Chapter 9: Communicating Science to the General Public

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Description

Chapter 9 of "An Instructor's Guide to Ethical Issues in Physics."

Body

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Section 9.1: Introduction

The APS has a Statement on Civil Engagement that begins, “The American Physical Society applauds its members who have helped ensure that public policy decisions are informed by sound scientific analysis. APS encourages its members to take advantage of opportunities for civic engagement drawing on their experience, whether through public or government service, by providing advice and information to government officials, or by contributing to public debate.”[1] In this chapter, the term “the public” will be used to describe those people without a strong scientific background. The APS statement calls on physicists to communicate with the public on issues that have a scientific component. This chapter will focus on the challenges in engaging in such communication and the skills that can help a physicist meet those challenges.

The American Association for the Advancement of Science has a comprehensive communication toolkit on their website.[2] Their suggestions include reversing the order of presentation when communicating science to the public: begin with the conclusion and follow with supporting details. The toolkit has sections on topics such as online communications, working with journalists, and engaging people through individual public presentations or participation in panel discussions. These individual pages have links to further information sources. Taken together, this body of information is probably too large to be explored in its entirety in preparation for a classroom discussion. It will likely be necessary to focus on a few of the pages or to divide the class and have each group read different sections.

A number of more concise readings are available as well. A ***Scientific American*** blog entry focuses on writing effective op-ed pieces.[3] Saperstein has a short essay on his collaboration with several other people to put together a panel discussion road show on issues related to nuclear weapons.[4] He also describes seeking out opportunities for individual presentations. An article by Pierson describes research into why people, at times, seem to reject scientific information.[5] He notes that research suggests presenting scientific information on a contentious issue can lead to increased polarization rather than consensus. He then discusses implications of this research for trying to create at least some limited consensus in the political realm. Aurbach et al. argue that an essential element to effective scientific communication with the public is identification of a single, clear message for the communication to focus on.[6] They describe a three-minute exercise, modified from an improvisational theater technique, to generate a concise statement of the core message one intends to communicate. This statement can then be used to guide the development of the entire presentation, thus avoiding overloading the audience with unnecessary information.

The National Academies report, ***Communicating Science Effectively: A Research Agenda***, takes a comprehensive look at science communication.[7] Two passages in Chapter 1 are particularly relevant to a discussion of ethics in physics. Pages 11-12 provide a concise discussion of different forms of scientific communication and broad issues that arise when scientists try to communicate with the public. Pages 17-22 explore the different goals scientists may have while communicating to the public, ethical issues that may arise during the communication, and why simplistic models of the nature of this type of communication need to be discarded. Chapters 2, 3, and 4 explore in more detail issues that were raised or only hinted at in Chapter 1. Reading all three of these chapters is probably going to be too much for a typical undergraduate class assignment. However, most sections in these chapters can be read independently, so an instructor can pick out a few topics that are likely to be most relevant to their students. Most of these sections outline both what is understood about a particular aspect of science communication and what is not yet understood. For instance, in Chapter 2, the report discusses research on how people respond to in-person engagement with scientists but then goes on to point out that little is understood about how people respond to efforts to engage with scientists on larger scales, such as through public online events. Chapter 5 focuses on research questions in the field of science communication. While interesting to read, it may not have much immediate relevance to a discussion of ethics. Astbury and Hines wrote a review of this National Academies report, arguing that although some parts were helpful, others were outdated.[8] They describe a case in Great Britain where the public was engaged to help shape guidelines regarding nanoparticle research, and they argue that there should be more of this type of interaction between scientists and the public.

Discussion Prompts:

1. "APS encourages its members to take advantage of opportunities for civic engagement…." Do you think physicists have an *obligation* to take advantage of opportunities for civic engagement? If so, should this be viewed as an obligation for each individual physicist or is it more a community obligation to make sure at least some physicists are engaged with the public?
2. Describe a situation in which you tried to convey scientific information to one or more people without a strong scientific background. Do you think you were successful? How could you tell? What factors do you think influenced your level of success?
3. Imagine you are asked to talk about physics to a group of art majors taking a sculpture class. In particular, you are to explain to them the principle of equilibrium: an object will be in equilibrium if the net force on it is zero and the net torque on it is zero. How would you prepare for this task?

4. As you look back over the reading, what suggestions for how to engage the public were ones that had not occurred to you before?
5. Suppose you were going to write an op-ed for a local, online news service. The op-ed is designed to advocate for public policy that promotes increased use of a particular form of energy (such as solar or wind). What would you put in your opening paragraph?
6. List the different ways in which physicists can engage the public in a discussion of societal issues with a technological component. Which can you imagine yourself participating in as a student? Which as a professional who has been in the workforce for several years?

