Classroom Exploration of the Oceans: Reaching Classrooms through Online Education Evaluation Report

Introduction

The *Classroom Exploration of the Oceans* (CEO) was sponsored and collaboratively organized by the National Geographic Society and its Education Foundation, The National Oceanographic and Atmospheric Administration's Office of Ocean Exploration, NOAA's Marine Sanctuaries and the College of Exploration (a not-for-profit education, technology, and research organization in Potomac Falls, VA).

The overall goals of the CEO series as quoted from the workshop web site were:

- To motivate and inspire educators to teach about the ocean and ocean exploration;
- To raise the level of ocean awareness among the education community and ultimately increase students' knowledge and understanding of oceans;
- To promote ocean-literacy and "Oceans for Life" in teachers, and ultimately students, through identifying ocean-related concepts, accessing related resources, and connecting content knowledge and understanding to learning standards;
- To provide an ocean-focused community of teachers, that includes the ability to network with colleagues, communicate with content experts, and gain access to a comprehensive list of ocean-related resources; and
- To promote professional well-being and sense of worth, and give teachers a "sense of stature" through their interaction with their colleagues and scientific experts (Tuddenham).

Further, upon completion of the CEO workshop series, teachers should be able to:

- Understand the importance of the oceans and ocean exploration;
- Apply the newly-acquired or reinforced foundation of ocean-related knowledge and materials to create and use lessons plans and engaging classroom activities;
- Incorporate information related to specific grade levels and standards and build lesson plans and/or integrate ocean-related material into existing curricula;
- Promote ocean-literacy to students through teaching ocean-related content, guiding them to student resources, engaging them in ocean exploration material, and, motivating them to pursue ocean-related interests;
- Use the workshop series and virtual teacher workshop website as a collegial network to share ideas, stories, and experiences, exchange lesson plans and teaching strategies, and seek out expert advice; and

- Know how and where to access ocean and ocean exploration resources, including archived keynotes and discussions, multimedia, Web links, books, and lesson plans (Tuddenham).

The CEO project was conceptualized and implemented as a series of nine, one-week workshops for teachers and informal educators featuring a keynote presentation of a nationally or internationally recognized ocean science researcher and curricular materials and lesson plans to assist participants with classroom infusion of workshop content and concepts. These presentations and materials have been and are being presented in an innovative and responsive distance learning environment implemented over the world wide web. Additionally, to further facilitate participants' post-workshop infusion activities, two instructional and resource CD-ROMs were created and/or provided to participants as they registered for the program. Finally, to better guide educators in curricular integration following participation, National Geographic developed a framework for ocean science literacy which was further provided to each participant.

On-line courses such as this provide a wonderful opportunity to delve into different areas of research within the field, to stay current with new discoveries, thoughts, and theories.

Response from teacher

An external evaluator was engaged to assist the College of Exploration with developing and implementing an assessment of the accomplishments of the CEO series, with particular attention to teacher learning in an online environment, and the potential of the CEO workshops to meaningfully engage these participants such that classroom infusion of ocean concepts and content is enhanced following participation. In this vein, a detailed and extensive survey was developed and administered to participants following the fifth week of the program—to contribute to formative evaluation of the program. This report analyzes and summarizes the survey results.

Participant Registration Information

Initial efforts to implement the CEO workshops included the establishment of a registration database by the College of Exploration. This process allowed, among other possibilities, for some analyses with respect to the audience recruited for participation, as well as participant intent for participation prior to engagement with the workshop.

Registration databases for the CEO workshops indicate a total registration of approximately 1,900 professionals (at the time this report was written), who demonstrated varying levels of participation from a low (registering and receiving the CDs and mailed materials) to a high (full participation, reading, posting comments, pursuing web links, and completing the survey). Of these 1,900 registrants, the majority were Caucasian and from the United States. The gender and age distributions are

reflected in Figures one and two. Participants were comprised from forty-eight U.S. states—all but North and South Dakota. By number of registrants, California followed by Florida were the home states of the most registrants. Registrants were further represented from fifty different countries, territories, or organizations including the Department of Defense Schools, Puerto Rico, Guam, American Samoa, Northern Marianas, and the U.S. Virgin Islands. Canada, England, and Australia were the largest non-U.S. sources of registrants in rank order.

As they registered, individuals were asked to identify anticipated level of participation. Of the total, 215 indicated an Audit Only level participation, with a range of from 1-3 sessions, to 4-6 sessions, or 7-8 sessions. A total of 498 individuals indicated they planned to audit all of the sessions. For those individuals selecting full participation, 570 indicated a range of from 1-3, 4-6, or 7-8 sessions, with 460 indicating they would fully participate in all of the sessions. As discussed elsewhere in this report, some difficulty arose with the definition of "full participation," as the narrative supports an interpretation that individuals could be highly engaged, but without posting questions or comments of their own. The need for further research in this area is discussed in the conclusions. In summary, it appears a number of individuals never intended to dialogue in the online community, preferring to individualize their workshop interactions through reading and/or obtaining materials.

