Improving Communication of Climate Change Science to Public Audiences: Early Career

Ocean Scientists and Science Interpreters Engage with Social Scientists

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Abstract

This manuscript describes a qualitative study based on the results of interviews with early career scientists (graduate students and postdocs) who participated as “science fellows” along with science interpreters for training led by social scientists as to how to discuss ocean and climate change issues with general audiences. Based on the interviews, the science fellows were generally enthusiastic and effective participants in the program, and the training gave them more confidence for discussing the effects of climate change on the ocean. In addition, and of equal importance, the science fellows generally believed that the training helped them organize their written and oral presentations of their own science for their professional colleagues and is a lasting benefit to their career development.
Improving Communication of Climate Change Science to Public Audiences: Early Career Ocean Scientists and Science Interpreters Engage with Social Scientists

The National Science Foundation supported six projects that comprised the Climate Change Education Partnership (CCEP) (http://ccepalliance.org/), including the National Network for Ocean and Climate Change Interpretation (NNOCCI) for which the Woods Hole Oceanographic Institution (WHOI) is the science partner. The CCEP Alliance works to advance climate change education for the general public and to develop a "collaborative community of climate and learning scientists and educational practitioners" (http://ccepalliance.org/).

The New England Aquarium is NNOCCI’s lead organization, and in addition to WHOI, NNOCCI includes informal science educators (Association for Zoos and Aquariums, National Aquarium at Baltimore, Monterey Bay Aquarium) and social and cognitive scientists and evaluators (New Knowledge Organization; Frameworks Institute; and Pennsylvania State University, Center of Science and Industry). The partners work together towards the goal of improving public awareness of climate change and its impact on the ocean (Spitzer, 2014; Fraser et al., 2015; Anderson, 2016). The key tool of the training program is the "study circle". The purpose of study circles is to train interpreters from informal science education institutions (ISEIs) and "science fellows" (from WHOI) as to how to use "framing" techniques (Volmert, 2014; Frasier, 2015) to effectively engage general audiences on climate change science and how climate change affects the ocean and its ecosystems. Framing is a research-validated communication strategy involving metaphors and other techniques proven to be an effective technique to explain complex science messages to general audiences.
Four study circles were formed each year for four years and each involved 20 Informal Science Education Institution (ISEI) educators (two each from 10 institutions) and two early-career ocean scientists (MIT-WHOI Joint Program graduate students or WHOI postdocs) who participated as the science fellows. The study circle participants each spent 100 hours during a six-month period with on-line lessons and practice with framing techniques. In addition to the on-line work, study circle participants also attended three, two-day face-to-face sessions with the first and third meeting hosted by an ISEI and the second by WHOI. In addition to the framing lessons and subsequent practice sessions, the WHOI meetings included lectures by WHOI scientists, discussions with WHOI and other scientists on ocean and climate change science, and laboratory tours. The WHOI science fellows participated in the training, as well as presenting and discussing their own research with the study circle participants. They also served the study circles as a resource for ocean and climate change science.

Professional evaluators are measuring the overall effectiveness of the NOCCI program (Frasier et al., 2015). This manuscript describes a qualitative study based on the results of interviews with WHOI early career scientists who participated in the NNOCCI study circles. The purpose of the study was to find out what the scientists believed they learned from their study circle participation, as well as what they believed they contributed to the program.

Methods

Thirty-one early career scientists participated in the NNOCCI Study Circles: 19 WHOI postdocs, 10 MIT-WHOI joint program students most of whom were in third or fourth year, and one member of WHOI’s technical staff. Twelve were randomly chosen for exit interviews and interviewed by the WHOI/NNOCCI co-P.I. (the author of this manuscript) in 2017 using the following questions as a guide: What did the WHOI science fellows believe they learned from
participating in the study circles? What did they believe was their contribution to their respective study circles? What was their opinion of framing as a technique to engage general audiences? Have they used framing in other contexts? Do they believe that what they learned as a study circle participant will help them in their careers?

In addition, two other early participants in the program were previously interviewed once the author and co-P.I. of the project (Yoder) learned that they did not have a positive experience in their study circle. Both were second-year graduate students. The results of this study are based on the 12 recent interviews, as well as the prior interviews with the two, second-year students.

Results

Question 1: What did the WHOI science fellows believe they learned from participating in the study circles?

Those interviewed generally had a very positive experience in the study circles and their interaction with the ISEI interpreters / educators. Some mentioned how impressed they were with how the interpreters could translate science into language more easily understood by broader audiences of non-scientists. Others appreciated the interpreters’ enthusiasm and commitment to educating broader audiences on climate change.