Section 9.2: Communicating about climate change

Public perception of the science of climate change provides a useful case study on the role communication plays in the formation of public opinion. Somerville and Hassol describe mistakes scientists commonly make when communicating directly to the public.[9] In particular, they argue that scientists need to make different word choices when speaking to people without a strong scientific background and need to organize their presentations differently for the general public. Their paper uses climate change as its primary example, and it includes a good overview of both the scientific consensus on climate change and the US public perception of climate change.

For a more formal approach to communication on climate change, see the paper by Wong-Parodi and de Bruin.[10] They describe a structured approach in which the goals of the communication are established, the target audience is characterized, materials for communicating to the audience are developed, tested, and delivered, and the target audience is assessed to determine the effectiveness of the communication. The authors also identify five maxims for scientific communication: (1) It should be accurate. (2) It should be limited to the information that is needed by the target audience. (3) It should be relevant to the decisions the target audience will be making. (4) It should use language that is understandable. (5) The communication materials should be tested for effectiveness.

There is also narrowly focused research on communicating the science of climate change. For instance, Goldberg et al. looked that the role of the communication mode when the desired message was that 97% of climate science experts agree that the planet is warming due to human activity.[11] Having members of the public read about this produced some favorable results, but a thirty-second video on the topic was significantly more effective. This paper is useful not only for this specific result but also in its discussion of strategy: the authors describe research on the Gateway Belief Model suggesting that acceptance of key information by an individual, such as the scientific consensus on climate change, opens the door to that person modifying their perspective on a larger array of climate-related issues.

A commentary by Massonnet outlines ways in which the study of the earth's climate is a complex problem.[12] The commentary includes summaries on the challenges of climate science not being a traditional laboratory science, the complexity of the Earth's climate, and the inability to acquire as much data as one would like. The commentary concludes with a discussion on the need for improving communications with the public and in particular being attuned to the specific needs of the target audience.

A commentary by Brown shows how a single data set (related to a heat wave in North Carolina) can be justifiably used to generate three very different sounding conclusions in the form of hypothetical headlines.[13] The mathematical analysis by Brown is straightforward but serves to remind students that it is important to represent the results of an analysis fairly and that it is important to dig deeper into brief summaries in order to understand how the results were obtained.

Discussion Prompts:

1. What are some strategies for engaging the public in a discussion of complex topics such as the evidence for climate change?
2. Choose a segment of society that you think would be particularly important to engage on the topic of climate change, and then formulate a strategy for reaching out to audiences in that segment.
3. How much technical background on the issue of climate change should a physicist have before engaging the public on that issue?
4. What sorts of phrases might you use in talking to a fellow scientist about climate change that could easily be misconstrued by a nonscientist?

5. Describe the Gateway Belief Model and discuss whether you think it accurately reflects your way of processing and responding to information.

Section 9.3: Communicating with the media

An article by Matheson looks at the importance of all scientists communicating with the public about their research.[14] This is especially important for those whose research is publicly funded. The author suggests that spending time getting to know some science writers will help. By honing one's storytelling skills, a scientist can turn an advanced intellectual presentation into a narrative that engages a broader audience.

Employers often place restrictions on the nature of employee interactions with the media. A common example of a restriction is forbidding employees to indicate their affiliation with the employer when speaking about political issues. Restrictions also commonly limit the conditions under which an employee can be interviewed by a member of the press regarding their work. For an example of this, see Fermilab's policy on Stakeholder Relations and Communication. [15]

The ***New England Journal of Medicine*** strongly discourages researchers from using press conferences to discuss their findings prior to the findings being published in a peer-reviewed journal. In fact, their Ingelfinger Rule indicates they will not ordinarily consider for publication research that has been published elsewhere, including in nonscientific media. The rule makes exceptions for results that would have an immediate impact on public health and for results discussed at research conferences that are covered by science journalists. An editorial discussing the rationale for this rule is of relevance to ethics in physics, despite the editorial's obvious focus on medical research.[16] This essay makes brief references to examples where premature dissemination by press conference led to significant misinformation being conveyed to the public. One of the cases they refer to is cold fusion, discussed in Section 2.3 of this Instructor's Guide.

To get a quick look from the science writers' perspective, see the code of ethics from the National Association of Science Writers.[17] The code does not contain any big surprises, but physicists interacting with the media can benefit from knowing what standards the National Association of Science Writers holds.

Sometimes a story that is reported in the news media gets amplified and repeated for long periods of time before it gets sufficiently fact checked. One example of this from the scientific realm was the claim that in order to maintain one's health, one must drink at least eight eight-ounce servings of water per day, and it must be plain, unflavored water. Scientists can help correct the record when the media have gone astray. Valtin wrote a review article on this topic, finding no scientific studies to support the 8x8 rule.[18] The article examines potential benefits and risks to drinking large quantities of water and debunks several related myths. A quick Internet search will now show a large number of references to the 8x8 rule as having been debunked.

