NISE network

NANOSCALE INFORMAL SCIENCE EDUCATION

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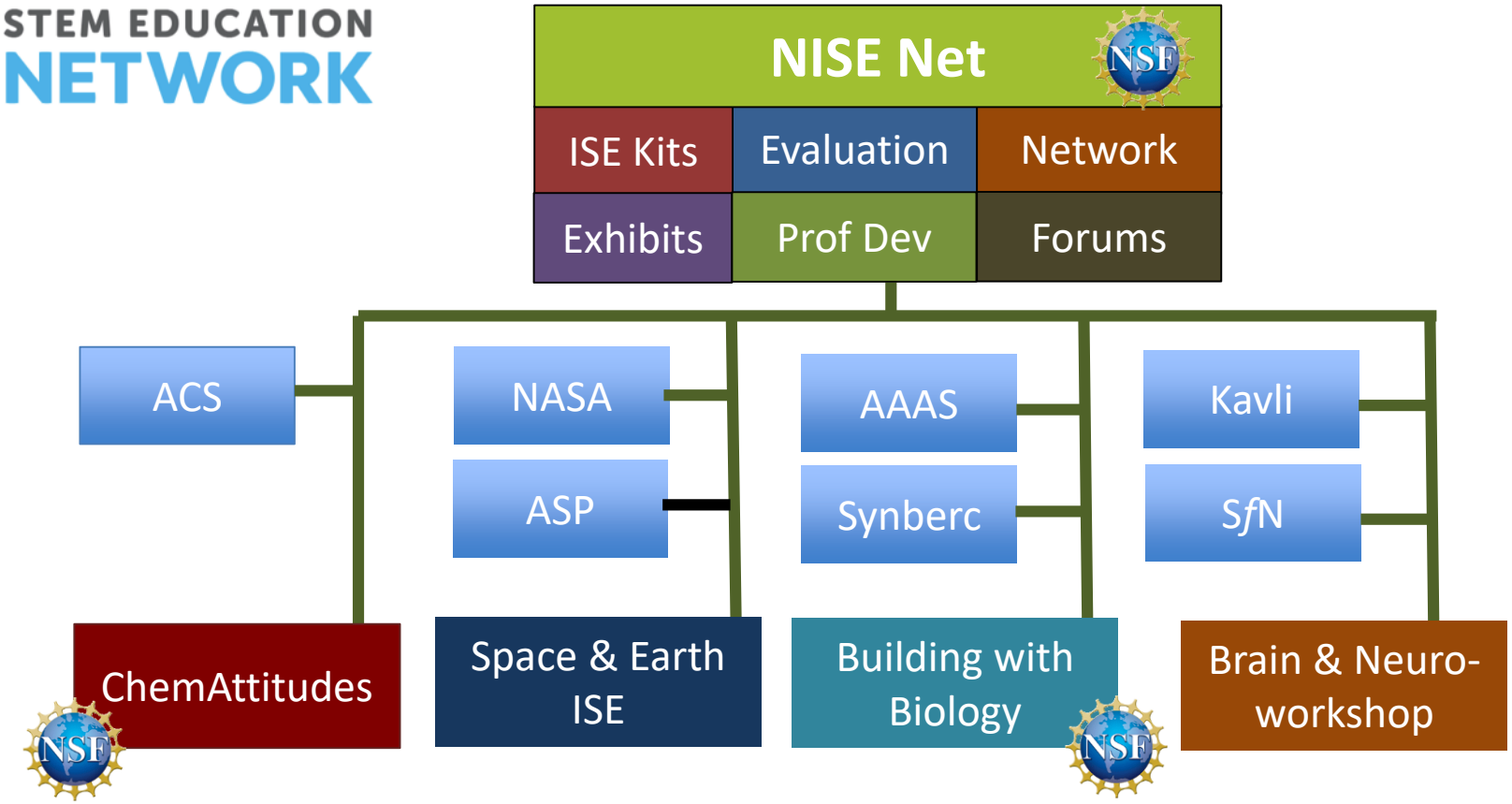
Museum of Science, Boston

