faculty or staff member, they can usually suggest undergraduate and graduate students who may be able to volunteer at your event or program. Also be sure to look into outreach offices at the local college that may coordinate volunteers and be aware of service requirements. Outreach programs may also be able to steer you in the direction of specific faculty, staff, and student groups that would be helpful in your search.

### Societal and Policy Experts

Museums and similar informal learning institutions can inform people about science and technology, but they also have the power to engage their public audiences to reflect on how aspects of STEM may affect their lives and society as a whole. Three big ideas that can provide us with a framework for conversations about technology and society are: 1) Values: values shape how technologies are both developed and adopted, 2) Relationships: technologies affect social relationships, and 3) Systems: technologies work because they are part of larger systems.<sup>[3]</sup> Consider seeking experts that can help make these societal connections and make STEM topics more relevant for your audiences. Sources of expertise can be found in local public health agencies, local governmental planning agencies, and university extension programs. There are academic programs and professional societies focused specifically on the study of science, technology, and society (STS).<sup>[4]</sup> Additionally, many STEM professional societies have special-interest groups or sections that focus on societal, ethical, legal, and policy implications of their discipline.

<sup>[3]</sup> Learn more: NISE Network *Nanotechnology and Society Guide: A Practical Guide to Engaging Museum Visitors in Conversations*: <https://www.nisenet.org/catalog/nanotechnology-and-society-guide>

<sup>[4]</sup> Professional societies focused specifically on the study of science, technology, and society (STS) include:

Society for Social Studies of Science (4S): <https://www.4sonline.org/sts-resources/professional-associations/>

Society for the History of Technology (SHOT) : <https://www.historyoftechnology.org>

Academic program lists can be found at:

<https://www.historyoftechnology.org/doing-history-of-technology/departments-and-programs-of-study/>



# Where to Find STEM Experts

## Student Groups

★ **Many students are closer in age to children and youth who may be participating in your programs.**

*These experts may be more approachable for your family and general audiences.*



**Photo Credit:** Museum of Science

**Photo description:** Student volunteers posing for a group photo at a museum event.

## BACKGROUND

### Student Groups

Graduate, undergraduate, and high school student groups can be wonderful additions to your STEM programming. Because they are closer in age to children and youth who may be participating in your programs, these student experts may be more approachable for your family and general audiences.

Colleges often have student groups associated with professional societies (such as the Society for Women Engineers) or affinity groups connected with STEM topics (such as environmental or astronomy clubs). Undergraduate and graduate students can be great partners, but inevitable turnover with student membership and leadership in these organizations can make working with them in the long-term a

challenge. Developing a relationship with the group's faculty or staff adviser can help smooth out annual student transitions. It also helps to be aware of school holidays and exam periods before requesting participation at events. Offering regular and predictable ways these groups can interact with your institution will go a long way in developing your student partnerships.

# Strategies for Finding STEM Experts

## Local, State, and Federal Agencies

- NASA
- NOAA National Weather Service meteorologists
- USDA Natural Resources Conservation Service

## Local Industry Professionals



**Image Credit:** Science Museum of Minnesota for NISE Network

**Photo description:** A NASA astronaut signing autographs at a museum event.

## BACKGROUND

### Local, State, and Federal Agencies

Local, state, and federal agency staff have a great deal of knowledge to share on a variety of STEM topics, including engineering, environmental management, water quality, waste management, land conservation, public health, transportation, Earth and space science, and much more. Additionally, keep in mind that many local agency staff can be very eager to make direct connections with local residents.

### Local Industry Professionals

You may have experts from local industry in your area. Many corporations with employee volunteer programs seek opportunities to contribute to the wellbeing of

their local communities and connect their employees with community members. Featuring local employers is a great method to make potential workforce development connections.

# Strategies for Finding STEM Experts

## Affinity Groups

- The Solar System Ambassadors Program
- The Night Sky Network
- National Audubon Society chapters



**Photo credit (left):** Oklahoma WONDERTorium

**Photo description (left):** Volunteers dressed up as science fiction characters in front of an exhibition.

**Photo credit (right):** Science Museum of Minnesota for NISE Network

**Photo description(right):** A NASA Solar System Ambassador wearing a hijab holding a sheet with Apollo mission patches.