Dumas-Mallet et al. did a study of newspaper coverage of biomedical findings.[19] Although the focus is not on physics research, the message is still relevant to the physics community. The authors found that newspaper articles often did not address the issues of uncertainty and the need for replication. Moreover, the authors suggest that the increased emphasis on scientists publicizing their findings may be in part responsible for hyped headlines. Some passages in the paper are heavier in statistical analysis than the typical undergraduate physics student may be comfortable with, but these can be skimmed without loss of the overall message.

Discussion Prompts:

1. Do you think it is appropriate for a physics journal to refuse to consider for publication a submission that has already been publicized in the media? If so, would there be any exceptions to this policy?
2. Think about the most interesting experiment you have ever done, either in an instructional laboratory or in a research setting. How might you discuss the experiment with a science journalist to make it interesting to the journalist? Could you do so without overselling the significance of the experiment?
3. Are you aware of other myths like the 8x8 rule that seem to have a lot of believers among the public but do not make sense based on your understanding of science? What strategy would you use to try to debunk the myth?
4. Explain the role uncertainty plays in scientific experiments in a way that a non-scientist would be able to understand.

5. Do you think all physicists have an obligation to actively seek out interactions with members of the press? If yes, what is the extent of this obligation? If no, which physicists, if any, do have such an obligation?

Section 9.4: Communicating with political leaders

While scientists have all of the usual opportunities to provide advice to elected officials (sending emails and letters, attending forums, arranging for meetings, etc.), there are some additional, more structured opportunities for the voice of scientists to be heard. Bandyopadhyay wrote a commentary on the importance of scientists playing a role in policy making, evidence that scientists can be influential, and ways that individual scientists can become actively involved.[20]

Troyer wrote of his experience as an AIP Mather Science Policy Intern during his undergraduate years.[21] This program pays for two undergraduate physics students to be interns in Congressional offices. He notes that while only some of his work drew on his scientific background, the experience was invaluable in educating him about how things get done in Washington and how much influence congressional staffers can have. Physicists with a PhD have similar opportunities through both the American Physical Society[22] and the American Institute of Physics[23]. A short ***Physics Today*** article gives further insight into the Congressional Fellowship experience.[24]

Numerous examples of physicists playing a formal or informal role in advising policy makers exist. For instance, Zimmerman wrote of his efforts to prevent Department of Defense money being wasted on a research program he found to be fundamentally flawed.[25] The program was examining the potential for bombs to use hafnium as an energy source. Additional background on the underlying experiments can be found in a ***Physics Today*** article.[26] While there have been some developments since the Zimmerman article indicating continued controversy, that does not detract from its message: it is important to do what you can to influence science policy, even when the process for change is frustratingly slow.

Herbert York, a physicist who worked on the Manhattan Project, wrote about multiple roles he had in science advising in ***Making Weapons, Talking Peace***.[27] In

Chapter 11, he described testifying before a Senate committee and serving on the General Advisory Committee for the Arms Control and Disarmament Agency, the Presidential Science Advisory Council, and Jason, a government funded think tank. During this time, York was involved with issues such as nonproliferation, antiballistic missile limitations, and the Vietnam War. The chapter looks at the mix of political and technical issues and at ethical concerns that arise when one disagrees with some of the policies of an administration they are involved with. The first five pages of Chapter 12 recount York testifying before Congress on two occasions as someone not employed by the government. York sensed that, as an outsider, he made considerably less impact with his testimony. York was also involved in negotiating arms control treaties. The role of physicists in addressing issues related to arms control has been covered in Section 7.4 of this Instructors Guide.

Discussion Prompts:

1. Discuss the way your position or job title can influence how receptive a particular audience will be to your message on public policy involving science. How might this affect your approach to trying to influence public policy?
2. What preparations would you make if you were going to try to influence public policy regarding renewable energy sources? What steps could you take to increase the likelihood that your voice would be heard?
3. If you were to work for a branch of a government (federal, state, or local), it is very unlikely that you would agree with all of the actions taken by that branch. How would you decide if a government’s actions have become so objectionable that you need to resign? Herbert York reported pressure to resign from Jason due to issues surrounding the Vietnam War. Would you have resigned?
4. Do you think it is possible to separate your political views completely from science policy advice you give to political leaders?
5. Review the APS Statement on Civic Engagement (reference 1). Would you recommend any changes to it, based on the cases you have looked at?

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Rights

Resource Type

Instructor Materials

Topics

Communicating Science and Engineering
Community Relations
Climate Change

Discipline(s)

Physics
Computer, Math, and Physical Sciences
Teaching Ethics in STEM
Research Ethics