

Science for the Public: Communication and Mentoring

This course aims to develop the knowledge and skills that scientists need in order to communicate effectively about science with non-experts and to serve as science mentors for young people. The components of the course are a biweekly seminar and fieldwork in mentoring.

Advisors for fieldwork Dr. Ali Whitmer (whitmer@lifesci.ucsb.edu), *for docents*
Wendy Ibsen (CNSI) (ibsen@cnsi.ucsb.edu), *for everyone else*

After-school participants: Need to go to the clubs a few times before starting work on activity development. Talk to Ali or Wendy (returns Tues) and Marcos (marcosg01@hotmail.com), the *Quantum Leaps* club leader.

Seminar organizers (consultant: LEAPS GK-12 Fellow Joe Summers)
Prof. Beth Gwinn (instructor of record for F) bgwinn@physics.ucsb.edu
Dr. Ali Whitmer (instructor of record for W) whitmer@lifesci.ucsb.edu
Dr. Fiona Goodchild (fiona@cnsi.ucsb.edu) & Wendy Ibsen (ibsen@cnsi.ucsb.edu)

October 1 Perceptions of Science and Scientists (Prof. Beth Gwinn) and Keys to Small-Group Communication (Teachers Marilyn Garza and Aaron Sottile)

October 15 Equity in the Science Classroom (Dr. Fiona Goodchild, Prof. Julie Bianchini and Teacher Aaron Sottile)

Influencing Perceptions of Science* and Scientists



Science
policy

*Education and
career choices*

Advancement of
Scientific Knowledge
& Technology

Social Progress

Life on Earth

Prosperity

* "Science" = technology, engineering

People's sources of information on Science & Scientists

Education: Early impressions last.



Girls light up circuits with LEAPS graduate Fellow Lisa Manning



Media: TV, newspapers, magazines. Portrayal of science by the media strongly influences public perceptions.

People's attitudes towards Science & Scientists: NSF surveys

Source: National Science Board's "Science and Engineering Indicators 2002" report

- 86% of adults agreed with the statement *"Science and technology are making our lives healthier, easier and more comfortable"*.
- 89% agreed with the statement *"Most scientists want to work on things that will make life better for the average person"*.
- 90% reported being interested in new scientific inventions.

People's attitudes towards Science & Scientists: NSF surveys

- 15% felt “well-informed” about science.
To most, science seems inaccessible.
- *The public image of scientists is stereotyped and unappealing to most.*



Negative impact on

-- *US science policy*

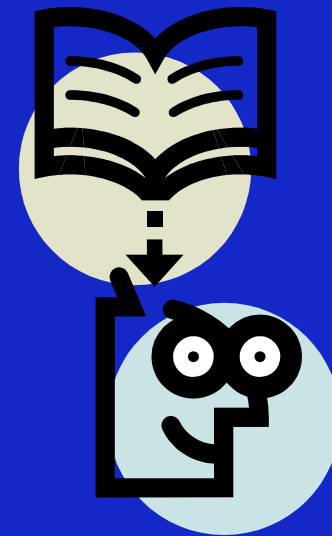
-- *Recruitment of young people to technical fields.*

(Increasingly, the US relies on immigration of experts & graduate students to serve its needs for new discoveries and for technical proficiency in the workplace).

Results from Communications Research

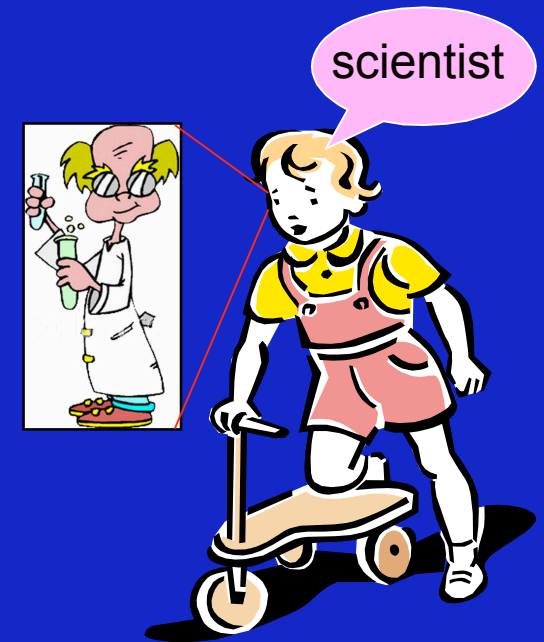
From on-line materials compiled by the Frameworks Institute, a consulting firm that conducts research on strategic communications in order to advise non-profit organizations on their publicity campaigns.