NSF 0532536, 0940143

NISE
NATIONAL INFORMAL STEM EDUCATION NETWORK



NISE
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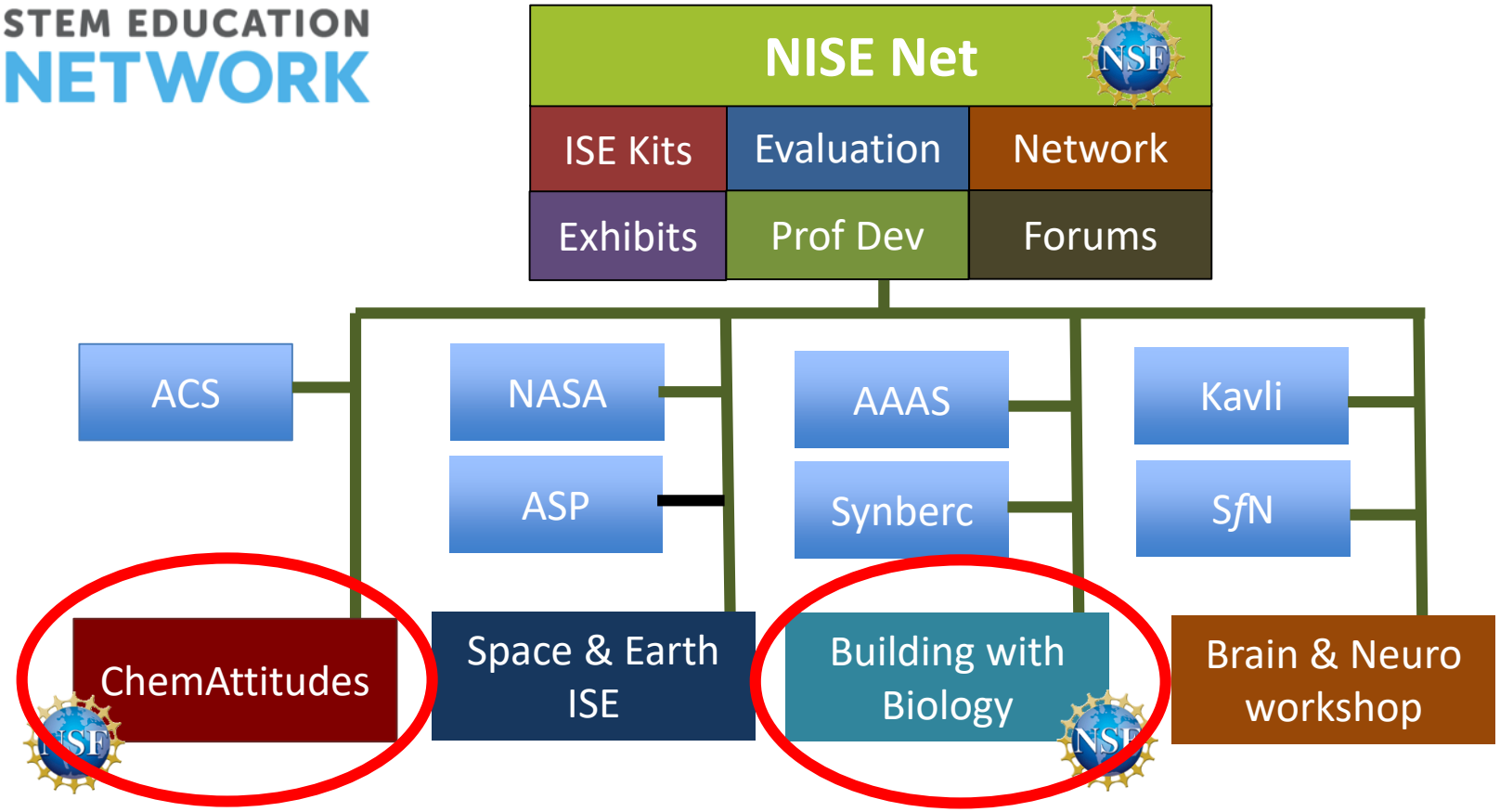
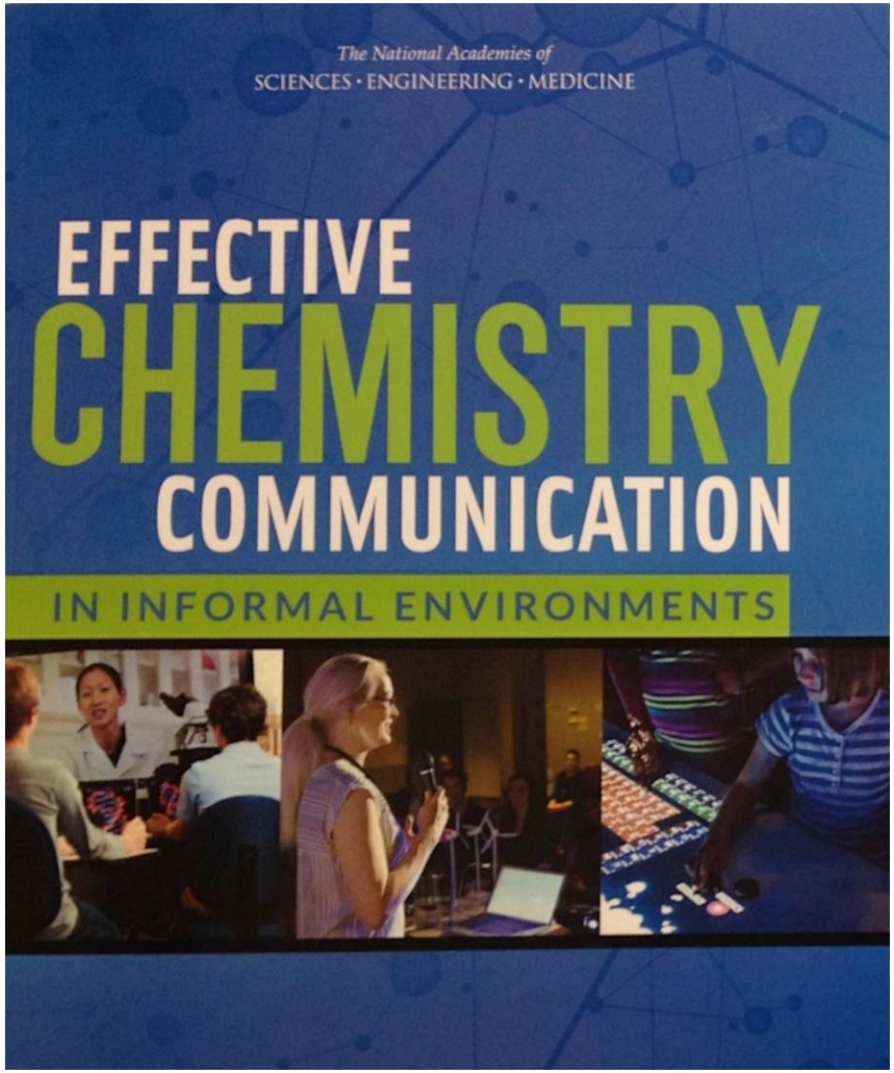