## BACKGROUND

### Affinity Groups

Enthusiasts, interest groups, and organizations with STEM connections often have members who are excited to share their passions. Examples of these groups can include avid gardeners, birders, amateur radio societies, and astronomy clubs. Some of these local clubs and groups may be part of larger organizations and umbrella networks such as birding clubs that are affiliated with the National Audubon Society and astronomy clubs that are part of the Night Sky Network.

# Strategies for Finding STEM Experts

## Indigenous Ways of Knowing

- Connect with Indigenous people in your area.
- Connect with the local Indian Health Service office, especially for health-related STEM topics.



**Photo credits:** Science Museum of Minnesota

**Photo description (left):** Group of people sitting in a circle around a large drum at a Native American special event.

**Photo description(right):** Two women staffing a Native American information table at a special event.

## BACKGROUND

### Indigenous Ways of Knowing

Seeking out and connecting with local Indigenous community leaders who have local knowledge and perspectives to share for a long-term relationship is the first step toward co-creating relevant educational materials or programs. Like all relationships, building trust with new partners takes time, and working with Tribal Nations is different from working with the majority culture.

If your institution is committed to a long-term relationship, you may want to explore the “Two-Eyed Seeing” approach increasingly being used to braid together Western methods and theories with Indigenous knowledge. Two-Eyed Seeing is “learning to see from one eye with the strengths of Indigenous knowledges and ways of knowing, and from the other eye with the strengths of mainstream knowledges and ways of knowing, and to use both these eyes together, for the benefit of all.”

Unlike many other STEM experts with full-time paid positions, Indigenous elders, leaders, and storytellers may need honorariums or stipends to compensate for their time and the expertise they share.

# Strategies for Finding STEM Experts

## Arts and Cultural Connections



## Additional Volunteers for



**Photo credits:** Science Museum of Minnesota for NISE Network

**Photo description (left):** Adult facilitator wearing a hijab working on a museum activity with a young family.

**Photo description(right):** Older volunteer at a museum talking about an activity with a young family.

## BACKGROUND.

### Arts and Cultural Connections

STEM experts can also be included as part of arts and cultural events that your institution may celebrate. These events are a great way to provide opportunities for learners to express their creativity, tell a local story, and make STEM content more relevant for your public audiences. Celebrating cultural events is a great way to involve experts, celebrate accomplishments, share stories of historical and living people and make STEM content more relevant. Additionally, some STEM topics, such as astronomy, provide an opportunity to include a rich cultural history from all over the world and are a way to connect and resonate with public audiences.<sup>[1] [2]</sup>



## **Additional Volunteers for a STEM event**

In addition to finding STEM experts, you may need to recruit other types of volunteers to help with your event. Potential sources of volunteers may include:

- College students, classes, or clubs with community service requirements
- Service-oriented college fraternities and sororities such as:
  - Alpha Phi Omega (APO) co-ed organization on 375 college campuses <https://apo.org/start-a-chapter/chapter-map/>
  - Professional fraternities and sororities [https://en.wikipedia.org/wiki/Professional\\_fraternities\\_and\\_sororities](https://en.wikipedia.org/wiki/Professional_fraternities_and_sororities)
- High school science clubs or students suggested by local high school science teachers
- Drama and theater students from local colleges
- Local industry staff and retirees
- Local service clubs

<sup>[1]</sup> For astronomy examples see: Andrew Fraknoi (2020) The Astronomy of Many Cultures: A Resource Guide, Fromm Institute, U. of San Francisco, Version 5.1; July 2020. [https://astrosociety.org/file\\_download/inline/eb3601be-8e70-4f11-8e12-3c8c5b52e66a](https://astrosociety.org/file_download/inline/eb3601be-8e70-4f11-8e12-3c8c5b52e66a)

<sup>[2]</sup> For example, Guerilla Science aims to change how people connect with science so that science is celebrated as an intrinsic part of human culture: <https://guerillascience.org>