- How do people interpret information on complex subjects like science?



How people process information: frames

- Frames are the *phrases, images and messengers* that link to people's larger knowledge and beliefs. People use "frames" to interpret and organize information.
- Strategic use of frames helps communicators deliver their messages efficiently & effectively.



“... framing refers to the construct of a communication — its language, visuals and messengers — and the way it signals to the listener or observer how to interpret and classify new information. By framing, we mean how messages are encoded with meaning so that they can be efficiently interpreted in relationship to existing beliefs or ideas.” (Frameworks Institute website).

Examples of verbal frames

- For scientists, “*Newton’s Laws*” evokes how the macroscopic world behaves.
- For middle-age people, “*The Golden Fleece Award for science*” evokes waste of taxpayer’s dollars on silly research.
- “The laser is one of many examples in science that ‘*Invention is the mother of necessity**’. The initial 1958 invention by Charles Townes aroused little excitement at the time. But thanks to later advances by many other scientists and engineers, lasers are now used extensively in manufacturing, communications and medicine”.

--refers to the old saw “necessity is the mother of invention” and a familiar invention to frame the idea that uses for discoveries often evolve long afterwards, through the work of many. (“Discoveries” also build on many others’ work).

* This phrase from Jared Diamond’s Guns, Germs and Steel

Examples from the popular press

--To convey a story in a limited amount of space, writers must use frames to evoke people's shared ideas, knowledge and values.

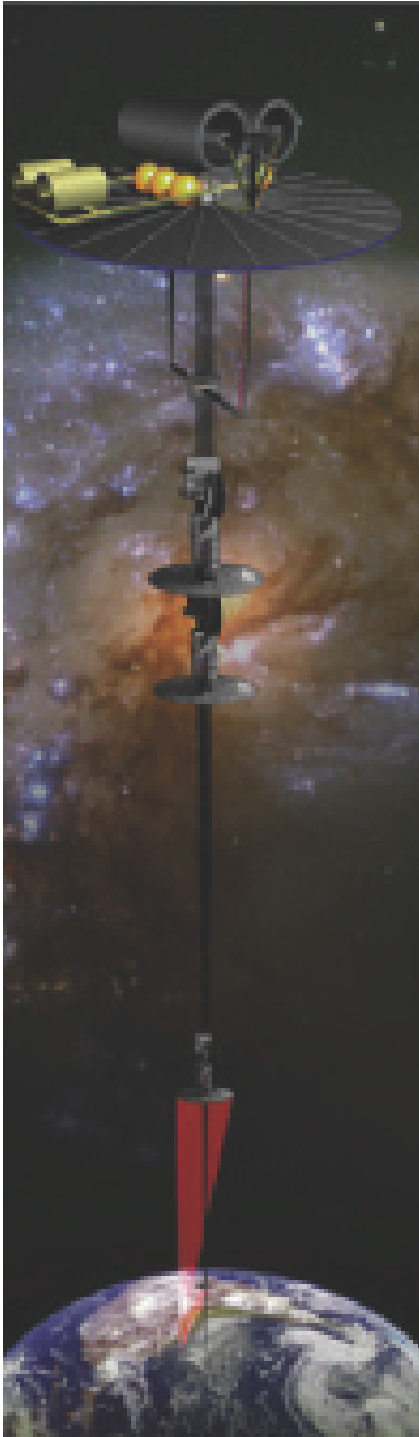
- **“Scientists launching spacey idea”** by Dave Barry (Miami Herald, Nov. 9, 2003)
- **“Quantum Mysticism”** by Margaret Wertheim (LA Weekly, June 11-17, 2004)