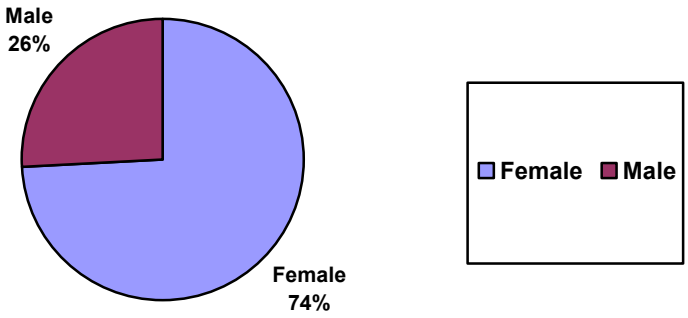

Figure 1. Distribution of registrants by gender—approximately 1,600 responses

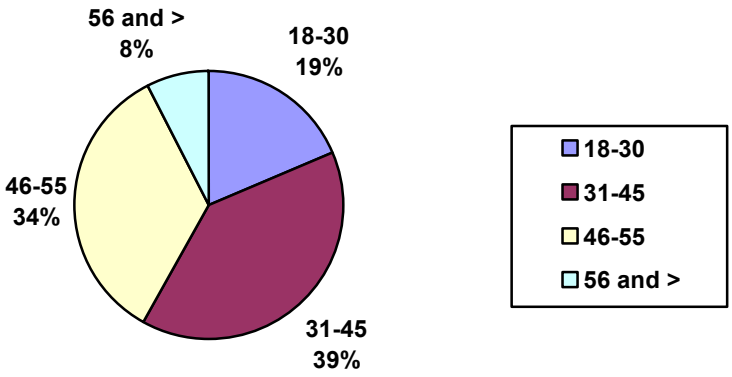

Figure 2. Distribution of registrants by age—approximately 1,500 responses

Figure three delineates the grade level distribution of the teaching responsibilities of these approximately 1,900 registrants. Classroom teachers or resource teachers accounted for 56% of the registrants, Other registrants included informal science education and/or higher education professionals. With respect to the geographic representation of the registrants, approximately 46% live further than one hundred miles from the ocean or Gulf of Mexico, and an additional 10% live from 51-100 miles from the ocean or Gulf of Mexico (Figure 4). This indicates the participants' activities in their respective classrooms could be a very significant source of knowledge about the oceans for their students, further augmenting the potential impact and importance of this mechanism for enhancing ocean sciences education nationally.

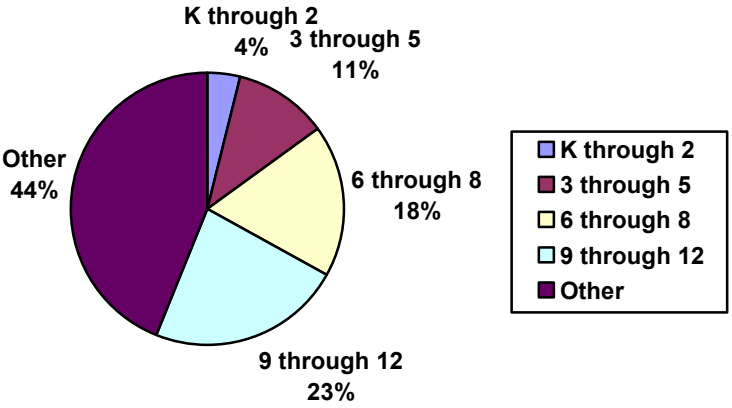

Figure 3. Teaching levels of registrants

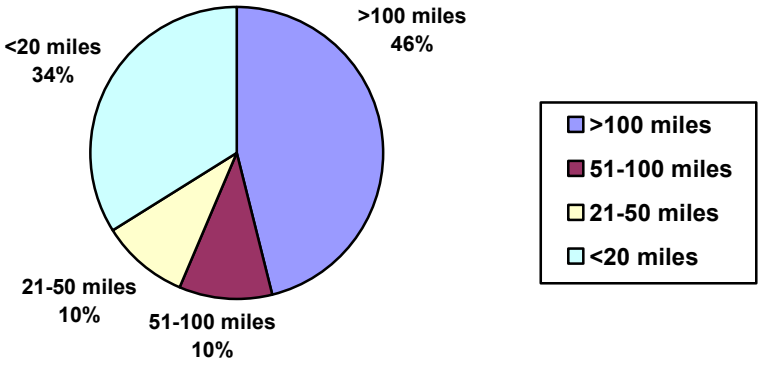

Figure 4. Miles which registrants live from the ocean

Evaluation Plan and Survey Results

The evaluation plan for the CEO project was multifaceted and designed to provide not only technical information for program improvement and planning purposes, but also to yield data for a broader understanding of learning in online environments. The evaluators utilized a survey which consisted of both selected response and open-ended items, along with content analyses of participant comments posted within the workshops. This survey was used both formatively and summatively, and was administered at the end of the fifth workshop. Additionally, one evaluator (Walters) participated as an observer in the first five workshops and obtained print copies of all of the narrative for analyses and comparisons. Further commentary was obtained from the students taking the CEO workshops for graduate credit and from questions posted by select individuals associated with the workshop funding partners, including the keynote presenters. The following analyses and narrative makes use of these sources where they provide enhanced understanding of the participant survey responses, overall perceptions, and learning.

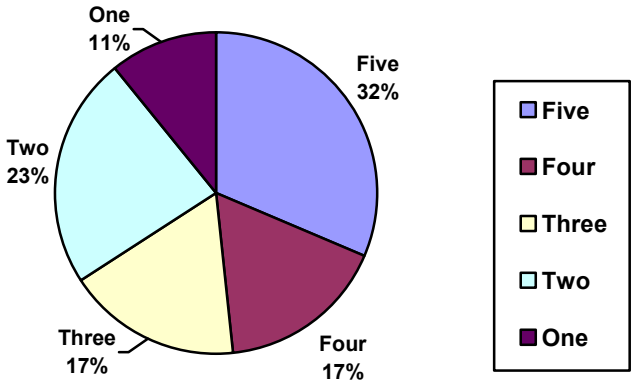

Figure 5. Number of CEO workshops in which respondents have engaged.