The National Academies, 2016

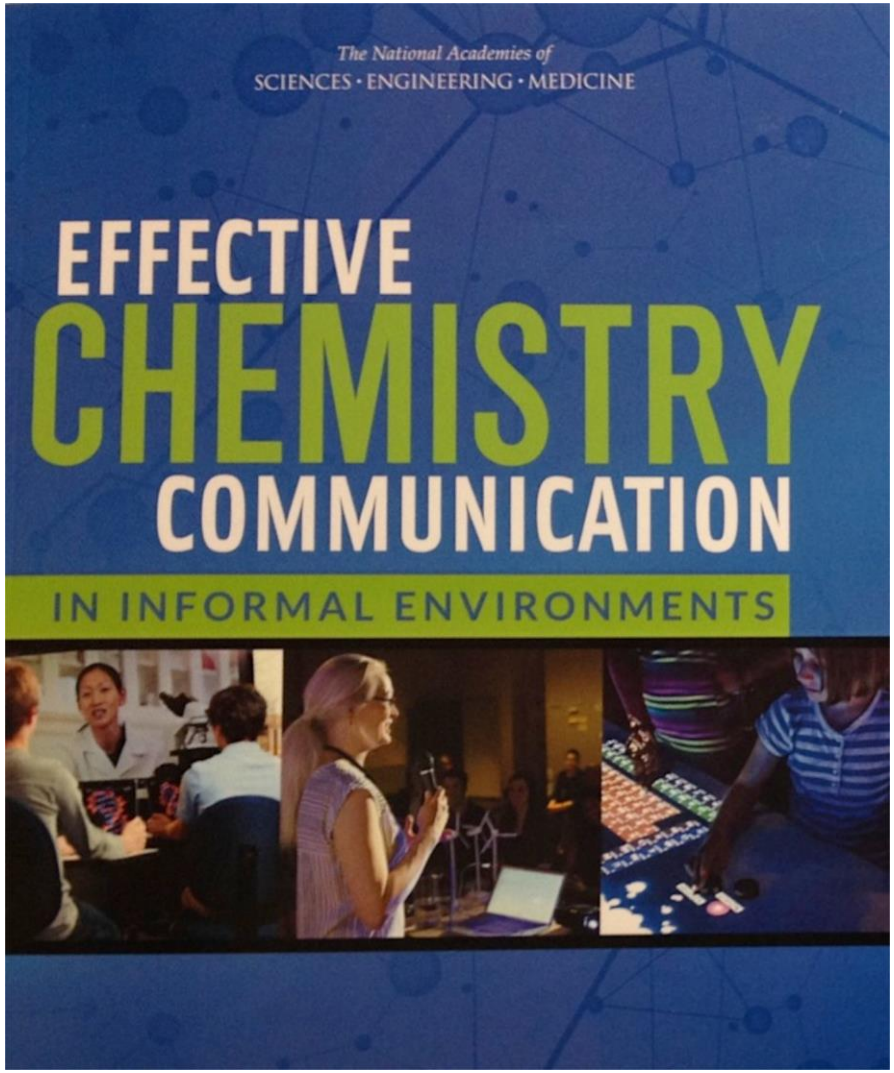
Report has 26 references to NISE Net

University-affiliated individuals … noted multiple benefits of participation. They … recognize that participating provides them with **valuable professional development**.

The benefits included learning **how to better communicate their own scientific interests to the public** … and "learning from the public—getting a chance to hear **their questions, issues, and concerns regarding nanoscience**."

"Engaging with the public is very motivating for graduate students and post-docs, and it helps them stay focused on **why they are doing their research and how it benefits society.**"

1238273



The National Academies, 2016

The report also said

Chemists and experts in empirical approaches to science communication, informal learning, and chemistry education **should collaborate to study chemistry communication in informal settings**. Research should focus on…public perception and understanding of chemistry….”

“NSF should support (such) research…through programs such as the AISL program.”

1238273

ChemAttitudes

Public attitudes to chemistry

Research report
TNS BMRB 2015

ROYAL SOCIETY OF CHEMISTRY

"What would it be like in each room?"

ChemAttitudes

"We asked participants to imagine two rooms: one that represented 'chemistry' and one that represented 'science'."

