

The Centers for Ocean Sciences Education Excellence (COSEE): A National Success Story

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Abstract—This manuscript will focus on the success achieved over a three year period by the COSEE Network of seven, regional Centers and one Central Coordinating Office (CCO). This success is based on a Network of professionals who are proactive and passionate about oceans sciences and education; embrace a common focus; exhibit extraordinary teamwork; involve multiple partners; understand the need in grass-roots and national leadership; work toward making its unique infrastructure seamless; and implement effective strategic planning. Specifically, the authors will focus on the following COSEE topics: serving as a catalyst and portal in engaging scientists and formal/informal educators to “bridge the gap” between their research and the relevance of those data to precollege teachers and their students, informal educators, and the general public within museums, science centers, and aquariums; determining “what” all audiences should know about our watery planet to be more ocean literate; working toward enhanced diversity in the workforce; implementing regional and national evaluation and assessment plans; developing a mechanism to infuse ocean sciences within existing *State* and *National Science Education Standards*; and disseminating high-quality COSEE resources, based on sound science. The COSEE Network is sponsored primarily by the National Science Foundation (NSF), the National Oceanic and Atmospheric Administration (NOAA), and the U.S. Navy’s Office of Naval Research (ONR).

I. INTRODUCTION AND BACKGROUND

The development and subsequent implementation of the COSEE initiative began in mid 1999 with an internal White Paper, prepared within the NSF-Division of Ocean Sciences (OCE), followed by the formation of an Advisory Committee of 10 community leaders (Cook and Rom, 2001). These individuals represented a range of educational sectors and interest groups (ocean sciences research, undergraduate education, K-8 and 9-12 education, informal education, teacher preparation and professional development, information technology, and underrepresented groups). This Advisory Committee planned, organized, and served as program facilitators at a Needs Assessment Workshop implemented May 25-26, 2000 at The University of Southern Mississippi (USM)-Gulf Park Campus in Long Beach, MS. Seventy-three people attended, representing all the educational sectors listed above. The collective recommendation of the Workshop

participants was for the establishment of Centers as a nationally coordinated program for ocean sciences in informal and formal educational sectors. The 10 COSEE Workshop Facilitators prepared a 69-page *COSEE Workshop Report* (<www.cosee.org>, 2000 and Walker, 2001). The Workshop participants specifically made 13 recommendations as listed below:

- Facilitate the integration of research into high-quality educational materials to engage the minds of students in the excitement of discovery and develop their interests into a mature understanding of the ocean’s relevance to their lives;



Fig. 1. Professional development programs involving alignment of high quality curricula with *State* and *National Science Education Standards*. Photo courtesy of COSEE:NE.

- Promote the education of the public about the ocean and its influence on the quality of their lives and the prosperity of the nation;
- Assist in developing curricula with core competencies for more effective education;
- Encourage the investigation of teaching and learning in integrated sciences;



Fig. 2. Precollege teachers and scientists engaged in “bridging the gap” between ocean sciences content and instructional strategies. Photo courtesy of COSEE:NE.

- Foster the inclusion of groups traditionally underrepresented and underserved in science in order to draw on their new ideas and perspectives;



Fig. 3. Engaging traditionally underrepresented groups to draw on new ideas and perspectives. Photo courtesy of COSEE:CGOM.

- Encourage the sound preparation of teachers;
- Provide opportunities for professional development of inservice teachers, undergraduate faculty, and administrators;
- Assist in improving the reward structure for teaching, including faculty and graduate student teaching;
- Encourage the effective use of information technology;
- Establish internships;
- Provide career information across the spectrum of the ocean sciences community;
- Effect many of these changes by fostering collaborations and partnerships both among people and between organizations; and

- Formulate strategies to evaluate these initiatives.

The rationale for these recommendations was based on envisioning the COSEE regional sites as “windows to the ocean” both physical and virtual, providing ocean sciences information to educators, the public, and the news media. Further, it was envisioned these COSEE would be advocates for ocean sciences education, from informal, through K-12 and undergraduate to graduate education. As excerpted from *COSEE Current* (2001), “The COSEE should be funded as a long-term commitment to educational change. Ocean sciences educators need these “windows to the ocean” to access ideas, information, and resources that connect and celebrate ocean sciences teaching, learning, and scientific discovery for all the education sectors. The COSEE “windows to the ocean” should have high visibility and be identified as “the place to go first” for directions to opportunities and resources in ocean sciences education and professional development. Entrance to these “windows to the ocean” should be available both “virtually” by the Internet and in person at a COSEE site.”