Some specific science fellow comments about the study circles included:

"Fantastic. Opened a lot of ideas";

"I realized I had been isolated in academia for much of my life and the interpreters helped me understand 'Who are the American people?'”

"Interesting to speak about science in a different way, e.g. from a social justice perspective";
"Pleasantly surprised" [at how much she enjoyed the experience] "Very happy I participated";

"Loved the structure and how it brought people together." Face-to-face meetings were "very powerful";

"The enthusiasm of the interpreters is contagious. Working with them peeled back another world";

And "Interpreters were enthusiastic and bit off-putting. Was I in a cult?"

**Question 2: What did Science Fellows believe was their contribution to their respective study circles?**

How science fellows felt about their contribution to the study circles depended on when they participated in the program. During the first few study circles, the participating scientists did not fully understand their role nor was their potential to contribute fully understood by the other participants. Two early WHOI participants poorly reviewed their role in the program and what they believe to have gained and contributed. Both were second-year graduate students and had yet to take their general exam, which is a critical step towards moving on to the research phase for a Ph.D. degree. The WHOI co-PI interviewed them to better understand their negative impression of the program. The students indicated during the interview that they did not understand their role nor did they believe they learned very much of value to them. They believed their time could have been better spent on their own academic pursuits.

The program made three changes in response to these poor reviews. First, we realized that the students were probably too early in their Ph.D. program to appreciate the potential value of learning how to explain their research to the general public; we decided in the future to involve more postdocs and more senior graduate students (e.g. those who had completed their general
exam). Second, we coined the phrase “science fellow” to help identify the role of the WHOI participants. Third, we had the science fellows give a short presentation on their research or on the general topic of climate change and its effects on ocean ecosystems during the first face-to-face meeting of the study circle rather than during the second meeting (which had been the initial schedule). The latter change helped the interpreters better understand science fellows and their scientific perspective, what science fellows could contribute to the program, and also led to more productive relationships between the interpreters and the science fellows.

Changes as to how the program engaged the WHOI participants led to a dramatic improvement in the reviews by the science fellows and how they viewed their contributions to the program. The two most common comments during the recent set of interviews were that the fellows were asked and answered a lot of questions regarding climate change. Of particular importance, the fellows believed that their interactions with the interpreters increased the interpreters’ confidence for dealing with general audiences on climate change issues. In general, the fellows believed they made significant contributions to the study circles and were appreciated by the ISEI interpreters.

Some specific comments included:

“I provided background on specific topics as well as ‘how scientists think.’”

“I felt super-valued and appreciated for my contribution to the study circle.”

“I didn’t feel that I contributed very much, but I learned afterwards that the program had a highly favorable view of my participation.”

“The interpreters were excited to speak with me about my own science, and I enjoyed showing them my lab when they visited WHOI.”
“I didn’t feel fully integrated at first so it took a while before I felt I was making a significant contribution.”

“I felt very welcome in the group and that I was making a contribution.”

“I believed my own research talk went over well. I noted that the interpreters really wanted science content, e.g. on ocean acidification.”

“Felt my presentation at the first face-to-face meeting as to how global warming works was highly valued and appreciated. Making this presentation made me feel actively engaged with the group.”

Questions 3, 4 and 5: What was their opinion of framing as a technique to engage general audiences? Have they used framing in other contexts? Do they believe that what they learned as a study circle participant will help them in their career?

The framing technique as developed by Frameworks Institute (frameworksinstitute.org) and applied to climate change science was the focus of study circle training. Framing can seem very different from the way scientists believe they should speak to general audiences. One key difference is to avoid falling into the “swamp” by stressing the various crises associated with a changing climate. Also, an important framing technique is to approach an audience by seeking common values (e.g. appreciation of nature) rather than with facts that illustrate the negative impacts of climate change. Another framing technique is to try to conclude conversations with ideas as to how individuals can positively affect those who influence public policy. Individual actions, e.g. recycling, are fine but not an effective way to bring about change.

The WHOI co-PI was initially uncertain as to how early career scientist would respond to framing, particularly the idea of emphasizing common values as a way to initially approach an audience rather than with facts. Science is based on facts, and facts are the currency of the trade.
Science fellows, however, responded favorably to framing. They appreciated that the framing technique was based on social science research and was evidence based. They accepted the concept of appealing to values and of avoiding the crisis trap, i.e. avoid presenting facts that make the climate change situation seem so dire as to cast doubts on whether any actions could lead to effective solutions or mitigation. Finally, some fellows believed that framing training helped them organize their thoughts in preparation for effective science presentations, and thus was an important tool for their career.