Public attitudes to chemistry

Research report
TNS BMRB 2015

ROYAL SOCIETY OF CHEMISTRY

ChemAttitudes

Science
Welcoming, friendly "I think it's more sociable in the science room...I think it will have more sociable people"
Fun
Active, discovery, exploration
Applied to the world
Busy, excitement, buzz
Open to non-experts "you don't have to have a science brain to understand what's going on"
Accessible to everyone
Visual, demonstrable

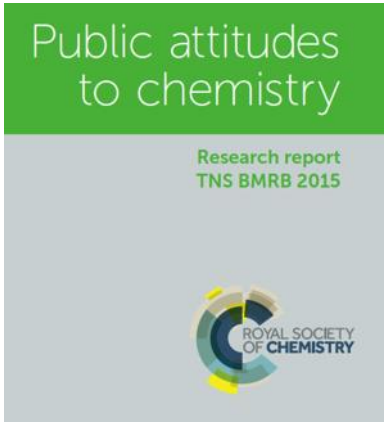
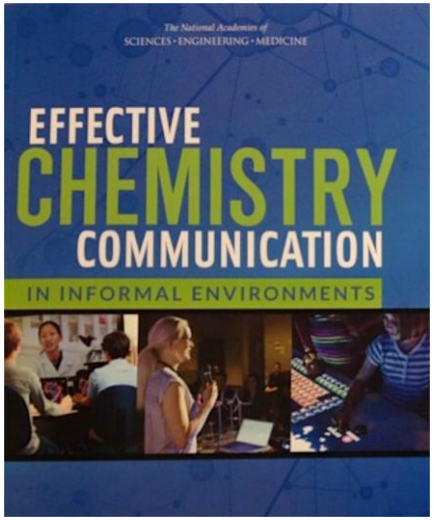


Table 2.11: Comparative characteristics of chemistry and science

Chemistry	Science
Intimidating, hard to understand, would feel ignored "You wouldn't dare to touch anything"	Welcoming, friendly "I think it's more sociable in the science room...I think it will have more sociable people"
Serious	Fun
Methodical, repetitive work	Active, discovery, exploration
Chemistry not involved in the end product	Applied to the world
Quiet, silence, concentration	Busy, excitement, buzz
Inaccessible, hard "I feel we can relate to science a little bit more, surrounded by animals, plants, whereas in the chemistry room they're doing experiments, you need to be someone of a certain profession or qualified"	Open to non-experts "you don't have to have a science brain to understand what's going on"
Work going on in the background, 'behind closed doors'; hidden or secretive	Accessible to everyone
Microscopic, can't easily see what's going on	Visual, demonstrable

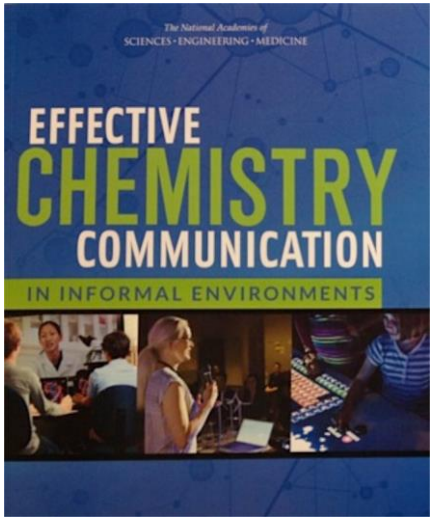
ChemAttitudes



The National Academies' report suggests two potential sources of negative attitudes toward chemistry:

- people's past history with the topic
- the nature of chemistry itself:
  - abstract, invisible scale
  - general purpose nature of the field

ChemAttitudes



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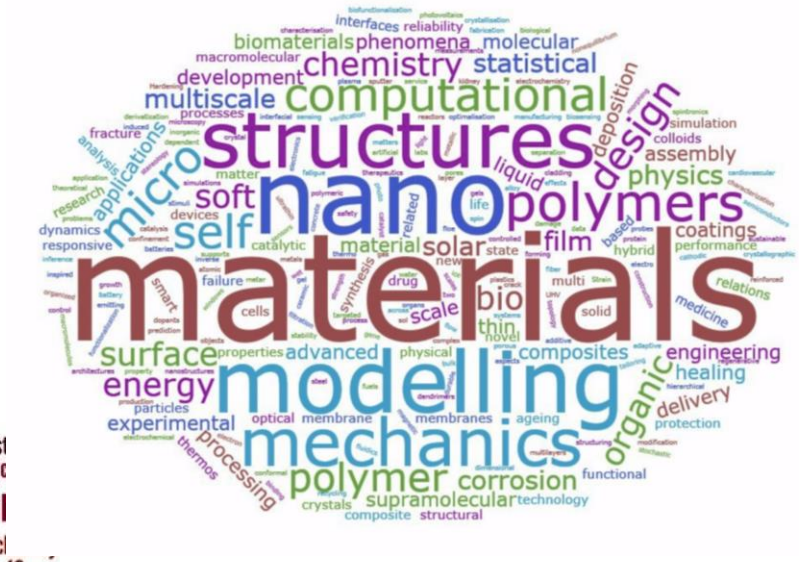
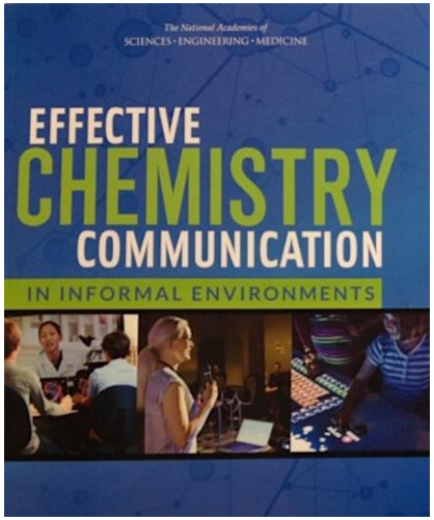