It should also be noted that the COSEE organizational structure was not a topic of discussion at the beginning of the May 2000 Workshop; however, a possible organizational structure had evolved by the final day of the Workshop. “The group consensus was that the COSEE should consist at least in part, of “regional centers,” distributed across the U.S. and formed by consortia representing as many educational sectors of the ocean sciences as possible. Several advantages for ease of public access favor the location of “regional centers” at informal education sites and in sites among large populations of traditionally underrepresented groups. By being regional, these “Ocean Sciences Learning Communities” could more easily leverage resources available at this operational level. Additional benefits were also noted for having a small, central office in Washington, D.C. that could maintain liaisons with NSF and other federal agencies, and provide national coordination for the “Regional Centers.” Advisory Boards for the COSEE should also be formed at the regional and national levels and should represent as many stakeholders as possible. Above all, the COSEE must be a unifier of the ocean sciences education and research communities.”

Based on the *COSEE Workshop Final Report* (2000), in April 2001, a COSEE Implementation Committee was organized. This group of nine individuals was selected by NSF-OCE from both the original Workshop participant list and scientists and educators who were new to COSEE (Cook and Rom, 2001). This Committee was tasked with receiving the original *COSEE Workshop Report* and identifying high-priority goals and activities that could be implemented with the total funding, expected to be available initially, approximately \$1 to 1.5 million per year. This report may also be found at <www.cosee.org> and in summary in the *COSEE Current* (2001). Based on these documents and subsequent recommendations, the NSF-OCE and Division of Undergraduate Education (DUE) developed an Announcement of Opportunity in the fall of 2001 with a proposal submission date of January 18, 2002. Twenty-six proposals were submitted and seven were funded, three for three years and

four for five years, beginning in the fall of 2002. Additional funds were provided by ONR and NOAA's Office of Atmospheric Research (OAR) and the National Ocean Service (NOS).

II. YEAR 1 ACCOMPLISHMENTS (LATE FALL 2002-APRIL 2004)

These seven initial Regional Centers are listed below with detailed information on each COSEE available at <www.cosee.net>:

- COSEE-CA,
- COSEE-Central Gulf of Mexico,
- COSEE-West,
- COSEE-FL,
- COSEE-Southeast,
- COSEE-Mid Atlantic, and
- COSEE-New England

In November 2002, a COSEE-CCO was established in Washington, D.C., at the Consortium for Oceanographic Research and Education (CORE). An initial COSEE website was established by the CCO. The major accomplishment during the first year was the development of infrastructure for each regional COSEE involving partners from academia, informal science centers, industry, non-profit organizations, K-12 formal education, and undergraduate education. Center Advisory Boards were formed. Woven within the COSEE tapestry were the cross-cutting themes of evaluation and assessment, diversity among underrepresented and underserved groups, state and national standards, and technology. In March 2003 (approximately six months following initial awards), NSF-OCE hosted a Principal Investigators' Meeting. Each of the COSEE provided a programmatic overview during this Meeting and it was obvious there were significant strengths and expertise. However, it was equally obvious that these seven COSEE and the COSEE-CCO needed to act together as a more focused network to ensure the success of the COSEE concept. Therefore, in April 2003, a COSEE Council was formed with eight voting members, one representative from each of the seven regional COSEE and the COSEE-CCO and a COSEE Council Chair was elected. In May 2003, an Evaluators workshop was held in Washington, D.C. Throughout the first year, Quarterly Council Conference calls were held to fully engage Council members in the network development process. In addition, face-to-face COSEE Council Meetings were convened at the National Marine Educators Association (NMEA) and the American Geophysical Union (AGU) Annual Conferences. In the fall of 2003 and winter of 2004, a COSEE National Advisory Board (NAB) was formed and planning for the development of a COSEE Strategic Plan began.

Additionally, during 2002 -2004, several COSEE individuals had been part of an *Ad Hoc* Committee in developing the *Educational Strategy* for National Oceanographic Partnership Program (NOPP) [2002-2004].

Further, select COSEE individuals were also actively involved in 2002 and 2003 in providing testimony and/or input into the U.S. Ocean Commission Report: *An Ocean Blueprint for the 21st Century* (2004). These testimonies, letters, e-mails, and phone calls effectively provided a common focus for ocean sciences education. COSEE leaders also contributed to the development of the *NOAA Education Strategic Plan* (2004) and the *NOAA-Sea Grant: Marine and Aquatic Literacy: Educating the 21st Century Workforce Brochure* (2004).