Respondents were queried with regard to the number of CEO workshops in which they participated. Figure five indicates the percentages of participation by numbers of workshops. Significant overlap occurs in constructing an image of which workshops were attended by the participants. Looking only at the first five workshops, in rank order participants engaged in:

1. Living Light in the Ocean (May)—82%
2. Importance of Ocean Exploration (April)—77%
3. Ocean Floor Mapping (July)—66%
4. Polar Seas (June)—64%
5. The Monitor and the Hunley (August)—52%

It appears from these data and comments provided by respondents regarding participation, that the summer months were problematic and had a negative impact on participation. One key element in this was access to the WWW through school computers. A number of respondents indicated personal, home technologies were not sufficient to allow access. Additionally, a number of the respondents indicated summer scheduling conflicts created difficulty in participation.

The primary participation rationale suggested by respondents was a personal interest in the ocean, followed by interest in online learning opportunities, relationship to courses taught, and interest in obtaining graduate credit. Of note, approximately ten percent of respondents participated because they had previous experience with a National Geographic/NOAA online workshop—suggesting National Geographic/NOAA has developed a teacher-constituency or "returning audience." The item generating these data allowed for overlapping responses. The rank order of participation for the leading six rationales based on numerical response rate is as follows:

1. Overall interest in the ocean
2. Interest in online learning opportunities
3. Relationship to professional responsibilities
4. Interest in obtaining graduate credit
5. Previous experience with a National Geographic online workshop
6. Request from a colleague or administrator

The College of Exploration uses a software delivery system (*Caucus*) which maximizes user control of the learning environment—a fact which emerges from narrative provided by respondents. Consequently, isolating the level of participation in the online workshops is difficult, as the technology allows for a high degree of individual choice in the level of engagement. Participants can "log in and out" of any specific workshop asynchronously during the week of delivery, without time constraints. Further, they can read only, or post commentary and ask questions to the keynote presentations or other participants' postings. One feature which emerges in later analyses is that participants are increasingly self-directing in how they engage with and structure the online learning experience—making it even more problematic in isolating particular engagement patterns for the group. Nevertheless, one approach to measuring participation is to use the

number of times users logged on during a week, and a self-perception item for level of engagement. Figure six indicates most respondents—68%—logged in to each workshop multiple times during each week; figure seven delineates the perception of the respondents of their actual participation versus anticipated participation. Follow-up questions to elicit rationales to explain discrepancies revealed in figure seven are summarized later.

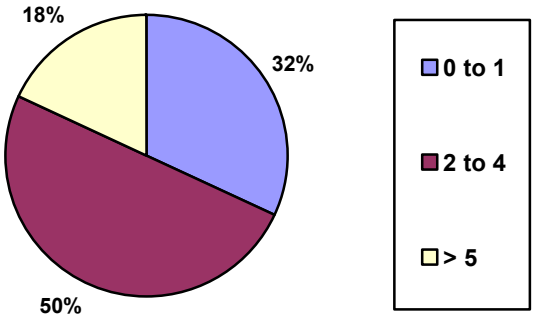

Figure 6. Respondents indicate a high percentage of engagement with more than one workshop in the CEO series.

This pattern of multiple-engagement is a strong indication of the perceived quality of the CEO workshop by participants, measured in terms of self-selection to participate. Most perception data are collected as an overall evaluation of the quality of the professional development experience on equal interval scales of ascribed value. Consequently, through self-choice, respondents enhance the credibility of a conclusion of high perceived value of the CEO workshops—as their decision could have been to disengage.

Thank you for all your work in organizing this program. It is wonderful to have an online community of science educators to bounce ideas off and receive feedback on your ideas from.

Response from Teacher

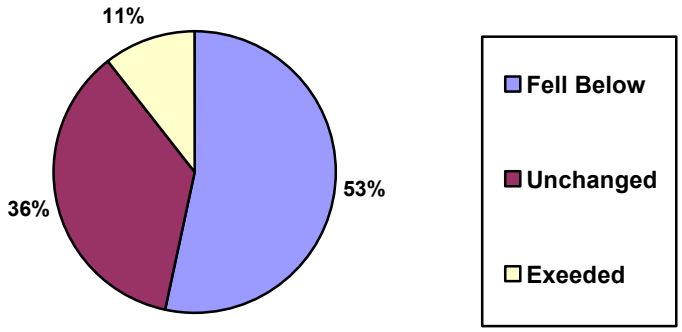

Figure 7. Deviation of actual participation levels to anticipated participation levels.

Slightly more than half of respondents indicated they were unable to participate in the CEO workshops at the level they intended to participate when they registered for the workshop. A follow-up question queried respondents as to reasons for the discrepancy between anticipated and actual participation, which is summarized in Figure 8.

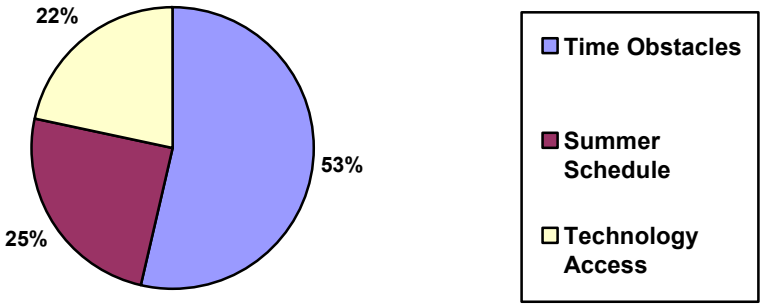

Figure 8. Respondent explanations for deviation in planned versus actual participation.