ChemAttitudes



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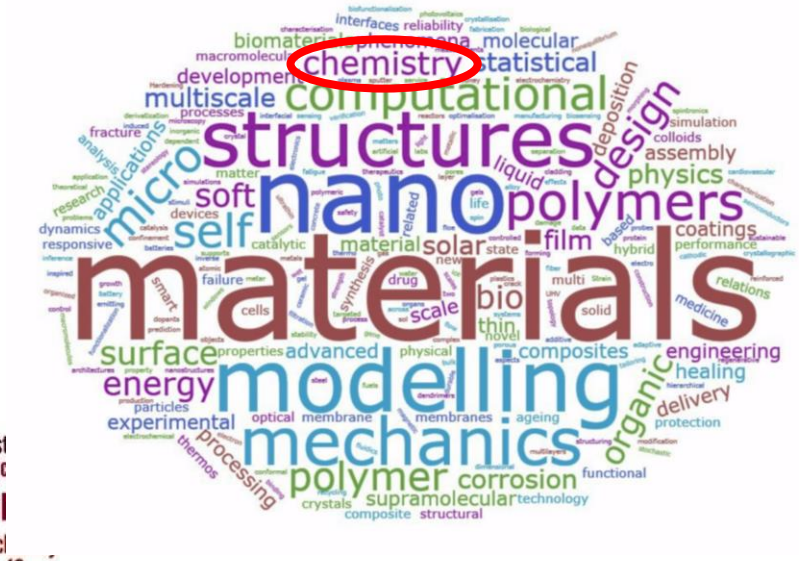


ChemAttitudes

The **ChemAttitudes** project aims to have a strategic impact on publics' attitudes toward chemistry, specifically, their

- **interest** in chemistry,
- understanding and perception of its **relevance**, and
- feelings of **self-efficacy** with respect to it.

The project will use **design-based research** to develop knowledge and educational activities that embody that knowledge.

ChemAttitudes starting theoretical framework

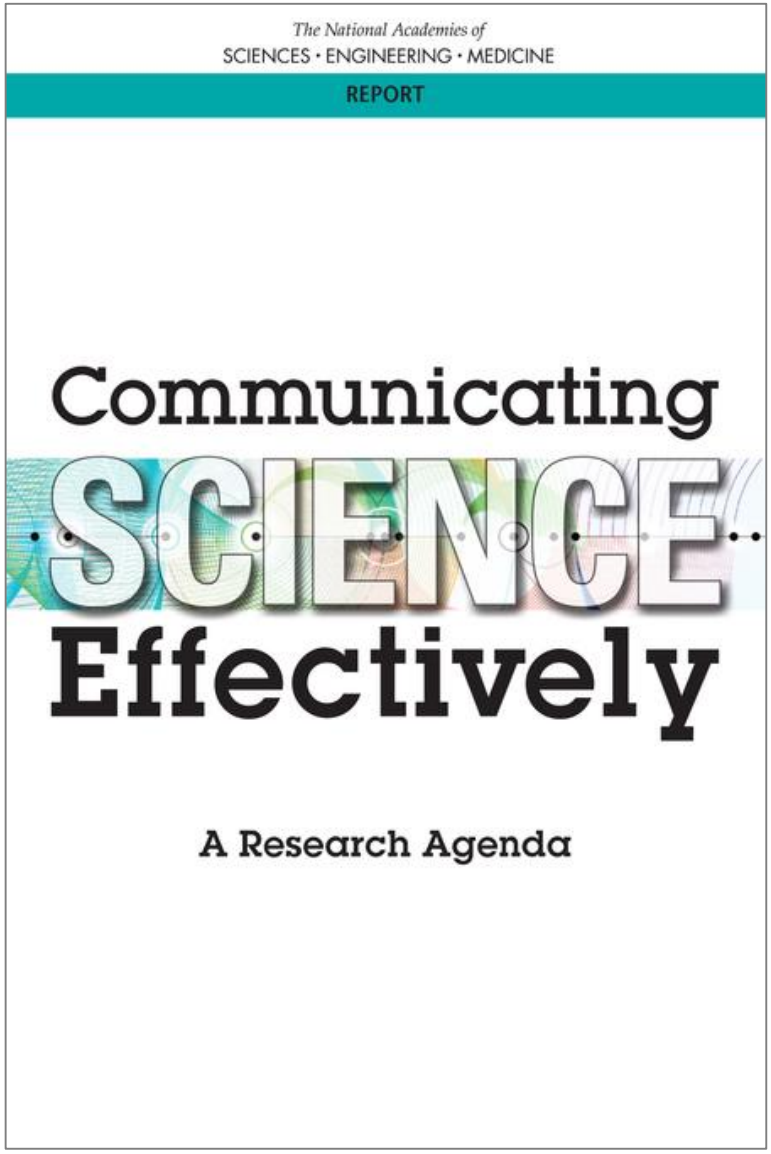
Phase 1: Strategies for Individual Activities	Phase 2: Strategies for Activity Groups	Phase 3: Strategies for Trainings and Facilitation	Outcomes / Impacts
Content should include: • Applications / uses Program formats should: • Be hands-on and interactive • Allow for observation of phenomena and manipulation of materials	Content should include: • Varied science information Program formats should: • Vary among activities	Facilitator trainings should include: • Information about event and activity goals • A common understanding / definition of chemistry • Tips about how to get visitors to ask & answer questions about observations Facilitators of hands-on activities should: • Let visitors do activities on their own • Ask questions of visitors about what they are seeing / experiencing	Public participants will have an increased **interest** in the field of chemistry.
Content should include: • Applications / uses • Social issues • Links to everyday life • Links to other STEM topics Program formats should: • Include discussion and consideration of how the topic relates to everyday lives now and in the future	Content should include: • Varied applications / uses • Varied societal implications Program formats should: • Include a variety of ways to connect and interact with activities	Facilitator trainings should include: • Information about event and activity goals • Information about how to include examples & ask questions of visitors to help them create links to their experiences Facilitators of hands-on activities should: • Include examples & ask questions about things they think will be familiar	Public participants will have an increased understanding of the **relevance** of the field of chemistry to their lives.
Content should include: • Foundational science information Program formats should: • Be hands-on and interactive • Allow for use of tools or models of tools • Include discussion of visitors' roles in development of the technology and how to do it responsibly	Content should include: • Varied levels of information (from more to less complex) Program formats should: • Be developed for visitors of a range of abilities	Facilitator trainings should include: • Information about how to encourage visitors and provide positive reinforcement • Tips about how to help visitors do an activity on their own Facilitators of hands-on activities should: • Let visitors do activity on their own • Include positive reinforcement and self-regulatory comments	Public participants will have increased feelings of **self-efficacy** about chemistry (their ability to do chemistry activities and participate in conversations about chemistry).