# Contacting Experts

## Steps for Inviting Experts to Participate

- Start early!
- Cast a wide net
- Craft a clear written email message with your request
- Create a simple recruiting flyer
- Make personal phone calls
- Stay in contact
- Send preparation materials in advance



★ **Be upfront and clear about their commitment.**

**Image Credit:** Noun Project

## BACKGROUND

### Contacting Experts

Once you have some idea of the kinds of experts you would like to recruit for a project or event, you will need to begin contacting them and inviting them to participate. Keep in mind that you may need to cast a wide net to find experts who have interest and capacity to work with you.

- Start early!
  - Experts are busy people, so give them as much advance notice as possible
- Cast a wide net
  - Keep in mind that many people you contact may not respond
  - Many experts may not be able to participate due to time constraints and prior commitments
  - Seek advice and suggestions for additional people from those who respond

- Ask experts you have worked with before about ideas they may have
- Ask people you know (staff, volunteers, board, sponsors) for suggestions
- Craft a clear written email message with your request
  - Be sure to briefly introduce yourself and your institution
  - Describe the commitment request
  - Be clear if this is a volunteer request or if you are offering some type of compensation
  - Provide key logistical details for events
  - Write the message so that it can easily be shared with others (if appropriate)
  - Ask about their interest and availability
- Create a simple recruiting flyer
  - Design a flyer that can be posted and shared physically and virtually
  - A flyer is appropriate for situations where you are seeking many volunteers such as a large event or inviting a group to a training orientation
- Make personal phone calls
  - Phone calls can be more effective in getting a response than emails
  - If you call, always follow up with a written email with details
- Stay in contact
  - Follow up with reminders and confirm logistical details in writing
  - Provide information they will need to know about your facility (transportation details, access) and/or project (background, contact information)

Send preparation or review materials in advance (e.g., agendas, tips sheets, training videos, etc.)

# Finding STEM Experts by Subject Area

- Chemistry and Physics
- Space and Earth Science
- Environmental Sciences
- Agriculture
- Biology and Biomedical Sciences
- Neuroscience
- Engineering, Technology
- Computer Science, Math, Statistics
- Incorporating STEM into Arts and Cultural Celebrations

## Chemistry and Physics

### Colleges and Universities

You may find experts at a local college in chemistry, chemical engineering, and physics programs. Many chemistry and physics departments have traveling demo shows and public outreach programs. Many chemistry departments are already active in annual events such as National Chemistry Week and Chemists Celebrate Earth Week.

### Student Groups

High school chemistry and physics teachers may be willing to serve as experts; they also may be able to suggest high school students who could volunteer at your event to facilitate hands-on activities.

#### High School ChemClubs

There are over 600 high school ChemClubs; many of these clubs do outreach with younger students. Find out whether a high school near you has an active ACS ChemClub at: <https://www.acs.org/content/acs/edu/education/students/highschool/chemclubdirectory.html>

#### American Chemical Society (ACS) Student Chapters

ACS has student chapters located on many college campuses around the world. Once you find the name of a student chapter, please contact [undergrad@acs.org](mailto:undergrad@acs.org) to reach out to their faculty advisor. To find the closest chapter to you, please visit: <https://www.acs.org/content/acs/edu/education/students/college/studentaffiliates/find-a-chapter.html>

#### Society of Physics Students (SPS)

The SPS has more than 843 chapters at colleges and universities across the country: <https://www.spsnational.org/about/governance/chapters>

### SPE Student Chapters

SPE, the international society for optics and photonics, has student chapters and clubs at universities around the world. SPE has educational outreach resources on light, lasers, and optics as well as the International Day of Light: <https://spe.org/membership/student-services/student-chapters>  
<https://spe.org/education/education-outreach-resources>



### Professional Societies

#### American Chemical Society (ACS)

ACS has 185 local sections organized geographically throughout the U.S. To find contact information for your state please visit: [https://lookup.acs.org/lookup/local\\_search](https://lookup.acs.org/lookup/local_search)