The primary reason respondents participated less than anticipated was the time constraint. Based on the narrative responses, time constraints can be viewed under two orientations: participants' personal and professional lives were too busy to allow additional time to be devoted to the workshop, and the one week format for each workshop—which was more accurately a Sunday through Friday experience—precluded respondents from more fully engaging. With respect to the first factor, time for professional development is one of the most frequently cited explanations for why teachers do not participate. With the second factor—the one week time frame—after the first week, the College of Exploration facilitators began archiving keynote presentations and opening past workshops for continued exploration and use. This appears to have been an effective response to assist the time issue, based on participant use discussed in this report on p. 25.

A second, time-related issue was the differentiated schedules of educators over the summer months. The traditional nine month teaching contract period has resulted in a significant life-style change for classroom teachers in June, July, and August.

Consequently, both narrative data and log-in tracking indicate participation in the summer months lagged considerably behind the April and May months. Statistically significant differences were observed in workshop participation by month—indicating the narrative comments relating to summer participation are credible.

The third explanation for actual and anticipated participation is related to technology access, and was also observed in the assessment of the previous, *Sustainable Seas Expedition* online workshop in 2000. Teachers report that they rely on school-based technology to access the online workshop as opposed to home computers. This became a compounded challenge for summer workshop participation beyond the previously noted summer scheduling issues.

In terms of overall perceptions of the workshop, participants were overwhelmingly positive about the value of the CEO series. Figures nine through thirteen summarize related survey items to describe this picture.

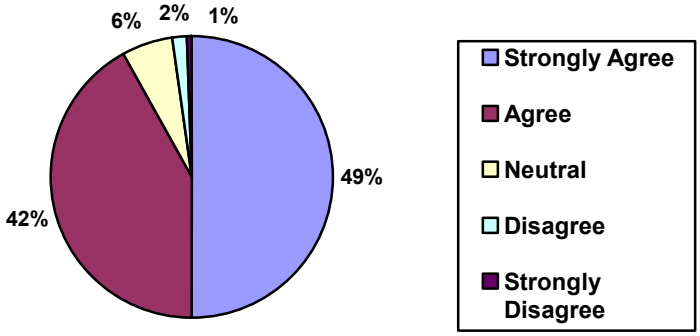

Figure 9. Respondents agreed all aspects of the CEO series were positive experiences at a 91% level.

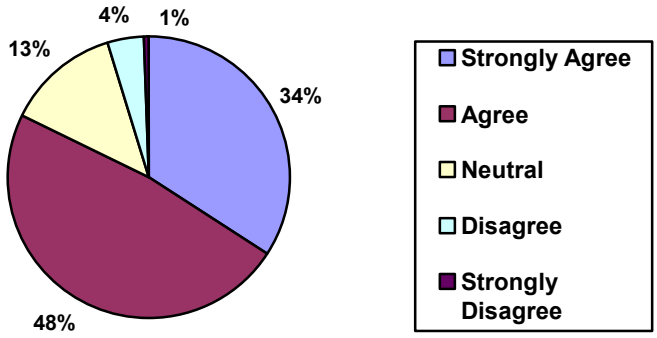

Figure 10. Respondents Strongly Agreed and Agreed (82%) that directions for participation in the CEO workshop were clear.

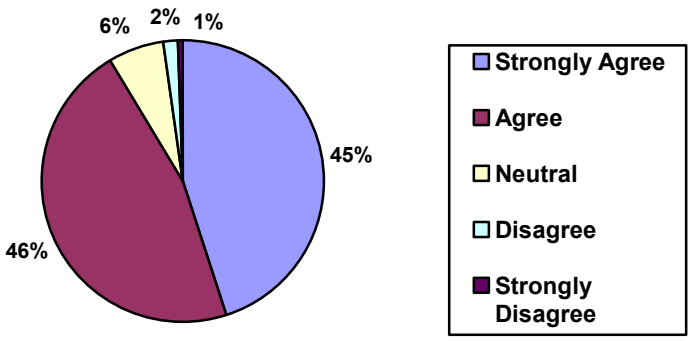

Figure 11. Respondents Strongly Agreed and Agreed (91%) that the organization of the workshop was done well.

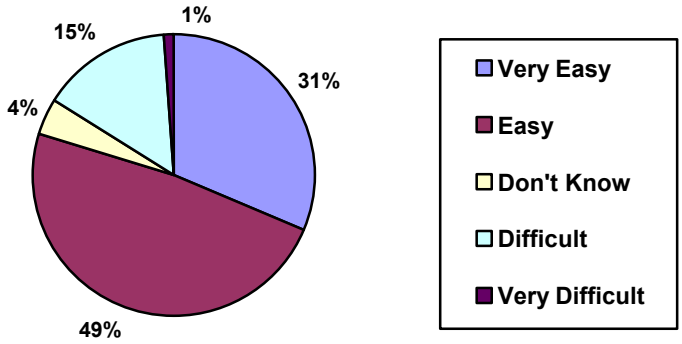

Figure 12. Respondents rated the overall navigability of the CEO workshop web site as 80% Very Easy and Easy.

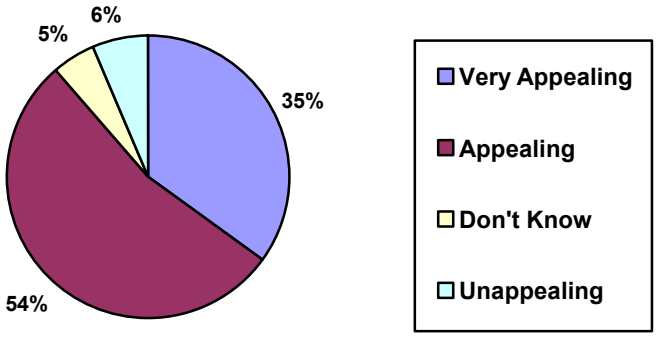

Figure 13. Respondents rated the overall visual look and feel of the CEO workshop series as 89% Very Appealing and Appealing.

