What kind of public communication of science is right for a democracy?

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Public Engagement with Science

The theme of this year’s American Association for the Advancement of Science (AAAS) annual meeting—“Science As a Way of Life”—speaks to both the science and engineering communities and to the broader public. The AAAS meeting draws hundreds of speakers whose work emphasizes the multidisciplinary nature of modern science and the role of science in society.

Few scientists (or their spouses) would contest the view that being a scientist pervades all aspects of their lives, professional and personal. But science is really a way of life not only for scientists but for all people, whether they choose it or not. Virtually every major issue facing global society today has science and technology components at its core: terrorism and other forms of violence, economic productivity, health status, global warming, and the need for sustainable development. History has shown that when individuals and nations lack infrastructure and access to science and technology, they are doomed to lag behind their better-equipped counterparts.

Some people are not so happy about how central science and technology are to their lives. Although in the United States the relationship between science and society is basically positive, science and technology often encounter skepticism and wariness in other parts of the world. In a recent address at the AAAS, Sir David King, science advisor to the British prime minister, reported the results of attitude surveys that showed substantial differences in the way people in the United States and the United Kingdom view science in general and certain issues in particular. For example, whereas Americans are basically positive about genetically modified foods, people in Britain are extremely wary. The British are supportive of therapeutic cloning, whereas Americans are mixed at best in their views. Differences also exist in attitudes to global climate change and policies to combat it.

One traditional response of the scientific community to what it views as a lack of appreciation or misinterpretations by the public has been to mount so-called public understanding or education campaigns designed to “enlighten” the populace, either about science in general or specific issues in particular. Some initiatives have been quite successful. Examples include campaigns about the dangers of air pollution and high blood pressure, and the negative health effects of smoking and lack of exercise.

But simply trying to educate the public about specific science-based issues is not working. Many science skeptics are already quite well educated, but they relate more to the risks of science and tech...

Two meanings of “engagement”

- Educational engagement
- Political engagement
Science communication meets particular personal needs

◆ A personal need
  Medicine, personal technology, jobs

◆ A national need
  Economic development, public health, national security

◆ A cultural need
  Embodiment of the human spirit

◆ …and therefore a political issue
Public understanding of science is driven by politics

- Motivated by institutional needs: publishers and producers, science writers, scientific societies, government agencies
- Defined as: Public understanding of science = public appreciation of the benefits that science provides to society
- Affected by the politics of institutional and social relationships
Is this science communication?

Lab/Field → Formal paper
  ↓
Meetings
  ↓
Preprints

→ Media (web, TV magazines, radio newspapers, blogs, Twitter, books, etc.)
→ Textbooks
→ Policy documents, etc.
Sphere of Science Communication
Four models are at work in the political world:

**Information delivery**
- Deficit model
- Contextual model

**Public engagement**
- Lay knowledge model
- Public engagement model
The “deficit model” is the default

- Longstanding concerns about lack of public knowledge
- More knowledge is better (“fill the deficit”)
  - Measures of scientific knowledge
  - Examples: NSF, Eurobarometer surveys of public knowledge and attitudes
- Many excellent educational materials produced
A BRIEF HISTORY OF TIME
FROM THE BIG BANG TO BLACK HOLES

STEPHEN W. HAWKING
WITH AN INTRODUCTION BY CARL SAGAN
Public understanding of science

Data from NSF Science Indicators series, 1988-2006

- Center of earth hot (T)
- Electrons smaller than atoms (T)
- Universe began w/explosion (T)
- Antibiotics kill viruses as well as bacteria (F)
- Human beings evolved from earlier species (T)
The deficit model has limitations

- **Lack of context of questions**
- **Interpretive layer is limited**
  - Attentive, Interested, “Residual” public
  - Definition of “scientifically literate”
  - Easy to misinterpret
- **Lack of usefulness for action**
  - No progress in 30 years
  - No demonstrated link between knowledge and action
Contextual model add reality

