

DEVELOPING CAPACITIES IN SCIENCE COMMUNICATION AND COMMUNITY ENGAGEMENT

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Background

Outreach and public service are among the key missions of land-grant universities. Involvement of scientists in these activities is critical to shape the public's scientific literacy and attitudes towards science (Gauchat 2011). This has also been recognized by federal funding agencies that often mandate that research projects benefit society and contribute to the achievement of specific, desired societal outcomes. Nonetheless, scientists do not typically receive training on how to engage a broader audience that does not have some degree of training in their field, and how to effectively communicate complex concepts and their relevance to everyday life. Successful community engagement hinges both on recognizing the needs and interests of the audience and developing according strategies to convey relevant information (e.g., Bubela et al. 2009).

To address this problem, our team has recently worked to create educational opportunities for scientists and new platforms for community engagement. We have launched the *Science Communication Fellowship*, which helps graduate students and postdoctoral researchers to develop targeted engagement activities (the first cohort of seven participants graduated in February 2016). With *Science on Tap* and *Science Saturday*, we have also initiated new, monthly platforms that allows scientists to engage the public through informal, discussion-based presentations. These efforts have primarily been supported by Sunset Zoo and Portal to the Public Network. The key objectives of this proposal are to build on our current efforts and expand both the educational and public engagement opportunities for scientists. Specifically, our goals are twofold: (1) Adapt the current science communication training to connect more diverse audiences, targeting both established scientists (faculty members) and aspiring scientists (undergraduates). (2) Ensure sustainability of initiated engagement opportunities (*Science on Tap*) and facilitate new ones by fostering high quality connections between K-State scientists and K-12 classrooms in the greater Manhattan area.

Training and engagement activities

Science communication training

The science communication training provided through the proposed project will largely build on the existing curriculum that we developed for the *Science Communication Fellowship*. The program builds on the fact that communication strategies scientists use to communicate their work amongst each other are not effective when interacting with the general public. In fact, research has shown that scientists communicate more effectively with the public by inverting the pyramid of their usual presentations to colleagues, starting with the bottom line and emphasizing why people should care about their work (Fig. 1). Workshops consequently focus on three goals: (1) Participants reflect and discuss the broader relevance of their specific research projects. (2) They are taught to develop skills to initiate and carry an interactive conversation about science with members of the public. (3) They create novel, hands-on educational activities that are prototyped and refined with an actual public audience and subsequently presented at public engagement events at the zoo and local schools. Members of the first cohort have participated in 10 engagement events, having an estimated audience of over 850 people.

While helping graduate students to become proficient in science communication is critical for our mission, it also poses some sustainability challenges for engagement activities in the wider K-State community, as the vast majority of graduates will eventually move away. To increase the number of resident scientists that actively engage with the public, we will expand current efforts and provide educational opportunities to K-State faculty members. We will modify the curriculum

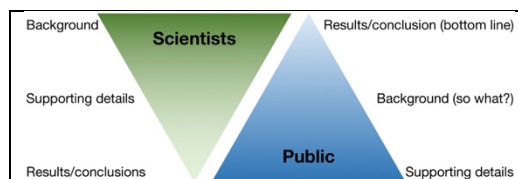


Fig. 1. Science communication model adapted from the American Association for the Advancement of Science. Communication strategies developed for the scientific community are often not effective when communicating to the public.

developed for graduate students to specifically cater to more advanced professional both in terms of their existing background and time constraints. To prepare scientists for engagement events at local schools, we will also focus the training on the Kansas College and Career Ready Standards for Science, which guide K-12 education in the state, to make scientists familiar with the needs and challenges of classroom teachers and build a common understanding and language that is necessary for effective communication.

Finally, the curriculum will also be adapted for use in undergraduate education. We will pilot a first iteration of an undergraduate science communication module in the *Natural History and Field Biology* course taught by Tobler in fall 2016. Undergraduates pursue individual, field-based research projects. Results will be presented to the public in the form of hands-on activities during events at the Sunset Zoo.

Ultimately, the science communication training will serve as the tool for sustained collaboration between researchers, teachers, and organizations involved in informal science education beyond this program's timeframe. To increase the impact of our efforts, we will also make educational modules available to other entities at K-State and other universities.

Public engagement activities

The second goal for this project is to create and foster sustainability in public engagement activities for scientists that have participated in the science communication training. We will target two complimentary strategies to accomplish this goal:

(1) We will use this project to firmly establish one of our successful pilot projects, which were initiated in 2015 and 2016. The goal is to build our community's enthusiasm for science in a fun and unique way, to make scientists more accessible to address questions of public concern, and to cater both to adult (*Science on Tap*) and family (*Science Saturday*) audiences. *Science on Tap* is held in a relaxed setting at the local Tallgrass Taphouse and features brief, informal presentations followed by lively conversation. *Science Saturday* is held at the Sunset Zoo and includes hands-on activities that introduce K-State research to audiences of all ages. Support for this project will allow us to continue these events for at least an additional four semesters (fall 2016 to spring 2018) by broadening the presenter base of trained scientists and by contributing to covering logistical costs.