Taken as a whole, it seems the participants viewed the quality of the CEO series highly positively from a technical and instructional sense. Respondents were asked to provide input on improving the layout, organization, or visual elements of the online workshop, notwithstanding the strong positive evaluation of these elements. Analyses of the narrative provided for this item reveals a number of individuals were "first time" participants in an online experience. A number of responses highlighted the learning

curve in technology skills which would be unrelated to the implementation of the workshop. This correlates to nearly ten percent of the respondents who indicated elsewhere that their own technology skills were deficient, resulting in difficulty managing the experience. Further, as revealed earlier, participant access to hardware and adequate connection to the internet seemed to be a significant reason why these issues continued to surface in the suggestions for improvement.

On a constructive note, several comments did seem to focus in the group of responses. First, there seems to be a perspective that the sheer amount of links and pathways within the CEO workshop was overwhelmingly beyond what was necessary or expected. This seems to have further created a navigational problem for a number of individuals. Some struggled with following commentary and responses, feeling that the links between related science content or conversations were not clear enough. A few respondents shared prior experiences with other online management software systems. Nevertheless, it did not negatively impact the overall perception of the value of the learning experience—in fact, numerous positive comments were observed with respect to the wealth and quantity of resources and links. Additionally, these comments with respect to time, in another analysis presented in the *Themes for Further Research* section of this report, are a strong factor highlighting the individualized structuring of the learning environment evidenced among participants.

Several comments indicate that the online managers were cognizant of participant responses throughout the series of workshops and were actively managing and revising the online environment while the workshops were "underway." Select narrative here includes: "the organization has been getting better with time…I felt the whole set up was great, I did notice adjustments as the workshop progressed." This responsiveness of personnel managing an online space would be very critical in this type of learning program, where the virtual environment "moves" in response to participant interest and conversation, and cannot be predicted prior to implementing a program.

One other significant focus is observed in these narrative sections—again, participants are expressing time challenges in being able to keep up with both the pace and breadth of this CEO series, and technology access issues due to limitations in technology capability on the participant "end." Several respondents mention the one week "window" even though this was not solicited in the item.

When solicited specifically regarding personal technology skills necessary for participation, respondents were somewhat more positive in self-assessment than were the respondents to the survey for the *Sustainable Seas Expedition* workshop. Figure fourteen reflects the breakout of responses, and reveals a continued hesitancy in claiming competence for their own technology skills.

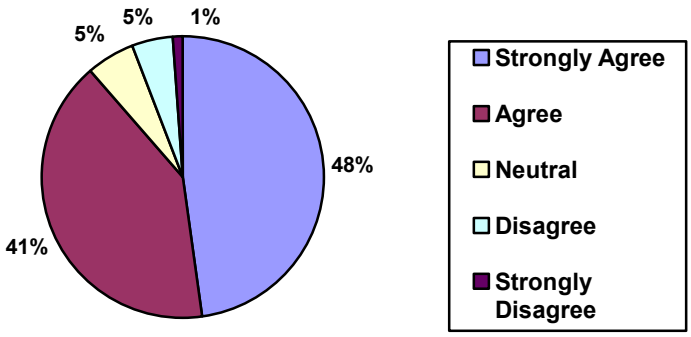

Figure 14. Respondents indicated (89%) strong agreement or agreement that they possessed the technology knowledge-base or skills required to effectively participate in CEO.

The two critical dimensions of this CEO workshop series were increasing participants awareness of ocean science content and, following workshop participation, increasing the infusion of ocean sciences content and concepts in the participants' classrooms. Figures fifteen and sixteen are strong with respect to the self-reported perceptions of participants on these dimensions. These are very similar to participant self-reported figures for other regional and national educational projects.

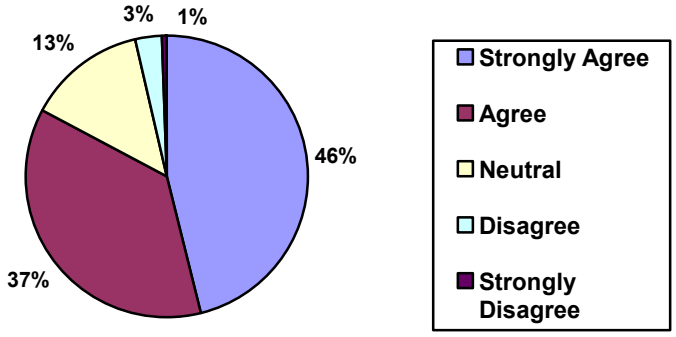

Figure 15. Approximately 83% of respondents indicate an enhanced understanding of ocean science content following participation in the workshops.

Infusion of Materials into Classroom Instruction

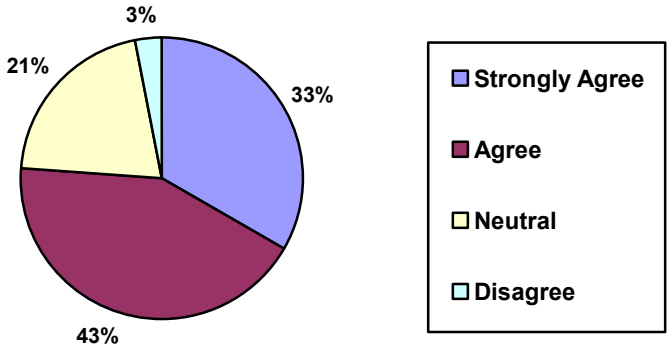

Figure 16. Respondents Strongly Agree and Agree (76%) that they will increase infusion of ocean science content in their classroom instruction as a result of participating in the CEO workshops.

