Training STEM Graduate Students to be Engaging, Effective Communicators

The importance of effectively communicating science to the public has never been clearer. Skepticism and misconceptions about climate change, energy innovation, and vaccinations are commonplace in today's media. In addition, many public funding agencies increasingly favor research with strong broader impacts for society, including a focus on dissemination of research to the public.

As skepticism grows, funding opportunities shrink, and technology becomes ever more pervasive, today's graduate students must develop the skills to communicate their research in ways that non-experts can appreciate. However, science communication training is typically not a formal part of graduate education. Instead, students learn to present their research through trial and error, and usually only in settings where the audience shares their background and expertise (e.g., conferences, symposia, and lab meetings). Such experiences offer little help in crafting an accessible, public-friendly message.

While the need for science communication training is increasing, the interdisciplinary nature of such training often dissuades individual academic departments from creating their own communication program. Most graduate STEM programs thrive on a finely tuned curriculum tailored to gaining subject-specific expertise, whereas the elements of effective communication are general, and span all scientific fields. The broad nature of science communication is not a limitation, though—it is a key asset. Courses in science communication attract participants from a wealth of backgrounds, thus creating an environment where students can practice clarifying and distilling their research to a cohort of peers and non-specialists.

Learning to becoming an effective science communicator is more than just a classroom experience, though. Students also need to practice and to hone their newly acquired skills, ideally by a public performance in a small venue. A public talk is an opportunity to receive feedback on ideas and techniques, and, more importantly, it gives a student confidence in their abilities as science communicators.

Today’s graduate students need interdisciplinary science communication training as well as experience practicing these newly acquired skills. Our response to the Innovation in Graduate Education Challenge is a call to the NSF: help us fill a gap in our education by funding start-up science communication training and practice programs around the country.

Engage: A prototype science communication training program

For the last three years, we have successfully developed and implemented an interdisciplinary science communication training program called Engage. This program has three key aspects: First, we attract and enroll a cohort of graduate students from a broad range of STEM backgrounds. Second, we teach these students an innovative curriculum that we designed to improve their communication skills, and which helps them to create a dynamic, public-friendly talk about their own research. Third, we provide our students an experiential learning opportunity wherein they take their newly-crafted message to the Seattle public.
The training aspect of *Engage* incorporates elements of composition and storytelling, improvisational arts, and development of analogies, while focusing on clarity, brevity, and accessibility. Through this carefully scaffolded curriculum, students design an engaging 20-minute talk that they then present to a public audience. We have offered our course to 42 University of Washington graduate students from 24 science disciplines since 2010. Since 2011, we have teamed with Town Hall Seattle’s Science Lecture Series\(^1\) where our students’ talks are paired with those of nationally recognized scientists.

Using our experiences in creating and growing *Engage*, we have developed a comprehensive program guide, which includes lesson plans, readings, activities, and advice on assembling a public science lectures series. This guide is designed to make *Engage* easily portable to other universities, and is available through our website.

### An Example Day in the *Engage* Classroom

1. Preparation and warm-up
   - Improvisation and theater games

2. Lesson
   - Clarifying your message
   - Instruction and techniques for separating what your message is from how you will convey it

3. In-class activity
   - Storyboarding
   - Students list key components of their message on notecards, arrange these into a story, and begin to sketch ideas for visual aids.

4. Wrap-up
   - Critical feedback
   - Students share their storyboards in small groups, providing feedback on flow and design.

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*Engage* students warm-up with theater games.  
*Credit: Bettina Hansen, The Seattle Times*

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**Engage as a nation-wide solution**

The *Engage* program addresses the need for training graduate students to be effective communicators, and its portability makes it ideal for expanding to many institutions. The primary obstacle to this expansion is financial support. In our experience, the *Engage* program has never been able to meet the student enrollment demand, and has relied very heavily on unpaid instructors and volunteers. The interdisciplinary nature of the graduate training course, which is so critical to its success, has also been its Achilles’ heel. In a time of ever decreasing academic budgets, departments are reluctant to fund a program that serves students from so many other departments, schools, and colleges. Thus, by funding innovative, interdisciplinary *Engage*-like programs across the country, the NSF can meet the need for graduate science communication training, and avoid the reliance on departmental budgets for funding these training programs.

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\(^1\) Town Hall Seattle is “Seattle’s community cultural center.” Our audience attendance has ranged from 30 to nearly 100 members of the Seattle public.
We suggest that the NSF provide competitive, renewable grants for curriculum and lecture series development. We also suggest that such grants include strong elements of graduate leadership. As students prepare for tomorrow’s opportunities and challenges, it is critical they play a central role in creating a communication program that meets their evolving needs.

NSF science communication training grants would provide funds for a period of graduate-led curriculum development, support for a graduate student instructor, and offset the costs of implementing the lecture series. We anticipate that the annual budget for such a grant would be $20-50k, depending on the costs of the instructor, advertising, and supporting a public lectures series. These grants should support an interdisciplinary and experiential approach, elements we have found critical to the success of students. Importantly, each new program would not need to start from scratch, as the Engage curriculum could be shared with the grant recipient.

Implementing science communication training programs across the country will enhance graduate education in a number of ways. Students who participate in these programs are encouraged to explore their work from new perspectives, to share their personal motivation, to see their research from a public perspective, and to explore how research can be woven into the art of storytelling. As a result, these students are comfortable stepping outside the “ivory tower” to become effective, engaging proponents for both their own research and for science in general.

**Summary: Meeting the demand for graduate student science communication training**

The demand for creative, engaging, and meaningful science communication is unlikely to decrease, however, STEM graduate students are not being trained to meet this demand. We have designed an innovative science communication curriculum that trains an interdisciplinary cohort of students to become engaging communicators, and provides experiential learning opportunities to these students.

The NSF is well suited to extending programs like ours across the country by funding small science communication training grants. Such grants will help train a generation of young scientists who are not only outstanding STEM researchers, but who can also excite the public with the wonders of their work.

*Sara Bender, UW Graduate Student in Oceanography, begins her Engage talk at Town Hall Seattle.*