- Adds social psychological component to individual knowledge
- Recognition of social context, demographic groupings, institutional trust
Science Media Use (NPs & TV)

Deficit Model

Knowledge about research

More optimistic interpretation of potential benefits

Heuristic / Framing Model

Support for research

Based on Scheufele 2005
Contextual model addresses particular audiences

http://www.hsl.virginia.edu/historical/medical_history/bad_blood/index.cfm

http://www.biologia.arizona.edu/
The contextual model also has some limitations

- Still sees science literacy as “problem” to be addressed
- Still fundamentally depends on "transmission" of information
- No discussion of political issues: empowerment, participation, democracy
Lay knowledge/expertise

http://www.sciencecartoonsplus.com/gallery/biology/galbio2c.php
Lay knowledge model developed to address limitations of deficit model

- Developed in 1990s, in part as academic and political reaction to earlier models
- Fits technical issues into existing knowledge systems
- Privileges local knowledge
- Assesses actual behavior in real world
Who is the relevant expert?

- Chernobyl fallout in Cumbria (NW England), scientists failed to acknowledge uncertainty, acted as bureaucrats, didn’t understand local landscape or farming
Indigenous knowledge

- Scientists fail to acknowledge reliable knowledge produced through non-“scientific” means
(Lack of) trust in institutions

- For example, cancer clusters
Local knowledge offers a more democratic approach to knowledge

- Not just addressing mistrust
- Not just addressing misunderstanding, problems with “expert” knowledge
- BUT...active construction of appropriate knowledge for local context, drawing in technical, economic, social, legal, regulatory, and other information from many sources
Lay knowledge isn’t just about controversies
Welcome to Citizen Science Central!

A clearinghouse for ideas, news, and resources in support of citizen science--partnerships between volunteers and scientists that answer real-world questions.

IDEAS
About this Initiative
Discussion Forum

NEWS
News
Events

RESOURCES
Toolkit
References
Projects
Proceedings
PathFINDER Science first appeared as a 1997 US Department of Education Technology Innovation Challenge Grant. [Image]

FEATURED
North American Lichen Mapping
Come join in this award-winning project as we map the lichens across the country. The Lichen project is the focus for student-scientists partnerships this month. Join us now as we continue to map lichens across North America.

Lichens and S02
Help us explore the environmental impacts of Sulfur Dioxide by studying the density and diversity of lichens.

Stream Monitoring
Join in the fun by testing your nearby creek with chemical, biological, and visual surveys.

Global Warming
Carbon Dioxide is considered to be the primary component of the Green House Gases. Help us track the changes in these gases by adding your local data.

Citizen Science
An Online Community for People involved in Monitoring Resources, Monitoring, Interacting, Learning, and Contributing.

Initiatives
Random selections from the Project FeedbackWatch. Project FeedbackWatch, project FeederWatch, project Project FeederWatch, project Project FeederWatch. Project FeedbackWatch is a natural world, FeedbackWatch the Jet of Unbridability, the movements of winter birds, trends in bird distribution, a "birds-eye view" from last week, and enter your story.

La Jolla, the Jet of Unbridability, the movements of winter birds, trends in bird distribution, a "birds-eye view" from last week, and enter your story. La Jolla, the Jet of Unbridability, the movements of winter birds, trends in bird distribution, a "birds-eye view" from last week, and enter your story. La Jolla, the Jet of Unbridability, the movements of winter birds, trends in bird distribution, a "birds-eye view" from last week, and enter your story.

Are you interested in Citizen Science? Do you want to contribute science while fishing? Do you want to contribute science while fishing? Do you want to contribute science while fishing? Do you want to contribute science while fishing?
BUILDING CONSENSUS:
History and Lessons from the Mesa de Diálogo y Consenso CAO-Cajamarca, Peru

MONOGRAPH 3.
INDEPENDENT WATER MONITORING
Public Participation in Scientific Research

During the past two decades, an increasing number of informal science education projects have involved the public directly in the multifaceted and iterative processes of scientific research—covering topics ranging from acid rain to backyard birds. Such projects contribute to awareness and understanding of key scientific concepts and excel in building interest in scientific activities and developing science-related skills, the evidence suggests. That's the conclusion of a CAISE Inquiry Group that has just completed a study of Public Participation in Scientific Research (PPSR) programs, often called “citizen science.”