With respect to this last item (Figure 16) respondents were queried to provide examples of how they intended to integrate the knowledge gained from CEO into their classroom teaching. A number of patterns emerge in these responses which illustrate a powerful impact of participation in the provision of both tools for classroom use, and enhanced content knowledge on the part of the teachers.

First, a number of the comments centered on the high quality and usability of the funding groups' CD-ROMs which were mailed to the participants after they registered. Comments specifically pointed to the video clips, digital images/photos, and the lesson plans and content information. Select narrative from respondents includes:

> *Information from the various researchers gave me ideas for activities to use in my classroom. Videos from the CDs were a wonderful addition for introduction sections of my lessons….my students love the videos on the CDs…the CDs we received have many wonderful pictures and sights to get the students' minds working and thinking…The CD-ROM is full of good resources to use and share with my students. I will try and incorporate as much of this information in my Oceanography classes where appropriate….I found your CD very enlightening and useful.*

One respondent observed, "The CD materials have already lead to my purchase of the NOAA CD of bathymetric charts of the US East Coast for incorporation into Topographic mapping lessons. I have only scratched the surface of used for this material!

An additional use of the CDs is revealed in a number of other responses, illustrating the "teacher multiplier effect" in the CEO series:

I will attempt to promote the use of the resources available during teacher workshops….I've passed CEO on to colleagues and classroom teachers as a resource….I also have shared this with my colleagues and will spread the word to other teachers as well….I requested copies of the Oceans of Life Brochure you sent out so that I can distribute.

A second pattern for infusion of CEO content and/or materials—beyond direct application of the CDs—is revealed in the enhanced content knowledge of teachers augmenting their capability to provide factual and relevant science content in classroom activities, with direct references to ongoing science research and "real scientists." Select responses highlighting this observation include:

This workshop is keeping me connected to science. As to integrating this new knowledge into my classrooms…this workshop is giving me more to work with….I like the added details from the scientists—they give new perspectives on things that I learned in the past, and I look forward to using their insights in my lessons….As a result of taking this workshop my students will be exposed to more ocean technology, research, and exploration than ever before. I am a marine biology person at heart but this workshop has exposed me to new fields and work being done. My students will truly benefit from this experience. I intend to integrate more ocean studies during the entire school year rather than only three weeks. I plan to keep studying this information, reading and looking at the information that has been mailed (such as Oceans of Life and the CD-ROM)…

Respondents were queried with respect to personal benefits they received from participation in the CEO program. The most significant numbers of responses seemed to cluster in three areas. First, respondents indicated the CEO series resulted in an enhanced content knowledge and understanding of the oceans. Second, respondents indicated the CEO series provided tangible resource materials for use in their classroom instruction, i.e. lesson plans, videos, the CDs, web links, student materials for both online and offline use. Finally, respondents indicated a primary benefit of the CEO series was the opportunity to network and interact with both peers and scientists. While these first two clusters are somewhat intuitive, the third cluster—interactivity and networking—highlight an important observation regarding this online program. While the participants are physically separated and interacting only in virtual reality, there is a strong connectivity among those who are most active such that they perceive and respond to group dynamics, social connections and interactivity, and social hierarchical structures in the online space, i.e. there is a distinct

Benefits Reported by Participants

1. *Enhanced content knowledge and understanding of the oceans.*
2. *Resource materials for classroom instruction.*
3. *Opportunities to network with scientists and peers in a learning environment.*

interactivity with experts (scientists) which is distinct from interactivity with peers—although positive in both aspects. The scientists, presenters, and resource educators are viewed as expert, and interaction with these individuals reinforces the perceived value, accuracy, credibility, and/or authority of the information. Interactions with peers results in a reinforcement of the perceived importance of infusion of ocean sciences content—somewhat of a validation of personal choices to not only participate in the workshop, but to plan on infusing the content in teaching after the fact. The observation of an authentic social experience was noted in the earlier Sustainable Seas Expedition, and is further evidence of the evolution of quality in these online experiences.

The next six items in the survey queried participants with respect to barriers and challenges to participation in the CEO series. Three specific items were posed to respondents as anticipated barriers based on previous program evaluation experiences: information about the program, time to meet participation needs, and technology barriers. Information about the course and technology barriers were perceived by a small proportion of respondents, from 7.3-9.6%. Time was a significant barrier as measured with this item, correlating positively with narrative provided by respondents on earlier items. Figure seventeen delineates the responses to this item.

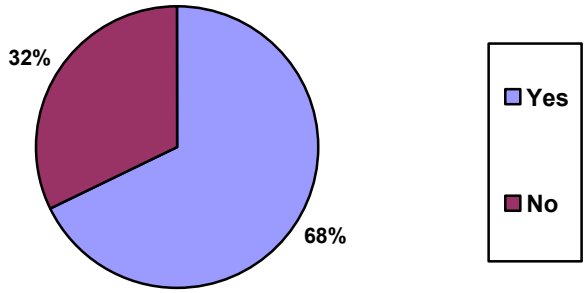

Figure 17. Of 188 responses, 68% or 127 respondents indicated time was a significant challenge to participation with respect to both professional and personal obligations, and the breadth of materials presented in the workshop.

Within this same section, an item was presented to again solicit the match between expected outcomes from participation in the CEO program and actual outcomes. Nearly 84% of respondents Strongly Disagreed or Disagreed with the statement "the workshop did not meet my expectations." Finally, an item soliciting other potential barriers to participation failed to identify other noteworthy barriers from respondents.