ChemAttitudes

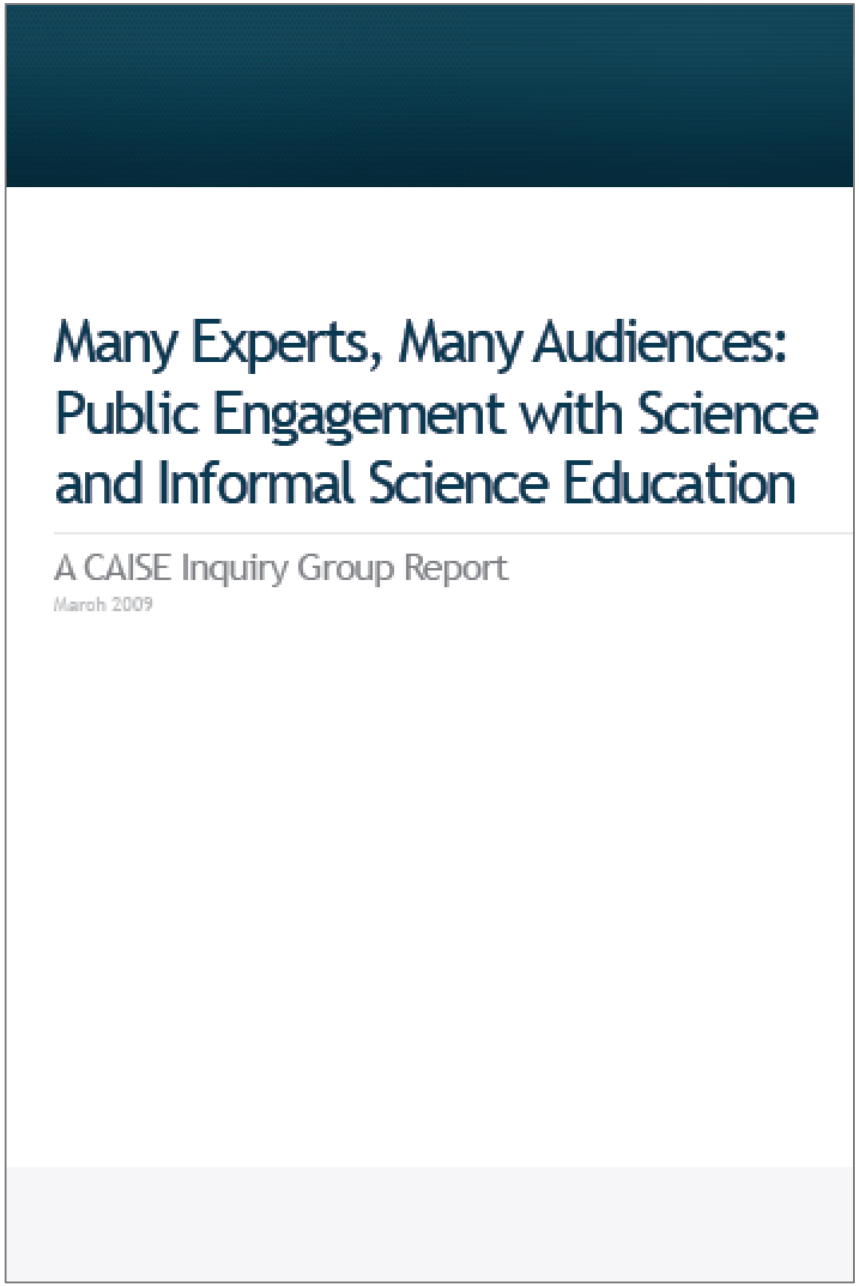
Using Design-Based Research to Develop and Disseminate Strategies and Materials to Support Chemistry Interest, Relevance, and Self-Efficacy

1612482

“the most widely held, and simplest, model of what audiences need from science communication … is wrong. A common assumption is that a lack of information and understanding of science fully explains why more people do not appear to accept scientific claims or engage in behaviors or support policies that are consistent with scientific evidence.... And although people may need to have more information or to have information presented more clearly, a focus on knowledge alone often is insufficient.... What is known now, though, is that public engagement often is essential for acceptable decisions about science-related controversies. It is clear as well that even when an issue does not involve a widely known controversy, science communication is more effective when scientists are willing and able to listen carefully and respectfully to different points of view.”



