So, You Want to be a Science Communicator?

An Introduction to Public Outreach as Part of the Scientific Enterprise

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Why should we care?

- Weakness in K-12 Science Education
- Low Public Scientific Literacy
- Politicization of Science
- Lack of Public Support
- Broad Social and Financial Implications
Student Achievement:

• Three in 10 Americans say they are bad at math. Among 18- to 24-year olds, it’s almost four in 10. ¹

• In 2009, just 34 percent of U.S. 8th graders were rated proficient or higher in a national math assessment, and more than one in four scored below the basic level.²

• In an international exam given in 2006, U.S. high school students ranked 21st out of 30 industrialized nations in science and 25th in math.³

• Only 43 percent of U.S. high school graduates in 2010 were ready for college work in math, and 29 percent were ready in science. ⁴
Teacher Qualifications:\(^5:\)

- The World Economic Forum ranks the United States 48th in the quality of mathematics and science education.

- Sixty-nine percent of United States public school students in fifth through eighth grade are taught mathematics by a teacher without a degree or certificate in mathematics.

- Ninety-three percent of United States public school students in fifth through eighth grade are taught the physical sciences by a teacher without a degree or certificate in the physical sciences.
Among Americans…

<table>
<thead>
<tr>
<th>Issue</th>
<th>Public</th>
<th>Scientists</th>
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<tbody>
<tr>
<td>Humans Evolved Naturally</td>
<td>32%</td>
<td>97%</td>
</tr>
<tr>
<td>AGW / Climate Change</td>
<td>46%</td>
<td>97%</td>
</tr>
<tr>
<td>Mandatory Vaccination</td>
<td>71%</td>
<td>84%</td>
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“We’ve arranged a global civilization in which most crucial elements profoundly depend on science and technology. We have also arranged things so that almost no one understands science and technology. This is a prescription for disaster. We might get away with it for a while, but sooner or later this combustible mixture of ignorance and power is going to blow up in our faces…”

Carl Sagan
What are the benefits?

• Increase Public Understanding of the Nature of Science and Scientists

• Advance Broad Scientific Literacy

• Support and Improve Science Education

• Create Visibility in the Community

• Secure Continuing Research Support

(Social and Financial)
What can you do?

• Formal Education: Teacher Professional Development and Classroom Involvement
• Multimedia Approach: Print, Web, TV/Radio, Traditional Lectures/Presentations
• Museum/Science Center Partnerships
It’s just that simple, right?

Well, there are some rules of the game…

What are the Top Ten things that every Science Communicator needs to know?

(With thanks and apologies… after J. Gregory and S. Miller, 1996)
1. Know what it’s all about.

- Be conscious and respectful of the roles/nature of Research/Higher Ed vs. Formal and/or Informal education.
- Choose your communication vehicles wisely.
- What are the +/− surrounding YOUR science and the public?
2. Know what you want to accomplish.

- What are you specifically hoping to achieve?
- Who is the intended audience?
- What are the “take home” messages?
- What will success look like?
What are your goals?

• Inspiration and Appreciation
  (Awe, wonder, curiosity, discovery)

• Accessibility and Relevance
  (Understandable and meaningful)

• Support Formal Education
  (Support and enhance, field trips, teacher training, careers)

• Entertainment and Lifelong Learning
  (Free choice learning and recreation)

• “New Science”
  (Hot topics, new ideas, headline science and technology)
Who is your audience?

- Students
- Families
- Adults
- Groups
- Early learners
- K-12
- Young Adults
- Seniors
3. Be accurate, but accessible.

- Good Science Communicators are good “science translators”.
- Make that which seems complicated, simple.
- In this context, less is sometimes more.
- And yes, it’s harder than you think!
“You do not really understand something unless you can explain it to your grandmother.”
Great Communicators:
Albert Einstein
4. Be fun, exciting and engaging!

• Audiences are self-selected…they don’t have to give you their time!

• Educational research shows that the experience matters.
What kinds of Experiences will help achieve your goals?

• Lectures
• Demonstration/Programs
• High tech/Low tech
• Content Themed
• Interviews
• Articles
• Online
• Process Themed
“Give your audience full reason to believe that all your powers have been exerted for their pleasure and attention. Raise their interest...keep it alive as long as the subject demands it. A flame should be lighted at the commencement and kept alive with unremitting splendor to the end.”
Great Communicators: Michael Faraday
5. Respect your audience.

- The audience is not a “blank slate.” Meet them where they are.
- The audience will expect expertise and competence, not condescension.
“[The audience member] is just as intelligent as you are, but does not possess your store of knowledge. He or she is not a student preparing for an examination.”
Great Communicators: H.G. Wells
6. Establish trust with the audience.

- Talk about HOW we know what we know.
- Don’t shy away from what we are less certain about—the self-correction of science is one of its key strengths.
- Explore science together with the audience as a co-learner.
“If a child is to keep alive his inborn sense of wonder, he needs the companionship of at least one adult who can share it, rediscovering with him the joy, excitement, and mystery of the world we live in.”
Great Communicators:
Rachel Carson
7. Give ‘em more than “just the facts”.

• Listen to what people really want to know.

• Negotiate new knowledge, understanding and attitudes about science with your audience.

• Be prepared to explain some of the workings of science.

• Good science communication should be a two way street.
8. Acknowledge the humanity of science.

• Science isn’t perfect, and neither are scientists.
• Science can create problems or solve problems.
• Science can be used for good or evil.
• Science is, perhaps, the most powerful tool we have.
9. Engage the audience.

• Facilitate audience interaction and participation.

• Know when to engage, and when to hang back.

• Practice and employ the “Visitor Experience” Model.
VISITOR EXPERIENCE MODEL

- Staff
- Environment
- Potential
- Visitor

↓ Experience
10. Walk the walk, and talk the talk.

- Become a student of science communication.
- Visit museums and science centers.
- Read popular science publications/web sites.
- Watch science education programming.
- Learn about the links between science and other areas of human activity.
Good Science Communication…

“[Good science communication] inspires someone to read a book, or take a course, and...most important, to learn the method of scientific thinking. [It] provides reason for hope, strikes the spark, awakens slumbering curiosities, and ignites the scientist that lives in all of us.”
Great Communicators:
Carl Sagan
In the end, science communication needs to be a reflection of the unique characteristics of the community you wish to embrace and serve.
1. **U.S. STEM Competitiveness Data**  
*Rising Above the Gathering Storm, Revisited: Rapidly Approaching Category 5 (2010)*  
National Academy of Sciences, National Academy of Engineering, and Institute of Medicine  
[http://www.nap.edu/catalog/12999.html](http://www.nap.edu/catalog/12999.html)

2. **Math Assessment Data**  

3. **International Math and Science Assessment Data**  

4. **College Readiness Data**  