(2) We will create an online platform that facilitates the connections between scientists and K-12 teachers in the greater Manhattan area. We will leverage close, existing ties to teachers and administrators from local school districts, including USD 383 (Manhattan-Ogden), USD 475 (Geary County Schools), USD 323 (Rock Creek), and USD 320 (Wamego), to first evaluate their specific needs both in terms of topics and logistics. Based on the needs, we will customize an online platform that features individual profiles of scientists, their expertise, and their engagement activities, as well as profiles of teachers and their instructional needs. This allows school teachers to identify scientists that can directly support their curriculum through classroom visits. In addition, scientists can identify suitable partners that can support the development of their broader impacts. Our team will actively facilitate interactions and identify suitable matches in the early stages of the project. Ultimately, the goal is for the platform to become self-sustainable as the number of participants grows.

Impact of the project

The project will generate new knowledge and resources through the development of expertise in science communication and new engagement opportunities, thus directly enhancing K-State's core mission. This provides key advantages for all stakeholders in the project. KSU students and investigators will benefit from added skills and networking opportunities, which will increase the quality of broader impact activities required by many federal funding agencies. Similar, Sunset Zoo will build capacity for its Education Department from the increased involvement of scientist with more diverse engagement activities attracting a wider audience, all of which supports its education efforts. Finally, Kansas schools and the communities of the greater Manhattan area will profit by having access to more diverse educational experiences, which ultimately increases scientific literacy and career readiness. We also plan to disseminate the professional development activities we develop to other institutions through Portal of the Public, which will contribute to increased capacities in science communication education nationwide.

Team

All team members share a passion and know-how for science communication, yet they approach the problem from very different backgrounds. Tobler is an active scientist with an extramurally funded research program. He has written dozens of articles for popular scientific outlets, contributed to magazine stories and a children's book, appeared on or consulted for multiple TV documentaries, and regularly interacts with the public in person through a variety of avenues. Bixby and Wade are educators at the Sunset Zoo with a background in the life sciences. Combined, they have over two decades of experience with the didactics of informal education, intimate knowledge of the Next Generation Science Standards, and connections to school districts and informal education institutions throughout the United States. All team members will work jointly to develop and implement curricula, as well as to realize the proposed engagement activities.

Timeline

Summer 2016	Re-iteration of existing Science Communication Fellowship for graduate students; development of undergraduate course units
Fall 2016	Implementation of undergraduate course; continuation of <i>Science on Tap</i> and <i>Science Saturday</i> activities; development of faculty course units; assessment of teacher needs
Spring 2017	Continuation of <i>Science on Tap</i> and <i>Science Saturday</i> activities; implementation of faculty course; generation of online portal
Summer 2017	Evaluation of the program and improvement to educational units; re-iteration graduate student course; advertisement of the online portal to regional schools
Fall 2017	Re-iteration of undergraduate course; continuation of <i>Science on Tap</i> and <i>Science Saturday</i> activities; active facilitation of contacts between educators and scientists
Spring 2018	Re-iteration of faculty course; continuation of <i>Science on Tap</i> and <i>Science Saturday</i> activities; active facilitation of contacts between educators and scientists

Sustainability

After the initial development, maintaining the proposed activities will require relatively few resources. Sunset Zoo has committed resources in the form of an Education Assistant position that helps to organize events. We will also encourage scientists that profit from the science communication training to consider including these activities in their broader impacts on extramurally funded projects, ultimately contributing to the maintenance of the program.

Accomplishment benchmarks

We are aiming to involve at least 10 graduate students and 10 faculty members in science communication training each year. The enrollment for the Natural History and Field Biology course is capped at 25. Hence, we hope to involve up to 90 K-State students and faculty in this program over the next two years. *Science on Tap* events will be held monthly during the academic year (16 events over two years), and *Science Saturdays* during the winter months (10 events over two years).

Matching K-State funds

The *Science Communication Fellowship* for graduate students and outreach activities are in part supported by the Division of Biology (\$13,000 through an NSF grant awarded to Tobler). In addition the Graduate School is supporting the *Science Communication Fellowship* for a second year in a row (\$1,200 for the 2016-2017 cohort), and the Pacific Science Center has been contributing funds (\$5,000) through June 2016 as part of the development of the Kansas Portal to the Public Consortium.

References

- Bubela T et al. 2009. Science communication reconsidered. *Nature Biotechnology* 27:514-518
- Gauchat G. 2011. The cultural authority of science: public trust and acceptance of organized science. *Public Understanding of Science* 20:751-770