Building with Biology



Public Engagement with Science (PES) is usually presented as a “dialogue” or “participation” model in which **publics and scientists both benefit from listening to and learning from one another**—referred to as mutual learning. The model is premised on the assumption **that both publics and scientists have expertise, valuable perspectives, and knowledge to contribute to the development of science and its application in society**

Building with Biology

Dimensions of PES

More like Public Understanding

Focus

- Natural and human made world
- Processes of science
- Societal & environmental impacts
- Relevant personal, community, and societal values
- Institutional priority or public policy

Public

- Watch and read
- Ask questions or interact
- Talk and share views
- Deliberate and problem solve together
- Produce recommendations

Experts

- Advise the ISE folks
- Make presentations to the public
- Work to improve communication skills
- Welcome and value public input
- Act on public input

More like Public Engagement

http://www.buildingwithbiology.org/pes

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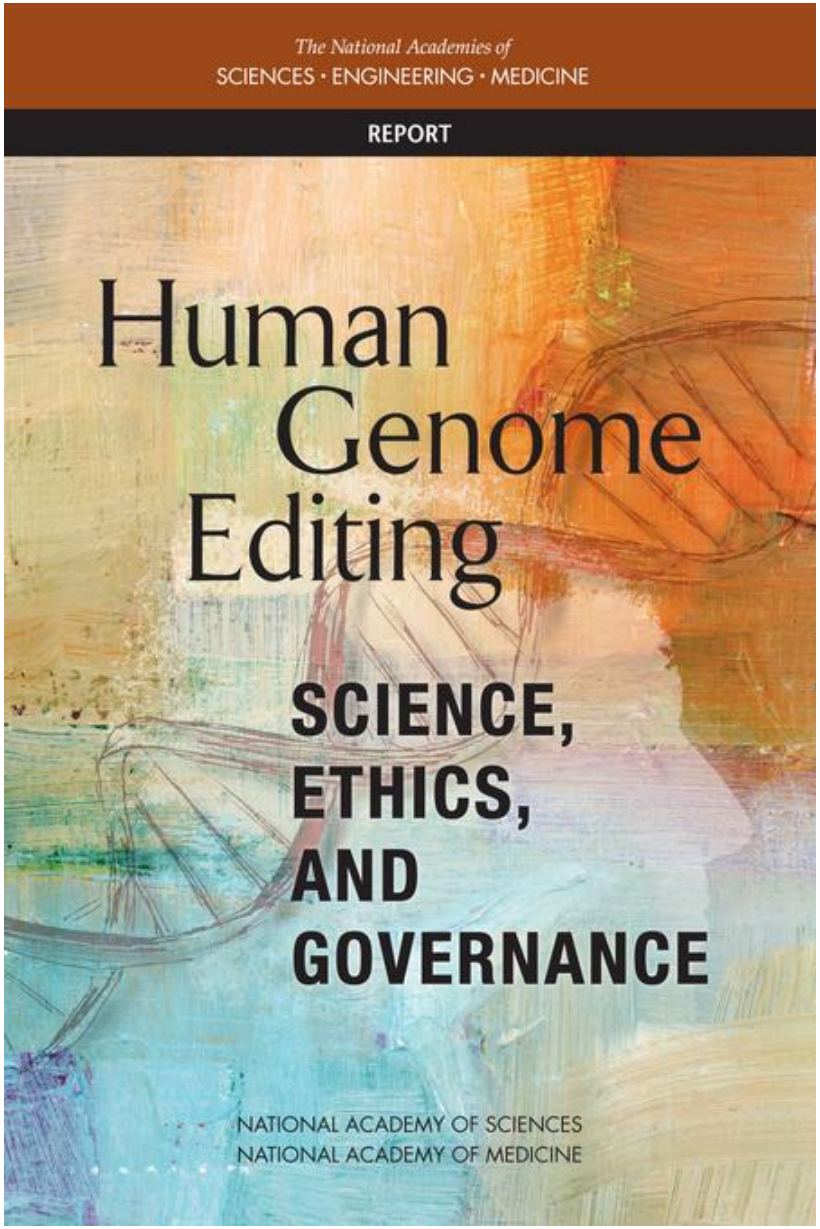
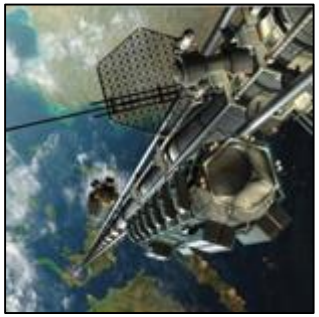
"The emergence of CRISPR/Cas9 as a research tool in the area of human genome editing has lent new urgency to calls for a **broad public dialogue** about these technologies and their applications."

The report calls for "**extensive and inclusive public participation…. developing the necessary content and communicating it effectively**….and improving public engagement."