Most science fellows are now using framing in their professional activities. For example, one former fellow pointed out that framing was very useful for speaking with diverse audiences during the time she worked in a Congressman’s office in the U.S. House of Representatives. Another believes that her framing experience contributed to being hired for her current position at a major Foundation. Many commented that framing was a useful technique for organizing one’s thoughts for presentations, including science presentations for specialists in their field.

Some specific comments on framing included:

“Framing is useful as a process for organizing my thoughts. I expect to use the technique in the future. Great training for how to prepare a public talk”

“Framing provided specific tools for presentations.”

“Framing gave me the confidence to be more communicative with general audiences.”

“I use the framing techniques like appealing to a value, metaphors and empowering the audience for solutions in everything I’m doing professionally.” And “In particular, I learned how important framing techniques are when I was working on Capitol Hill as an international policy expert and speaking regularly to very diverse audiences.”
“My fiancé believes I have gotten better at explaining my science, and I attribute this to the NOCCI training.”

“I use framing (metaphors) when speaking to public groups and in particular, I’ve been in a couple of videos and newspaper media events.”

“Framing is key for pitching ideas internally, as my bosses are not ocean/earth scientists.”

“It works!”

“I use framing everywhere and all the time. It’s one of the most important skills I’ve learned during my time working at WHOI.”

Discussion

There is a clear need for scientists to be better prepared to communicate complex scientific issues to general public audiences (e.g. Leshner, 2007). Some have concluded that “Perhaps the most dramatic example of the negative consequences of poor communication between scientists and the public is the issue of climate change …” (Brownell et al., 2013). Yet, there are few institutions that provide training for undergraduate or graduate students (or postdocs) as to how to present and discuss scientific issues to general audiences (Brownell et al., 2013). Part of the reason is that there have been traditionally few incentives within scientific institutions and from those institutions that support scientific institutions (e.g. Federal funding agencies) to support student training for general audience communication skills (Shipman, 2013). A notable exception within the ocean science community was the NSF-funded COSEE program (www.cosee.net), which among other activities, developed an ocean communication course suitable for graduate-level programs, e.g. as currently taught within the MIT-WHOI (Massachusetts Institute of Technology and the Woods Hole Oceanographic Institution) joint graduate program.
Leaving aside the importance of communicating climate change issues to general audiences, the NNOCCI experience and the results presented here also show another important reason for including communication training for graduate students and postdocs. Our interviews with NNOCCI science fellows show that the training that they received (framing) to communicate climate change issues to general audiences was generally viewed by the fellows as an important new skill that helped them in other ways with their career. A general comment from the interviewees was that the training also helped them organize their science presentations to professional audiences. One interviewee uses framing as a tool to help them pitch ideas to their supervisors in their first position beyond their postdoctoral appointment. This benefit of the training is consistent with my personal observations on one of the benefits of an informal writing course given several times over the past few years for MIT-WHOI joint program graduate students. The informal course focuses on how to write an article for general audiences describing one’s research (e.g. see the recent student issue of Oceanus, Vol 51, no.2, Winter, 2016 and on-line at [www.whoi.edu](http://www.whoi.edu)). According to the students, developing the techniques to write effectively for general audiences also helped them write better and clearer scientific articles.

McCann, Cramer & Taylor (2015) stated that “Although research is lacking on the true benefit of education and outreach activities, even while funding agencies begin to mandate their inclusion, the broader question is: If such activities are expected to be beneficial, will the research scientist be willing to participate in these activities?” Our results are a contribution to a growing number of studies that demonstrate the benefits of teaching communication techniques based on social science research to graduate students in the physical and biological sciences.
Furthermore, oceanography graduate students in the MIT-WHOI joint program and those having postdoctoral appointments at WHOI eagerly volunteered to participate in the NNOCCI program. The vast majority of those interviewed enjoyed the experience and believed that the time was well spent and contributed to their career development.

Conclusions

Early career ocean scientists (Ph.D. graduate students and postdoctoral scientists referred to as science fellows) were generally enthusiastic and effective participants in a program designed to train them and ISEI educators as to how to discuss ocean and climate change issues with general audiences.

The fact that the training methods were evidence-based and developed and validated by social scientists favorably impressed the science fellows.

The science fellows appreciated the outreach efforts of the ISEI educators, and their dedication to educating general audiences on climate change science. In turn, the science fellows generally believed that the ISEI educators appreciated fellows’ efforts to help the educators understand important details of climate change science.

From the training, science fellows become more confident at discussing the effects of climate change on the ocean and ocean ecosystems with general audiences. In addition, and of equal importance, the science fellows generally believed that the training helped them organize their written and oral presentations of their own science to their professional colleagues and would be a lasting benefit to their career development.


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