Exploring How to Communicate Science More Broadly and Increase Your Impact: Gears Professional Development Workshops For Early Career Scientists

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Abstract
Scientists are increasingly being asked to become more involved in communicating the ‘broad impacts’ of their work. To help scientists answer this call and better integrate their education and research activities, four Centers for Ocean Science Education Excellence (COSEE) have collaborated to create the Gears Professional Development Workshop for Early Career Scientists. The Gears workshops, which have been held around the country, explore a variety of communication techniques that are organized into four interconnected Gears or Areas: Deconstruct Your Science, Understand How People Learn, Build Effective Communication Techniques, and Broaden the Reach of Your Science. Participants practice concept mapping and storytelling and participate in hands-on activities focused on learning how people understand science, sharing their message with a non-science audience, and constructing broader impact statements. Evaluation results indicate that the Gears structure is a valuable way to present the skills used to communicate science effectively and the majority of participants indicated that the four Gears assisted them in thinking about how they communicate their science.

Introduction
When research and education are effectively interconnected, the process of discovery can help stimulate learning, and the resulting research can be communicated to a broader audience. Although there is no single approach for a successful integrated research and education plan, the Gears Professional Development Workshops for Early Career Scientists helps attendees build the foundation for thinking creatively about how their research will impact their education goals and, conversely, how their education activities will feed back into their research. Each workshop features demonstrations and discussions on a variety of communication techniques, organized into four, interconnected Gears or areas: Deconstruct, Understand, Build, and Broaden. These day long workshops are a joint collaboration among four Ocean Science Education Excellence (COSEE) Centers: COSEE Networked Ocean World (NOW), COSEE Ocean Systems (OS), COSEE OCEAN, and COSEE California (CA).

To date, the Gears workshops have been held at the Ocean Sciences Meeting (February 2012), Woods Hole Oceanographic Institution (May 2012), ASLO Winter Meeting (February 2013), Howard University (March 2013), and Ocean Sciences Meeting (February 2014) and have engaged over 110 graduate students, post-doctoral researchers, and early career professors.

The Gears in Detail

Gear #1: Deconstruct Your Science
When translating scientific research, it helps to break down your message into its key components. This gear focuses on two methods for deconstructing your message including Concept Mapping (COSEE OB) and Storytelling (COSEE NOW).

Gear #2: Understand How People Learn
This gear focuses on what the educational research says about how people learn and what this can tell us about effective ways to teach our students and communicate with the public. The Understand gear sets the stage for incorporating effective strategies for learning into practice as scientists share science with diverse audiences (COSEE CA).

Gear #3: Build Effective Communication Techniques
Learners build an understanding of the world around them through their experiences, motivation, and social interactions. This gear includes information about how you can apply concepts, and effective practices and strategies gleaned from the learning sciences, into your education and outreach efforts (COSEE CA).

Gear #4: Broaden the Reach of Your Science
The ability to share your scientific message with those outside your research group is critical for career advancement. With funding trends moving towards large collaborative research programs, it is more important than ever that scientists collaborate not only within their discipline, but also across and beyond scientific disciplines. This gear provides guidance on how to get your message out to others (COSEE OCEAN & COSEE NOW).

Evaluation Results
Evaluation results from the first four Gears Workshop (Ocean Sciences 2012, WHOI 2012, ASLO 2013, & Howard University 2013) indicate that the workshops are successful at developing early career scientists confidence and comfort in communicating their science. Participants indicated that the workshops met their expectations with an average rating of 4.6 out of 5.0 and averages of 4.9 out of 5.0 at both WHOI and Ocean (this was not measured at the 2013 ASLO Winter Meeting workshop).

The post-survey results from the workshops also indicate that the Gears structure is a valuable way to present the skills and techniques used to communicate science effectively. By the end of all workshops, the majority of participants indicated that the four Gears made sense to them (Howard = 100%, ASLO = 93%, WHOI = 90%, and Ocean Sciences = 91%). Moreover, the majority of participants from all workshops responded “yes” when asked if the four Gears facilitated them in thinking about how to communicate their science and if they understood how the four Gears worked together to help them communicate their science. This percentage has increased since the first workshop at Ocean Sciences with more than 93% of the respondents indicating “yes” for both questions at the Howard, ASLO, and WHOI workshops versus 76% for both questions at Ocean Sciences.

Summary
♦ The purpose of the Gears workshops is to provide early career scientists with the skills and techniques necessary to improve their teaching and communication and help them to develop and implement more robust broader impact projects.
♦ Comparison of pre/post assessment demonstrate that the participants found the workshops helpful in thinking about and communicating their science.
♦ Due to the success of the previous Gears workshops, workshop facilitators will explore mechanisms by which to support future workshops and to support Gears participants in their education and outreach efforts.