Exploring Nano & Society – Invisibility Cloak

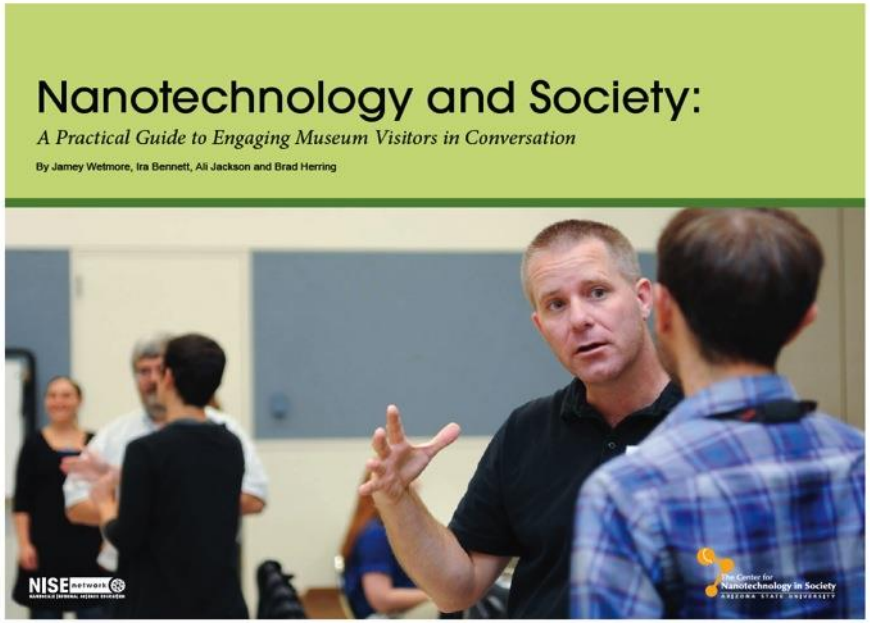


Exploring Nano & Society – Space Elevator

Exploring Nano & Society – You Decide!

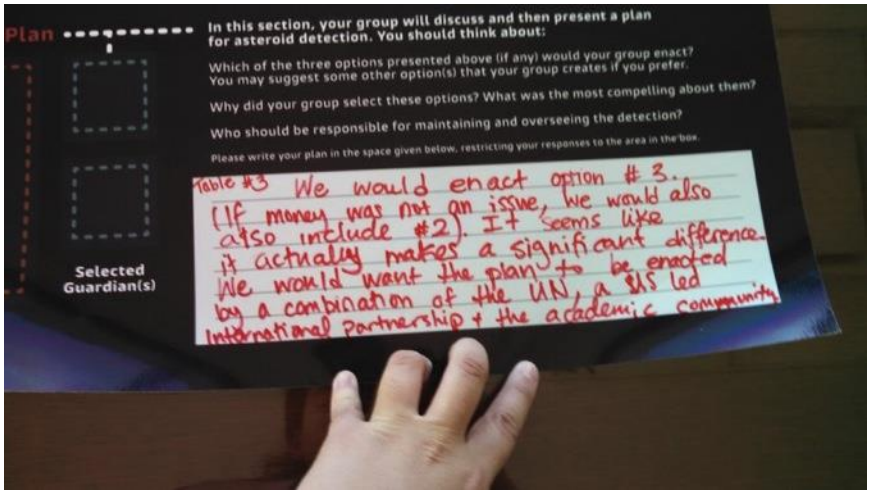
Exploring Nano & Society – Flying Cars

Exploring Nano & Society – Tippy Table



NISE network
NANOSCALE INFORMAL SCIENCE EDUCATION

NISE Net and MOS experience with dialogue programs we call Forums



Building with Biology

Activities and Conversations about Synthetic Biology

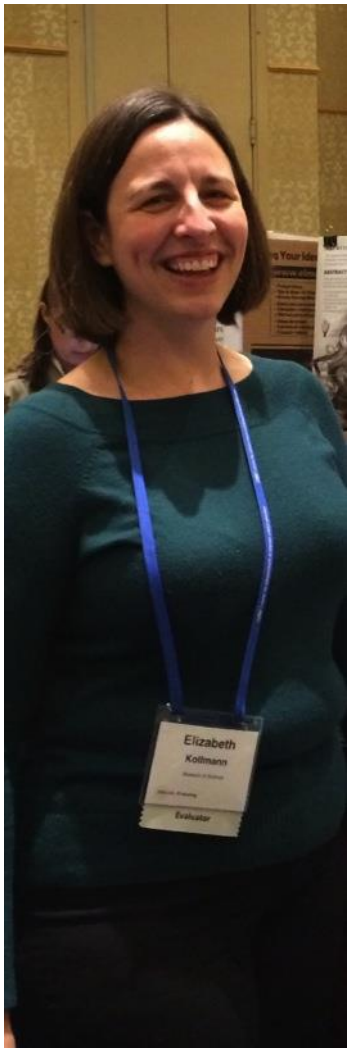
1421179

Museum of Science®

NISE NATIONAL INFORMAL STEM EDUCATION NETWORK

Through these projects we are able to:

- conduct research on learning,
- apply it to design of educational materials and professional development, and
- disseminate both to informal science education professionals and scientists



Now

- Liz Kollmann will talk about the **ChemAttitudes** project, and then
- David Sittenfeld will talk about the **Building with Biology** project

ChemAttitudes

Building with Biology