COSEE-Ocean Systems: *Faculty-Graduate Student Collaborative Workshop Model*

A key challenge in improving scientists' capacity to address "Broader Impacts" criteria is helping them communicate their research clearly and logically to others. Given the misconceptions about climate change -- including a general lack of understanding of the oceans' important role -- the need for involving scientists in clarifying connections within the ocean-climate system has never been more vital. Four COSEE Centers -- California, Networked Ocean World (NOW), Ocean Systems, and West -- have embarked on developing and testing a series of "scientist-centered" workshop models, partnering ocean research faculty with graduate students to create concept maps on ocean and climate topics. The strategies and approaches for the "Faculty-Graduate Student Collaborative" (FGSC) project are described, including: I) Using literacy as a framework; II) Applying the "Learning & Improvement Cycle" and conducting focus groups; and III) Contributing to Network priorities while meeting the needs of the Centers.

I) Using Literacy as a Framework

The strategy begins with aligning the expertise of participating faculty members with specific "Ocean Literacy" (OL) and "Climate Literacy" (CL) principles. Using workshop application data, graduate students' responses about their comfort with these OL and CL principles -- along with their ratings of the principles' relevance to their work -- are used to "match-make" students with individual faculty members. These data are then compared to post-workshop evaluation data to determine if the workshop resulted in measurable changes in the students' perception of "comfort" and "relevance" of the CL or OL content. In addition, the faculty-graduate student teams produce concept maps that are grounded in OL or CL principles, targeted for a specific audience (e.g., undergraduates, general public).

Pilot workshop (Darling Marine Center, 29-Jan through 02-Feb 2010) - In a half-day professional development session prior to the arrival of 17 graduate students/post-docs, faculty members (Pete Jumars, Larry Mayer, Andrew Pershing of UMaine; David Fields and Ben Twining of Bigelow Laboratory for Ocean Sciences) were trained to concept map by COSEE staff. Using the OL and CL "match-making" process, graduate students/post-docs were teamed with these faculty members to collaboratively create "consensus maps" targeted for an audience of freshmen undergraduates not majoring in science (Figure 1). During a full day of map preparation, graduate students/post-docs provided the faculty a "bridging perspective" to the undergraduate population, while the faculty in turn had a chance to explain and clarify their deep knowledge of complex science topics on a peer-to-peer level with the graduate students/post-docs. On the final day of the workshop, the graduate students/post-docs showcased their "consensus" concept maps to Waterville Senior High School students who critiqued their presentations and provided specific feedback (i.e., use of jargon, context in the "big picture," clarity of concept maps, memorability of "take home message"). Linda Duguay (COSEE-West) and Cheryl Peach (COSEE-California) co-facilitated the workshop and helped give participants a perspective of the COSEE Network as a whole. Sage Lichtenwalner of COSEE NOW spearheaded an abbreviated "Teaching & Learning" activity from Rutgers University's "Communicating Ocean Sciences for Informal Audiences" course.

Figure 1: Pete Jumars (right) works with a team of graduate and post-doc students during the pilot Faculty-Graduate Student workshop.

II) Applying the "Learning & Improvement Cycle" and Conducting Focus Groups

A key component of the FGSC evaluation is a series of "Learning & Improvement Cycle" charts (see Figure 2), based on project objectives that are content-focused or process-focused:

CONTENT OBJECTIVES

- Exposing scientists and graduate students to fundamental learning theory and pedagogical knowledge;
- Promoting understanding and use of ocean and climate literacy principles; and
- Raising scientist and graduate student awareness about the "needs of the learner."

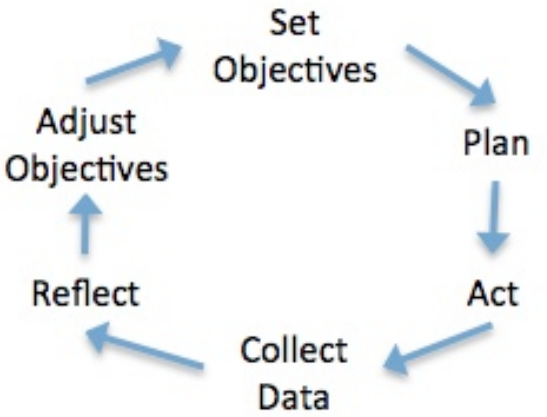

Figure 2: The "Learning & Improvement Cycle" used to develop the workshop.