III. YEAR 2 ACCOMPLISHMENTS (MAY 2004-APRIL 2005):

The COSEE Network's web presence was initially a disparate collection of seven individually designed and maintained regional websites. During Year 2, this fragmented approach was abandoned in favor of a more unified and coherent web presence. In April and May 2004, a multi-step process involving the NAB and the COSEE Council led to the formulation and subsequent adoption of *The COSEE Network Strategic Plan* (2004). Throughout Year 2, the *Plan* (revised in April 2005 and provided below in Year 3) served the Network well as a framework for collaboration and coordination. In addition to collective work implemented by the COSEE Council, *Ad Hoc* working groups were formed to focus on branding and logo development and the creation of a policy and standard operating procedures document. In addition, a cross-cutting working group from three Centers began work on a guidance document, 'Engaging Scientists,' for research scientists who wish to become more involved in formal (K-12) and informal education. Further, the *Ad Hoc* COSEE/NMEA Ocean Literacy group developed seven concepts or essential principles, i.e., 1) the Earth has one big ocean with many features; 2) the ocean and life in the ocean shape the features of the Earth; 3) the ocean is a major influence on weather and climate; 4) the ocean makes the Earth habitable; 5) the ocean supports a great diversity of life and ecosystems; 6) the ocean and humans are inextricably interconnected; and 7) the ocean is largely unexplored.

IV. YEAR 3 ACCOMPLISHMENTS (MAY 2005-APRIL 2006)

The COSEE Network Strategic Plan (2004) was recently updated by the COSEE Council and is now known as the *COSEE Network Strategic Business Plan* (2005). Key elements of the *Plan* are presented below:

The COSEE Network Strategic Business Plan

April 2005

The COSEE Network Strategic Business Plan – April 2005

Mission - Our Collective Purpose

Spark and nurture collaborations among scientists and educators to advance ocean discovery and make known the vital role of the oceans in our lives



Fig. 4. Teachers and scientist engaged in a marine polymer. Photo courtesy of COSEE:CGOM.

Values - What We Stand For

Leadership

- We are passionate and tenacious about delivering quality results that matter to the world
- We are strategic visionaries and catalysts for change
- We are committed to the generation and dissemination of new knowledge

Collaboration

- We recognize the value of diversity and the power of our collective work



Fig. 5. Students collecting benthic samples near an offshore barrier island. Photo courtesy of COSEE:CGOM.

- We build effective partnerships to leverage greater outcomes than we could achieve alone
- We foster information sharing and open communication

Innovation

- We embrace natural curiosity and inspire learning



Fig. 6. Boy Scouts collecting specimens from a salt marsh. Photo courtesy of COSEE:CGOM.

- We are creative, resourceful problem-solvers
- We encourage risk-taking that leads to new ideas and novel solutions

Vision - Our Picture of the Ideal Future

The COSEE Network is a sustainable force ...

- The public values the ocean as an integral part of the Earth system



Fig. 7. Experiential activities empower learners of all ages to value the ocean as an integral part of the Earth system. Photo courtesy of COSEE:NE

- A vibrant and effective COSEE Network has expanded its partnerships and influence throughout the Nation
- The COSEE Network is well-funded by multiple public and private institutions
- Ocean scientists, ocean engineers, educators and public and private leaders have forged powerful partnerships to deliver relevant, exciting products and services that inspire and inform the public
- Diverse people of all ages are learning about the ocean and pursuing careers in science
- Science discoveries are contributing to effective ocean policy

- We have internationally recognized spokespersons and exciting, ongoing media coverage about the ocean
...we are firing up the world's imagination!

Goals – Our Focus for the Next 3 Years

Goal #1: Catalyze interactions among scientists and educators to enhance ocean sciences literacy for target audiences

Goal #2: Establish and expand an effective Network infrastructure to support collaboration and leverage diverse strengths

Goal #3: Build stable funding and support for program sustainability

Goal #1: Catalyze interactions among scientists and educators to enhance ocean sciences literacy for target audiences

Key Results:

- The COSEE Network speaks with a common voice about ocean sciences literacy
- The COSEE Network delivers coherent program to advance ocean sciences literacy

- Increase in participation of diverse audiences in all COSEE programs by 2007
- There is consistent growth in the number of collaborations among scientists and educators that are qualitatively rich and sustained
- The COSEE Network provides mechanisms for rapid translation and dissemination of recent discoveries and events to the public

Key Strategies:

- Develop and promote an array of strategies, identify effective practices, and partner with professional organizations to engage scientists in education
- Promote the use of the ocean literacy concepts
- Develop coherent delivery system to advance ocean sciences literacy
- Survey COSEE Network with web-based tools to identify and analyze products and services
- Increase recruitment, retention and opportunities for networking for under-served and under-represented audiences
- Influence Federal agencies’ policies regarding reporting results

Action Plan (Next six to eight Months):

Action/Deliverable*	Completion
COSEE Network Voice on “Ocean Sciences Literacy”	
1. Develop sample ocean science questions for National Assessment of Educational Progress (NAEP) and state assessments.	May 2005
2. Post framework on “ocean sciences literacy” on COSEE website.	June 2005
3. Develop strategies for dissemination of ocean literacy concepts within COSEE Network and with external targeted audiences in coordination with key external stakeholders.	September 2005
4. Promote and monitor inclusion of ocean sciences concepts into national and state standards and assessments.	December 2005
Partnerships between Ocean Scientists and Educators	
5. Develop and implement a plan for engaging scientists and educators. Include a web-based <i>Guide</i> , professional development related to using the <i>Guide</i> , a system for dealing with referrals, and a system for tracking the number of facilitated engagements / COSEE services.	August 2005
6. Investigate mechanisms for rapid translation and dissemination of recent discoveries and events to the public.	April 2006
COSEE Network Program Delivery	
7. Develop criteria of excellence for COSEE programs.	May 2005
8. Compile an up-to-date, accurate description of program activities at each Center. Create a template for descriptions.	June 2005
9. Develop and implement a plan to document, publicize and market COSEE results / impact. Consider how to best use the criteria to select case studies of “significant programs” that COSEE offers. The purpose is to create a snapshot of COSEE Network and its impact.	September 2005
Increase Participation by Under-served and Under-represented Audiences	

10. Conduct an inventory of COSEE Network activities and programs related to increasing diversity of participants.	August 2005
11. Analyze inventory for effective practices and greatest impediments within COSEE Network programs and activities. Identify partners and the most effective practices and strategies for retaining underserved and underrepresented audiences.	December 2005

Goal #2: Establish effective Network infrastructure to support collaboration and leverage diverse strengths

Key Results:

- The COSEE Network responds quickly to opportunities and challenges as the voice of the entire Network
- There are twice as many scientists and educators involved in COSEE Network as there were in May 2004
- There is consistent growth in the number of collaborations among scientists and educators that are qualitatively rich and sustained
- COSEE partners are satisfied with being part of the Network umbrella
- A national evaluation demonstrates that COSEE is meeting its goals
- The web portal is being used effectively for internal and

external communication

Key Strategies:

- Define an organizational structure and internal operating agreements for the COSEE Network
- Centralize the development and/or dissemination of Network tools, products, and effective practices
- Develop and fund a *National COSEE Evaluation Plan* that includes: defined corporate metrics, centralized data collection, and integrated evaluation products
- Develop and implement a plan for getting “buy-in” from Centers, CCO, and NAB for the *COSEE Network Strategic Business Plan*
- Provide strategic technical assistance to Centers and facilitate communication across the Network

Action Plan (Next 12-18 Months):

Action/Deliverable*	Completion
COSEE Network Structure and Operating Agreements	
12. Complete search and hire Executive Director.	June 2005
13. Expand NAB by July 2005. Convene quarterly calls / contact with all NAB members.	July 2005 Quarterly
Centralized COSEE Network Tools, Products, and Best Practices	
14. Implement web development as described in CCO proposal. Designate a web portal contact at each Regional Center.	August 2006
15. Implement internal online database for COSEE activities, resources, and expertise for Center input and use.	December 2005
COSEE Network Evaluation Plan	
16. Define protocols, tools, and procedures for data collection. Implement the evaluation plan.	September 2005

Goal #3: Build stable funding and support for program sustainability

Key Results:

- 12 COSEE and well-funded CCO with Executive Director
- Participation and substantial contributions from all agencies at all levels of government identified in the Ocean Commission Report as well as from foundations and ocean-related industry (\$15 million in annual support by FY08 from organizations such as NSF, ONR, NOAA, and National Aeronautics and Space Administration [NASA])
- The COSEE Network has national identity and visibility

Key Strategies:

- Encourage legislation to implement U.S. Commission on Ocean Policy recommendations
- Support Federal actions to establish interagency office for coordination of ocean education
- Cultivate prospective funders from all sectors (Federal, states, local, private foundations, business and industry, and Non-Governmental Organizations (NGOs); examples may include but are not limited to the following: United States Geological Survey (USGS), U.S. Department of Education, National Institute of Environmental Health Sciences (NIEHS), Environmental Protection Agency

(EPA), Department of Energy (DOE), National Ocean Industries Association (NOIA), Marine Technology Society (MTS), Exxon-Mobil, Boeing, Raytheon, the Ocean Engineering Society, Oceanering, Chevron/Texaco, and/or British Petroleum

- Develop and implement a comprehensive communication

- and marketing plan including branding
- Develop fundraising plan for COSEE Network targeting foundations, industries, NGOs, and/or other appropriate groups/organizations.