National Chemistry Week coordinators (annual event mid-October) ACS maintains a list of National Chemistry Week coordinators that is searchable by state and zip code: <https://www.nchemlookup.acs.org/nchemlookup>

Chemists Celebrate Earth Week coordinators (annual event mid-April) ACS also maintains a list of Chemists Celebrate Earth Week coordinators that is searchable by state and zip code: <https://www.ccelookup.acs.org>

American Chemical Society (ACS) Experts: The ACS Experts are chemists and chemical engineers who provide reliable, in-depth analysis and respond to inquiries on a wide range of topics in the news and of interest to the public and policymakers. <https://www.acs.org/content/acs/edu/pressroom/experts.html>

The guide includes a list of resources for connecting experts by STEM disciplines. Some of these resources may work for multiple disciplines. A list of relevant annual events is also included with each subject area as a helpful reminder to upcoming partnership opportunities with experts.

Please note that this section is intended to be a starting place for inspiration, rather than an exhaustive list of all professional scientific societies. A good resource for many professional societies can be found at the American Association for the Advancement of Science (AAAS) affiliated societies at: <https://www.aaas.org/group/60/list-aaas-affiliates>

# Final Thoughts



The NISE Network strongly encourages institutions to collaborate with local experts. Partnering with experts is a key ingredient to many successful public engagement efforts. It is up to your institution to select how and when you would like to involve experts.

One of the best ways to find experts is to seek people and organizations in your community that are already involved in and committed to a STEM topic. Volunteers may offer their expertise and time, and some of them may have their own educational activities and information that are appropriate for your program.

- Identify experts you might like to work with and begin to build and grow your relationship over time
- Work with professional associations, higher-education institutions, and other networks to help you find and prepare experts to engage with local audiences

# Maintaining and Deepening Relationships

## Maintain contact and show your appreciation

- Send a follow-up thank-you note
- Share attendance statistics and photos
- Get to know them
- Offer them a free pass
- Subscribe them to your newsletter
- Periodically reach out and touch base
- Maintain their contact information
- Invite them to a volunteer appreciation event
- Publicly thank volunteer experts



## BACKGROUND

### Maintaining and Deepening Relationships

When you find a STEM expert that you enjoy working with, the next steps are to slowly nurture and grow your partnership over time. Effective partnerships require nurturing, understanding, and mutual respect.

### Ways to maintain contact and show your appreciation

- Send a follow-up thank-you note to experts who have participated in an event
- Share attendance statistics and photos of events if experts require documentation of their participation. Experts appreciate receiving photos showing their participation in an event (Note: Obtain signed photo releases of all people in shared photos)
- Invite them to events you think they might be interested in
- Get to know them by inviting them to an informal event attended by staff, volunteers, and advisors
- Offer them a free pass to your institution or an event
- Subscribe them to your institution's electronic newsletter
- Periodically reach out and touch base via email or phone
- Keep a list of experts and maintain their contact information

- Recognize their effort and invite them to a volunteer appreciation event
- Look for ways to publicly thank volunteer experts (social media, newsletter, etc.)

Nurturing these relationships is a way to build long-lasting ties to individuals and organizations within your community. Not every relationship with your institution will continue, but many are worth building upon. Over time, some of these partnerships may deepen and change in positive ways that you might not have originally anticipated. If a relationship does deepen to the point of joint projects, consider developing a written agreement about goals, plans, timelines, roles, and responsibilities to clarify understandings and future participation.<sup>[1]</sup>

<sup>[1]</sup> To learn more about partnering with a research center please see: *A Guide to Building Partnerships Between Science Museums and University-Based Research Centers*: <https://www.nisenet.org/riseguide>

For general collaboration advice see: *NISE Network Museum & Community Partnerships: Collaboration Guide and additional resources*: <https://www.nisenet.org/collaboration-guide>