PROCESS OBJECTIVES

- Bringing scientists and graduate students together in meaningful, peer-based collaborative context;
- Providing scientists and graduate students with practical pedagogical tools that help them improve their communication of important ocean science content to non-scientist audiences; and
- Providing scientists and graduate students a forum where they can test and improve their communication skills of important ocean science content to non-scientist audiences.

This cyclical approach addresses questions about which activities / products work under what conditions and how they can be improved. After each workshop or focus group, a debriefing is being held with the project team to discern and evaluate patterns in the collected data and plot strategies for redesigning activities, as necessary.

Web-based focus group (04-Jun-2010) - Four months after the pilot workshop, COSEE-OS held a web-based "focus group" with a subset of the non-faculty participants. The meeting had two goals: 1) To clarify some comments and feedback that received during the workshop; and 2) To discuss the graduate students' and post-docs' interests in teaching and professional development and growth as educators. The following summarizes the results of the pilot focus group:

STRENGTHS OF THE WORKSHOP

- Team organization based on "discomfort" with a topic (i.e., the "match-making" scheme based on OL and CL Principles);
- 1:3 ratio of faculty to graduate students / post-docs prompted good collaboration;
- Having faculty present their own concept maps to the graduate students/post-docs was a good starting point for team-building;
- Homework assignment (i.e., asking assigned ocean-related questions of non-scientists prior to the workshop) was extremely valuable and "eye-opening";
- Interaction with and feedback from high school students was very interesting and helpful; and
- Discussion around learning theory was appreciated.

RECOMMENDED IMPROVEMENTS FOR FUTURE WORKSHOPS

- Add a new half-day session for the graduate students to spend time on the COSEE NOW "Teaching & Learning" activity;
- Increase amount of time and direct interaction with high school students (e.g., follow-up on how specifically to improve the presentations);
- Staff potentially give more guidance on the creation of effective concept maps, particularly for teams who may be having difficulty; and
- Include examples on how to get and adapt to audience feedback in different scenarios (e.g., talking with a stranger on a bus ride, giving a 10 minute "demo" at an informal science venue, helping to teach a course, etc.).

INTERESTING OUTCOMES

- All focus group participants continue to use concept maps, including in their posters for professional

conferences (e.g., American Geophysical Union Ocean Sciences Meeting) and/or for their thesis committee presentations (i.e., as a way to explain their complex research);
- All felt that they underestimated the content knowledge of the high school students; and
- All saw the value of getting feedback from an audience and having a chance to discuss it with others (e.g., to come up with ideas for improvement).

III) Contributing to Network Priorities While Meeting the Needs of Centers

By improving scientists' ability to communicate important concepts and their interconnections, this project supports COSEE's overall mission "to spark and nurture collaborations among research scientists and educators to advance ocean discovery and make known the vital role of the ocean in our lives." In addition, by providing today's and tomorrow's scientists with the ability to clearly see how their "take home messages" have been translated to various audiences, this project supports the betterment of the following COSEE Network goals:

- Fostering the integration of ocean research into high-quality educational materials;
- Enabling ocean researchers to gain a better understanding of educational pedagogy; and
- Promoting deeper understanding of the ocean and its influence on each person's quality of life and our national prosperity.

The project is designed to meet the needs of each collaborating partner, to help maximize both the flexibility and "transferability" of the workshops to the rest of the COSEE Network:

- *COSEE California* - By teaming young faculty with NSF Graduate Teaching Fellows in K-12 Education (GK-12) at Scripps Institution of Oceanography to co-develop "Broader Impacts" content, FGSC workshops will provide training on flexible tools and approaches to enhance their education and outreach activities;
- *COSEE NOW* - This project is expanding the use of COSEE NOW's community software, promoting peer-based collaboration among faculty and graduate students within the new paradigm of Internet-based ocean exploration and research;
- *COSEE-West* - Teaming faculty mentors with graduate students from the University of Southern California, University of California Los Angeles, and the California State University System will promote "institutional cross fertilization" and potentially foster Master's students interests' in pursuing Ph.D. programs; and
- *COSEE- Ocean Systems* - As a thematic Center, outcomes of this project will help to improve the processes and products that are eventually transferred by COSEE-Ocean Systems to the entire Network.