Chapter 18
Mapping Out Scientists' Messages:
Models that Support Collaborative Critical Thinking

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EXECUTIVE SUMMARY

Funded by the Centers for Ocean Sciences Education Excellence (COSEE) program of the National Science Foundation (NSF), COSEE-Ocean Systems (OS) has employed concept mapping to facilitate collaboration and communication between ocean scientists and educators. Based on iterative feedback from and interaction with its participants, COSEE-OS has developed online concept mapping software linked to an ever-growing database with thousands of scientist-vetted resources, known as the Concept Linked Integrated Media Builder (CLIMB; cosee.umaine.edu/climb). Concomitant with the evolution of its CLIMB software functionality, COSEE-OS has transitioned from exclusively holding in-person concept mapping workshops to predominantly preparing for and delivering concept map-based webinar events, featuring ocean science researchers. This transition to webinars has greatly increased the number of participants and expanded the geographic reach from local to global. This chapter focuses on three key areas in which COSEE-OS has supported critical thinking: (1) the collaborative process of making meaningful learning by creating, analyzing, and improving concept maps with others; (2) facilitating subject-matter experts in the formulation of concept map-based presentations,

which audiences can use to evaluate the validity of their connections and conclusions; and (3) the training of scientists to use concept mapping as a technique to more clearly delineate and explain how their research is tied to societally relevant issues. Three case descriptions on how COSEE-OS concept mapping facilitation and infrastructure have been applied to ocean sciences education efforts—both within the COSEE Network and beyond to the National Aeronautics and Space Administration (NASA)—are also presented.

BACKGROUND

COSEE-OS Support of Critical Thinking

The COSEE program was born out of a workshop report (McManus et al., 2000), which recommended that the NSF play a leadership role in forming a mechanism through which exemplary practices in ocean sciences education be organized into distributed centers. A subsequent NSF-appointed COSEE Implementation Steering Committee reviewed the workshop report and recommended that NSF and other funding agencies proceed with establishing COSEE (Walker et al., 2001). They noted that, "The overarching goal is to increase and enhance collaboration and communications among ocean scientists, educators, and the general public." From these initial steps, a national Network of 10 COSEE Centers and a Central Coordinating Office were funded.

In fall 2005, Ocean Systems joined the COSEE Network with the objective of fostering substantive dialogue between scientists, educators, and the public through concept mapping. COSEE-OS developed, tested and iterated models of applied collaborative concept mapping and a related suite of interactive multimedia tools that focus on ocean and climate core concepts. These online tools are designed to graphically display how scientists see relationships among the concepts in their field.

Through its workshops and webinars, COSEE-OS has developed innovative methods to help scientists break down their research into core components and use creative thinking to make new connections for nonscientist audiences (deCharon et al., 2009; Bailin, 2002; Ennis, 1985; Paul & Elder, 2006). Having trained over 275 faculty- and graduate-level scientists, COSEE-OS has also supported several other types of critical thinking as defined by the California Critical Thinking Skills Test (CCTST; Insight Assessment, 2013) including analysis, evaluation and explanation. Facione (2000) designed the CCTST as a general test of critical thinking rather than one embedded within the context of a specific domain. Yet in 1990, he also noted the importance of domain-specific knowledge in the application of critical thinking skills and abilities. By focusing on concept mapping of ocean and climate