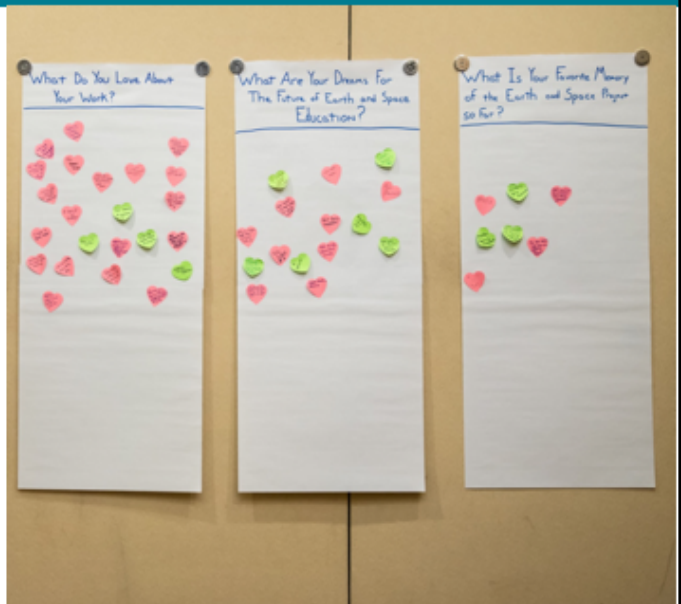
**Image Credit:** Noun Project

**Image Description:** Icon composed of Two humans with a heart between them.

# Reflecting on your experiences

Work with experts with a lens toward improving your relationship

- What went well and what could be improved
- Follow-up with experts
- Make time to talk with experts



**Photo credits:** NISE Network

**Photo description:** Sticky notes grouped in categories on a wall during a professional meeting.

## BACKGROUND

### Reflecting on your experiences

A useful process is to reflect upon your experience working with experts with a lens toward improving this specific relationship as well as future partnerships. This process can take many forms, including:

- Hold a debriefing conversation following an event with your own staff to reflect upon what went well and what could be improved].
- Send a short written questionnaire to the experts who participated in an event to share their thoughts about their experiences and ask if they would have liked any additional preparation now that they have attended the event. Make time to talk with experts involved in ongoing projects to reflect upon



challenges, successes, and what could be improved.

- Conduct an informal focus group with a handful of experts you worked with in the past year to learn about their experiences. Discuss with staff how this feedback might change your institution's partnering process.

These reflection activities do not need to be burdensome. Reflective practice is an established method to deepen your ongoing relationships with local experts.<sup>[1]</sup>

<sup>[1]</sup> For evaluation capacity building resources see: Pattison, S., Cohn, S., & Kollmann, L. (2014). NISE Network Team-based inquiry: A practical guide for using evaluation to improve informal education experiences. Second edition.

<https://www.nisenet.org/catalog/team-based-inquiry-guide>



## Future Online Workshops

2pm-3pm Eastern / 11am-12pm Pacific

**Tuesday, April 5, 2022**

Communicating Climate Change  
to Diverse Audiences

**Tuesday, May 3, 2022**

Earth & Space Roundup of NISE  
Network Resources

**Tuesday, June 15, 2022**

Reconnect and Re-engage with the  
NISE Network

Learn more at [nisenet.org/events](https://www.nisenet.org/events)



Learn more and register for one or all!

Learn more at <https://www.nisenet.org/events>

## Get Involved

Learn more and access the  
NISE Network's online digital resources  
[nisenet.org](https://www.nisenet.org)



Subscribe to the  
monthly newsletter  
[nisenet.org/newsletter](https://www.nisenet.org/newsletter)

Follow NISE Net on social networking  
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<https://www.nisenet.org/newsletter>

<https://www.nisenet.org/social>

# Thank You



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Photo Credits: Children's Creativity Museum for NISE Network, NISE Network, Science Museum of Minnesota for NISE Network, Emily Maletz for NISE Network  
Photo Description: Montage of children and adults using hands-on STEM activities in museums.

# Thank You



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**Image Credit:** Children's Creativity Museum for NISE Network

**Image Description:** Girl pouring liquid into plastic vial.

## Q & A

- What aspects of **working with experts** do you need help with?
- What **kind of experts** are you looking for?
- **Share advice** for maintaining and deepening connections.
- Share a strategy or technique **you have found successful**.