A final item in this survey section solicited narrative for the most significant criticism of the CEO experience. The most significant recurring critique was again, time to participate fully. This was observed both in relation to personal and professional obligations of participants, and with respect to the quantity of materials and links provided in each workshop. From prior teacher learning research, teachers tend to be oriented to "mastery of material" when they engage with a workshop or course—and it

may not be clear to participants from the beginning that they will be confronted with a scope of material that—due to the nature of the internet—cannot be encompassed. An interesting further observation will be discussed later related to this fact: when confronted with a pool of available learning opportunities beyond what time allows, how did participants structure their own learning environments through choices?

Other criticisms which surfaced related to the learning curve of an online workshop and its related technology skills. While only nine respondents expressed criticism of the format and structure—most of these criticisms were matched with observations that "it got easier as I learned what to do." Consequently, these criticisms are viewed as an inherent component of the tension and hesitancy of learning in new environments. With respect to this idea, a follow-on item isolated the percentages of survey respondents in CEO who had earlier participated in either the *Coral Reef* or *Sustainable Seas Expedition* online workshops. These data reflect only 13.3% of current CEO participants had any past experience with these other two workshops—but that the number of participants in the *Coral Reef* workshop exceeded the number in the Sustainable Seas workshop. The time series of the three workshops (*SSE*, *Coral Reef*, CEO) may reveal a trend that there is a growing population of teachers who utilize National Geographic/NOAA and online workshops as primary sources of ocean science education, which would support an interpretation that the *Oceans of Life* curricular framework—to the degree it is adopted by these educators—can assume increasing importance in the ocean sciences education community.

Of the respondents who did participate in the *Coral Reef* workshop, queries to compare the two programs reveal a more positive usability rating for the CEO series. Narrative suggests the navigability, links, and overall organization of CEO workshops proved more "user friendly." It should be noted, however, that such comments should be contextualized with increasing experience in participating in online learning among the respondents. It would be impossible, given the present survey, to know whether an authentic improvement in the implementation of the online workshop was made, or whether the respondents have simply learned how to better manage and navigate an online program. Nevertheless, with respect to quality of presentation and participation, numerous responses reflected these statements:

> *Even with the few glitches, the quality of the presentations, the presence of such experts for interaction make the quality of these online classes far exceed those of other programs I have been a part of…I am learning so much and sharing with others information gathered here to hopefully make a difference with present and future generations…It is here again that we can learn that one day one person at a time can indeed make a difference and there are many out there that feel the same, and it is a course such as this that pulls people together to do just that….*

Further, while the queries with respect to the previous *Coral Reef* workshop cannot be extrapolated to the potential results of the CEO workshop, of the twenty-eight people who took the *Coral Reef* workshop and provided responses to the CEO survey, figure eighteen indicates that 82% of these individuals are actively incorporating materials and

lesson plans from the *Coral Reef* workshop in their classroom instruction. This documentation is one of the few quantitative measures of post-program infusion of content and activities in the ocean sciences education community available, and is strong support for the potential and successes of previous and current National Geographic online programming.

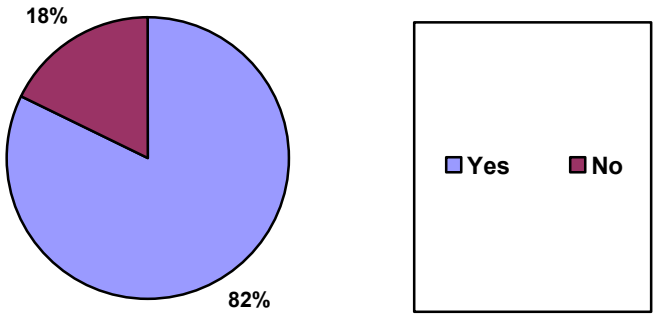

Figure 18. Of the CEO respondents who participated in the previous *Coral Reef* online workshop, 82% are currently implementing materials acquired in that previous workshop in their classrooms.

Use of CD ROMs

Respondents were queried with regard to two CD ROMs which were provided to them both to supplement the CEO online series and to further engage and support teachers in classroom instruction. The CEO CD and the Ocean Explorer CD were delineated separately within the survey to allow disaggregation of the results. For each CD, respondents were solicited as to whether they had received it, with approximately 87% affirming they had received the CEO CD, and slightly less than 80% receiving the Ocean Explorer CD.

Specific to the CEO CD, the narrative was clearly influenced by the time limitations previously identified in the assessment. Approximately one third of the responses (52 out of 134) related to the respondent intending to view the CD when time allowed, but given the "end of school year" and summer issues, this group of individuals were unable to evaluate the quality and usability of the material. Of those individuals who had already reviewed and used the CD—and this was a fairly significant number (82 out of the 134 total responses)—there was a uniformly and strongly positive response to the quality and usability of this CD. The most mentioned aspect of the CD in terms of usability and quality was the video clips and segments featuring scientists. Three negative comments related to grade level appropriateness from teachers of very young children, and four comments related to insufficient technology capability to run the CD. Of the positive comments relating to the CEO CD, the following quotes are typical:

> *The CEO CD-ROM will be a great resource in both science and social studies classes. I will use the interviews, video clips, and photographs both to "hook" students and to provide information—for those whose preferred learning method*

is verbal, hearing an interview rather than having to read it will be extremely helpful. Watching video clips brings whatever they are studying to life for middle school students….

Respondents were asked to rate the usability of the CEO CD for classroom preparation and instruction on a scale from one to ten, with ten being "most usable, as compared to other similar materials with which the teacher was familiar. Of 117 responses, the mean response was 7.78—significantly above the average of 5.5. Only approximately 14% of responses were below the average. It is not possible to match these lower responses to the negative narrative commentary—but it could be inferred some of these lower responses are from teachers who have not reviewed the CD (only 82 prior respondents indicated they had reviewed the CD, but 117 respondents have completed the rating scale.)