Action Plan (Next 12-18 Months):

Action/Deliverable*	Completion
17. Draft resolution from COSEE Network that ties its <i>Strategic Plan</i> to Ocean Research Advisory Panel (ORAP)/NOPP.	April 2005
18. Develop five-year business / network development plan. <ul style="list-style-type: none"> • Number of centers (build out) – what will Network look like in the future? • Geographic distribution • Thematic foci • Governance • Funding formula/mix • Budget projections 	July 2005
19. Work with key individuals to ensure ocean education is a priority and COSEE has a direct link to the new ocean policy governance structure.	October 2005
20. Develop and implement Legislative Strategies to inform Congress of the role COSEE can serve in implementing the <i>U.S. Ocean Action Plan</i> .	October 2005

* These Actions/Deliverables each have a COSEE Network Coordinator and will become part of subsequent Year Accomplishments.

The major accomplishments in which the COSEE Network have been and will continue to be involved in Year 3 include the following (note: many of these documents may be found at <www.cosee.net>):

- The NSF posted its second, Announcement of Opportunity in the fall 2004 with a March 2, 2005 due date;
- A national evaluation plan is currently being finalized and implemented;
- A **Draft Guide to Engaging Scientists and Educators** (posted on <www.cosee.net>);

- A Brochure, *Ocean Literacy: The Essential Principles of Ocean Sciences K-12*, (2005) has been produced by NOAA’s Office of Education and Sustainable Development, the College of Exploration, and the National Geographic Society;
- Professional development programs involving a positive paradigm shift emphasizing collaboration between K-12 teachers and scientists have and are being implemented annually within each COSEE;
- Enhanced partnerships with informal science centers, museums, and/or aquariums are occurring;



Fig. 8. Teachers and scientists “engaged” in studying plankton samples during a 2004 Summer Institute. Photo courtesy of COSEE:CGOM.



Fig. 9. Ecotourism and enhanced partnerships with informal science centers, museums, and aquariums are occurring within each COSEE. Photo courtesy of COSEE:CGOM.

- A diversity survey is being completed by all COSEE;
- These professional development programs have included annual “Teachers To Sea/Sea Scholars” aboard U.S. Navy-Oceanographic Survey Ships working “side by side” with Navy/civilian surveyors;



Fig. 10. Sea Scholars collecting sediment samples for analysis. Photo courtesy of COSEE:CGOM.

- The COSEE Executive Director position was advertised nationally; Dr. Susan Ganter will join the CCO as Network Director on August 1, 2005; and
- NSF will formally announce the results of the second COSEE competition in October-November 2005.

V. CONCLUSION

As indicated in a national survey by Belder, et al., (1999), the American public has only a superficial awareness of the importance of the ocean to their daily lives, much less its importance to all life on this watery planet. Therefore, in briefly re-reviewing COSEE’s evolution, the authors of this manuscript are of the opinion the COSEE Network has, over the last three years, become an enviable national success story in “bridging the gap” between formal and informal educators, scientists, and the general public concerning the relevance of the ocean to their everyday lives. Further, the COSEE are well-aligned and complement the 17 U.S. Commission on

Ocean Policy Report: *An Ocean Blueprint for the 21st Century* (2004), Part III, “Ocean Stewardship: The Importance of Education and Public Awareness,” and Chapter 8, “Promoting Lifelong Ocean Education,” (2004). However, these COSEE represent only a beginning. With sustained ocean sciences funding and proactive and focused collaborations, involving additional Centers throughout this country, our citizenry will become more aware and better understand the world’s ocean. All people need to be aware and understand the ocean drives global weather patterns; is essential for national security and defense; provides a variety of jobs; is critical to economic development; is a “sink” for carbon dioxide; is a source of food, medicine and energy; serves as an unequalled mechanism for transportation; affords humans with many recreational opportunities; conceals the Earth’s deepest canyons and highest mountains; and affords humankind an innate tranquility that it is directly tied to our survival as a species.

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