Opportunities abound, the group concluded, to create new PPSR projects, enhance those already underway, add PPSR elements to other informal science education programs such as exhibitions, and enhance research and evaluation of PPSR. As the authors note, "The natural world is full of questions whose answers require a PPSR approach. The number of published scientific papers based on citizen-collected data is increasing each year. Many more projects could be created that will appeal to the increasing numbers of amateur naturalists and stargazers who are interested in lending their brains to science."

The Inquiry Group based its conclusions in part on analysis of existing PPSR projects and programs, which vary in the extent to which the public is involved in different aspects of a scientific investigation—from data collection to defining a question for study. The report identifies three project types:

> **Contributory projects** designed by scientists, with participants involved primarily in collecting samples and recording data
> **Collaborative projects** in which the public is also involved in analyzing data, refining project design, and disseminating findings
> **Co-created projects** are designed by scientists and members of the public working together, and at least some of the public participants are involved in all aspects of the work
Public Partic in Sci Research

- Contributory projects: scientists design, public contributes data
- Collaborative projects: scientists design, public contributes data and also may help refine project design, analyze data, or disseminate findings
- Co-created projects: Scientists and public working together design, at least some public participants actively involved in most or all steps of scientific process
Bucchi, 2009
Yes, the lay knowledge model has difficulties, too

- What is the **role of reliable knowledge** about natural world (usually called "science")?
- Political context requires **commitment to technical and political empowerment**
- What is **relationship of lay knowledge to citizen science**?
- In what way is it a **guide for action**?
Model *du jour*: Public (political) engagement in science

- Consensus conferences
- Citizen juries
- Deliberative technology assessment
- Science shops
- Science cafes
Public participation about controversial issues

http://people.ucalgary.ca/~pubconf/

http://www.loka.org/images/sclove3.gif
Public engagement in nanotech

Example: Astronomy

◆ Policy decisions
  – Hubble repair/replacement
  – Human space flight
    » Shuttle use, replacement
    » Space station
  – Earth-observing missions

◆ Will decisions go the way experts want them to?
Many Experts, Many Audiences: Public Engagement with Science

Is nanotechnology safe? How should we respond to the possibility of catastrophic global climate change? Faced with profound personal and societal questions like these, we need the best scientific knowledge available. We also need opportunities for scientists, decision makers, and the public to exchange knowledge and perspectives “in a way that fosters responsible and appropriate scientific knowledge production and decision making”--and the informal science education sector is well positioned to help. That’s the conclusion of a CAISE Inquiry Group that over the past year has been studying public engagement with science in informal media like television, museums, and science cafes.

The ISE sector has been inspired in part by policy-oriented groups like the UK’s New Economics Foundation. Several years ago, Ecista, the European science center network, adopted a NEF model called DEMOCIs, the “part card game, part policy-making tool that enables small groups of people to engage with complex...
Public engagement model: Difficulties

- Which kind of engagement? Political or educational?
- Focus on process, not on content
- How to achieve basic substantive knowledge?
- Scaling up “consultation” to large groups
...and deep political meaning

- Not just about privileging local knowledge
- But giving *power* to publics, not to elites

- Do scientists have power?
- Are scientists willing to turn over power?
Deficit model
(including Contextual model)

Public Engagement model
(including Lay Knowledge model)
Deficit model

Public Engagement model
Summary

- Acknowledge the political dimension(s) of talking about public understanding of science – it is both an individual and a social concept
- Recognize the political commitments of using different models
- Don’t forget the enthusiasm
- Explore new ways to use the models