Helping Young Scientists Learn and Practice Public Engagement

By Lynn Uyen Tran and Catherine Halversen

Daraith Long (right), a student at University of California, Berkeley, explains to visitors how organisms breathe underwater. The Communicating Ocean Sciences to Informal Audiences course teaches students how to communicate scientific knowledge to the public in informal science education institutions. *Photo courtesy Lawrence Hall of Science*

As the relationship between science and society evolves, there is an increasingly urgent need for scientists to engage and communicate more effectively with the public about scientific issues. Leaders in the scientific community are calling for science graduates to know how to communicate their scientific knowledge with the public. They argue that research training programs need to include communication skills because, as one undergraduate science student recently remarked, "When you are pursuing research, it is easy to forget how important it is to be able to communicate your science to a broader audience."

To address this call, the Lawrence Hall of Science (the public science center of the University of California, Berkeley) developed the Communicating Ocean Sciences (COS) series *(www.coseeca.net/programs/communicatingoceansciences)*. First offered in 2005, the series comprises two university-level courses for undergraduate and graduate students in science-related majors. The courses are currently taught at more than 25 colleges and universities around the United States. One course, COS K–12, is team-taught by a scientist and a formal educator and provides students with experience communicating science to schoolchildren in K–12 classrooms. In the other course, COSIA (Communicating Ocean Sciences to Informal Audiences), a scientist and an informal educator team-teach, and the students have the opportunity to communicate their scientific knowledge in informal science education (ISE) institutions.

In the COS series, ocean and climate scientists from colleges and universities and master educators from formal and informal environments work together to address the following goals: First, introduce undergraduate and graduate students—the future scientists—to the importance of education, outreach, and the broader impact of ocean sciences research. Second, improve the ability of the scientists teaching the COS courses to communicate scientific concepts and research to their undergraduate students. Third, provide both graduate and undergraduate students and scientists with direct experience using exemplary, research-based instructional materials that model constructivist pedagogy—the idea that people learn by actively interacting with their social and physical environment. Fourth, promote thoughtful, mutually beneficial collaborations between scientists and educators as they co-teach the courses. Fifth, provide K–12 students from underrepresented populations and visitors to ISE institutions with significant ocean sciences instruction and college and university role models.

These courses incorporate pedagogy and learning theory described in current research literature, such as *How People Learn* (Bransford, Brown, and Cocking, 1999); *Taking Science to School* (Duschl, Schweingruber, and Shouse, 2007); *Understanding by Design* (Wiggins and McTighe, 2005); and *Designing Professional Development for Teachers of Science and Mathematics* (Loucks-Horsley et al., 2003). In each class session, students have opportunities to

- experience, discuss, and grapple with ideas and concepts through active "adult learning experiences" where they are placed in the role of the learner and are challenged to think deeply about ocean sciences concepts and science learning and teaching
- participate in activities that illustrate scientific concepts and instructional methods introduced in the session and that they can use in their field practicum
- reflect on their own learning, now and in the future.

Malavika Lobo (right), a junior molecular and cell biology major at the University of California, Berkeley, talks with visitors to the Lawrence Hall of Science about animals found in a tidepool. *Photo by Craig Strang*

A critical component of both courses is the field practicum, with the location for this practical experience being the primary difference between the two courses. For COS K–12, students present six lessons in school classrooms, and for COSIA, they present two-hour activities on six separate occasions in ISE institution gallery spaces. For both courses, the students teach learners about ocean sciences, first using lessons and activities that have been developed, tested, and refined by the course development team, and then using a lesson or activity that they have designed throughout the semester.

The COS series is an innovative way of connecting scientists with the public. It uses K–12 classrooms and ISE institutions as training grounds for young scientists to learn to communicate science to general audiences. In turn, the public has the opportunity to interact directly with the next generation of scientists. Meanwhile, as they teach the COS series, scientists are challenged to reflect upon how they teach in other courses, and in most cases, they change their practices to incorporate ideas presented in the COS K–12 and COSIA courses. Furthermore, several scientist and educator partners are collaborating to pursue grants to fund additional projects that would develop new programs for students, schools, and the public related to and drawing on the COS course objectives and content. Thus, the courses have created long-lasting partnerships between scientists and educators that have resulted in collaborations on projects beyond the course itself, as they learn to recognize, value, and respect one another's expertise. ■

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outline the opportunities for public outreach through the museum. The museum's program coordinators also receive the university's science press releases so they are aware of new discoveries that may be of interest to the public. Over time, the coordinators have developed strong and broad networks of scientist participants.

When a scientist commits to one of our programs, we provide written and video resources that we have developed (some in collaboration with the North Carolina Museum of Life and Science, Durham) to help them prepare their presentations. Through personal contact, we provide suggestions about preparation time, possible questions from the audience, and an invitation to arrive early for orientation by our staff.

Measuring outcomes

Summative evaluation is ongoing and includes feedback from both the public and scientists. The response from both has been tremendous. For example, Science Movie Night attracts 50 to 200 people, often including many teens. Scientist in the Classroom has unusually high scores in teacher ratings; teachers strongly value the opportunity for children to hear an expert voice. Scientists in this program find the preparation materials helpful, particularly tips for teaching children and information on how children learn.

Scientist in the Spotlight has reinvigorated formerly slow Friday afternoons. Almost one-third of participants, particularly Scouts and home school groups, report that they come specifically to see this program, which indicates to us the program's positive impact on the public's perception of scientists. When surveyed generally about what they learned on their museum visit, 50 percent of children and 40 percent of adults mentioned content from their interactions with scientists. Scientists involved in Scientist in the Spotlight report that they are happy with the preparation, audience response, and overall experience. Audience size has the greatest impact on the perceived quality of their experience; a few scientists with very low audience numbers reported much lower satisfaction.

Utah Museum of Natural History paleontologist Scott Sampson (left) shows a student a dinosaur fossil during a Scientist in the Classroom program. *Photo by Jeffry Allred © Deseret News*

Utah Museum of Natural History paleontologist Mike Getty (left) explains a new dinosaur find during a Scientist in the Spotlight program. *Photo courtesy Utah Museum of Natural History*

In addition to the success of our programs, another great outcome is that scientists now are inviting us to be part of the "broader impacts" description in their grant proposals to NSF and the U.S. National Institutes of Health. These additional funds will allow us to expand the opportunities to connect scientists with the public.

As our offerings grow and more scientists become familiar with them, we are finding it easier to recruit participants. A growing audience indicates strong interest by the public in these programs. The ultimate results are museum programs that are popular, relevant, and fresh, and a public with a better understanding of the people who do the science. ■

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