Dave's article

- Humor relies on shared ideas, so it's full of references to common beliefs and experiences.
- Science frames
 - *Science can change the world's capabilities*
 - *Science is incomprehensible: "Their plan is to build it using "carbon nanotubes", which, in lay-person's terms, are nanotubes made out of carbon."*
 - *Science doesn't address real people's problems*

Images of scientists

Creativity: Scientists have amazing ideas



Margaret's article

(she'll give seminar in W quarter)



Uses popular interest in movies as vehicle to relay important ideas about science, especially misguided attempts to use science in relation to matters of faith.

- Uses the effective framing tools of *humor* and *analogies*.

Example: describes someone who invests quantum physics with spiritual content as “... a befuddled and besotted lover..” , a humorous cultural theme.

- Science frames “ Quantum mysterions may embrace science in principle, but they have little more interest than creationists in learning about it in practice. Under their adoring gaze, the mathematical formalisms of quantum mechanics, **which make concrete predictions accurate to dozens of decimal places and which underlie the technologies of microchips and lasers**, are stripped of all empirical content and reduced to a set of syrupy nostrums.”

Ties to the theme that science is practical and predictive.

- Images of scientists Some are snake-oil sellers, but most seek the truth.

What “Science” means to people: your interviews

- To make connections to people’s mental models of science, you have to know what these are.
- Interview assignment: *Ask at least one non-scientist (such as the clerk at 7-11) to tell you briefly what image the term ‘science’ conjures for them.*
- Break into groups around interviewers. Take 10 minutes to discuss what images/frames of science people relayed. Then 5 minutes for each group to present to everyone.

Summary of discussion (partial)

Interviewees: Gas station attendants, salesclerks, people out on State Street on Sat. night, artist friends, Jr. high kids...

- People tended to mention “tools of the trade”: lab coats, safety glasses...
So these are images you can use to trigger “science” in people’s heads.
*For the kids you are working with, wearing safety glasses or a lab coat is special and can really make them **feel** like scientists* (also reinforces the importance of lab safety).
- **Forensics** came up more than once -- people mentioned science solving mysteries. Relates to current shows: images on TV really affect how people think about science/scientists.
- For gas station attendant, “science” evoked the cycle of planting and harvesting he did as a farmer in Iran and the possibility of a gasoline explosion in his current work. So science seemed immediate to his life.
- 7th grade girl thought of “middle-aged, fit woman” scientist doing work in the field

What “Scientist” means to people: the images you found

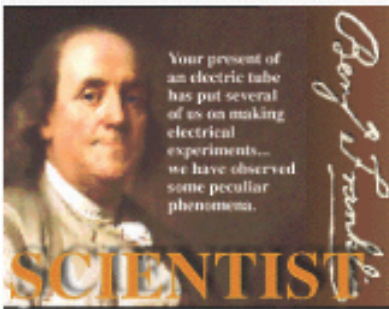
*Important! For young people, popular ideas of what scientists are like influences **whether they see science as suitable for them.***

Images* of scientists *Break into groups to discuss:*

- What positive messages might the images convey?
- What personalities and interests would find the image appealing?
- What aspects of the image could be ineffective or off-putting?

* That you turned in or I picked

- What positive messages might the images convey?
- Who would find the image appealing?
- What aspects of the image could be ineffective or off-putting?



From Emily M



From Joe: “The top eleven images that pop up when doing a Google image search for the word ‘scientist’ (in order left to right, top to bottom).”



Jens sent this one, too,

Summary of discussion (partial)

Dominant image of “scientist” from previous page:
Middle-aged or old, balding white guy who works in a lonely setting.

Some statistics from Bridget, who analyzed the first three pages of hits from a google search of the word “scientist”:

Real men scientists (18 total): 11 working alone, 8 wearing labcoats, 3 balding.

Cartoons/drawings of male scientists (12 total) All are wearing lab coats, 3 have pocket protectors, 8 wearing glasses, 10 are balding.

Real women scientists (6 total, 1/3 the number of men) All are alone, 5 in labcoats, 2 wearing glasses.

Cartoons/Drawings of women scientists (4 total, also 1/3 the number of men)

All are wearing labcoats, 1 is wearing a hairnet, none are wearing glasses.

(Thank you, Bridget!)

The lab coat is a common theme: it's a gender-neutral, race neutral identifier for “scientist”.

- What positive messages might the images convey?
- Who would find the image appealing?
- What aspects of the image could be ineffective or off-putting?



← from the PDK project

Summary of discussion (partial)

From visuals alone it's hard to tell that she is a scientist

With the text, this would appeal to girls

- What positive messages might the images convey?
- Who would find the image appealing?
- What aspects of the image could be ineffective or off-putting?

(from Paul)



Summary of discussion (partial)

Appealing image of a scientist having a good time

(Note after the fact: Be wary of reinforcing the “lone genius” frame of scientists -- it’s very limiting.)

- What positive messages might the images convey?
- Who would find the image appealing?
- What aspects of the image could be ineffective or off-putting?

from the PDK project



Summary of discussion
(partial)

Really conveys idea
of scientists working
together -- realistic as
well as positive

Introducing frames for science that trigger productive attitudes

(For example, that science is accessible: most people who excel in math and science work hard in these subjects -- their success isn't from some magic knack.) (Again, ideas are from Frameworks Inst.)

You'll be applying these ideas in your presentations later this Fall.

- **Step 1: DEFINE THE MESSAGE**

Start by deciding what is the big idea you want to get across about science -- opportunity, future, science in service to society, science as a community of diverse people.....

Introducing frames for science that trigger productive attitudes

Step 2. Strategize about what frames will trigger ideas that reinforce the message: what analogies, images, and **messengers***.

To produce action towards a goal (like improving grades), the communication should convey personal responsibility and a way to achieve the goal (studying).

Step 3: Tell the story (ppt, poster, just chatting).

Keep it simple -- too complex is overwhelming.

Can be best to make separate communications for each idea.

* Will you communicate the message yourself? Will you quote someone? Will you prepare something for the teacher to present? *To be effective, the messenger must be perceived as expert and trustworthy.*

Some pitfalls

- Introducing a new frame by saying that an old frame should be gotten rid of. This may be all people remember! and just reinforces the old frame.

Example: “**Scientists aren’t all socially inept, uncaring people.** They are supportive of their communities.....”

- - Just convey your positive message - -

- Using expert terminology when addressing non-experts: baffling, indicates that the messenger is out-of-touch.

You have spent a lot of effort acquiring the special language of your field and are justly proud of being able to use it. It’s very easy to default to that language when trying to communicate with non-scientists. Sometimes people use technical language because they feel that their ability to “slingo the lingo” gives them legitimacy as experts in the eyes of the audience. Instead this produces incomprehension and hostility. So think about talking with your favorite non-scientist while you prepare.

References

1. The Frameworks Institute website,
<http://www.frameworksinstitute.org/strategicanalysis/perspective.shtml>
2. “Scientists launching spacey idea” by Dave Barry (Miami Herald, Nov. 9, 2003)
3. “Quantum Mysticism” by Margaret Wertheim (LA Weekly, June 11-17, 2004)
4. National Science Board's "Science and Engineering Indicators 2002" report on Science and Technology: Public Attitudes and Public Understanding.
5. The Annie E. Casey Foundation's publication “Making Communications Connections” by The FrameWorks Institute.
6. Worlds Apart by Jim Harz and Rick Chappell *(Thanks to Fiona Goodchild for this one)*
7. Chapter 13, "Necessity's Mother" in Guns, Germs and Steel by Jared Diamond.
8. <http://www.pdksciart.com/> “THE PDK POSTER PROJECT: Using Visual Means To Challenge Stereotypes” *(Thanks to Helen Hansma for this link)*
9. “Fifth grade students’ perceptions about scientists and how they study and use science” by Barman, Ostlund, Gatto and Halferty *(Thanks to Ali Whitmer for this one)*