Similarly, the respondents were queried with regard to the Ocean Explorer CD and lesson plans with which they were provided. In terms of overall usability in the classroom on the same one-to-10 scale described previously, this CD had a slightly higher mean score rating from respondents (8.0). A much larger proportion of the respondents, over 50%, had not had time to review of use the CD. Nevertheless, the narrative with regard to the CD from those who had used it and/or the lesson plans specifically, was highly positive—although qualified by a number of responses as being more difficult, challenging, and for older students than the CEO CD. With respect to the CD and lesson plans, select narrative included:

All the lesson plans are valuable because they can be modified to suit the purpose/lesson being taught even if the content of the lesson is not exactly what is needed….I like the real data, situations, and places used…the national standards application is quite usable….each lesson builds on the previous and I only wish I had them earlier in the school year—I will use them more this [next] year.

As with the narrative describing the CEO CD, the Ocean Explorer CD is perceived as having valuable and credible science content in a highly engaging format. Narrative suggests respondents are actively reviewing, as time allows, the CD materials with a view toward further infusion in classrooms. Based on the use of the Coral Reef workshop materials as previously indicated, it seems likely there will be a lasting impact of both the online series and the CD materials provided to reach students in the classrooms represented by these teachers.

Use of the *Oceans of Life* Brochure

Respondents were queried with respect to the Oceans of Life brochure they were provided. Interestingly, the responses were as positive, or more so, than the assessment of the CD ROMs, as described by the narrative data, but for different reasons. While the CDs were viewed as classroom/student focused materials, there was a strong perspective that the Oceans of Life brochure was a helpful tool for teachers to make planning

decisions and to guide subsequent development, sequencing, and pacing of instruction over a broad array of situations. Select narrative regarding this focus includes:

> *A good data source, I am passing it out to the Geography department…I like the simplicity of the six essentials…the matrix seems to be a very useful jumping off place when developing a core question for a unit of study. As a new teacher I feel that I often fall into a trap of overcomplicating lessons—I will use this matrix to better focus my goals for my students….I like how the geography standards are so clearly mapped out. I have shared this with my pre-service education students as a model of good curriculum design…I will keep this in my lesson plan book to guide my teaching from now on.*

Use of the National Geographic Web Site Usage

Respondents were asked to assess the overall usability of a web page which National Geographic developed to support the infusion of ocean science content and activities in classroom instruction. Figure nineteen indicates a high use of this web site by the respondents.

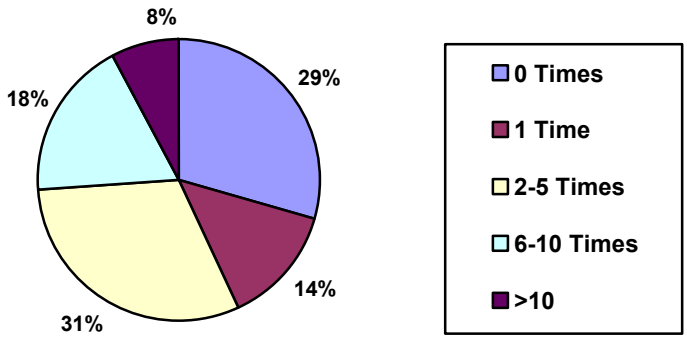

Figure 19. 71% of survey respondents who stated their level of use of the web site indicated some level of return use of the National Geographic web site developed for ocean science content.

On the one-to-ten anchor scale used previously, the respondents' mean score was 7.09, again significantly above average. Importantly, in a second question in this section, respondents were asked to compare the National Geographic web site to other web sites they had used. The mean score response for this item rises to 8.24—indicating that for web-savvy teachers (defined by the multiple-use finding in figure nineteen) the National Geographic site is viewed strongly positive in usability for the classroom. In a follow-up item, no significant cluster of comments was observed with respect to additional materials or content the users would like to see added to the site.

Generalized Analyses of Respondent Perceptions

Two final items were provided respondents with respect to the overall assessment of the CEO workshop series—likelihood of participation in another similar workshop and an open-ended commentary item. Figure 20 represents the overwhelming number of responses indicating participants were likely to participate in other online programs if they were offered—indicating the growth trend observed in online programs is likely to continue positively.

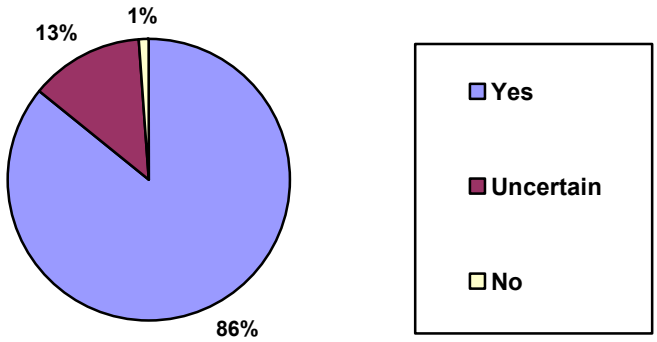

Figure 20. Likelihood that respondents will participate in further online workshops offered through or by the CEO partners.

The open-ended responses were reiterations of both the negative and positive narrative provided and summarized previously on the survey as described previously in this report. It is noteworthy that, as this was the final survey question and thus more likely to illicit the strongest view of each respondent, it is noteworthy that almost all of the negative commentary dropped from respondent narrative. This seems indicative that the strongest perception of respondents was highly positive. Of the positive comments expressed, the following quotes reflect not only the positive view of the respondent, but are illustrative of the rationale behind the perception:

> *This course is incredibly interesting and it is an honor to be able to participate with so many fascinating people. I feel that the information I have gained so far will enhance my teaching in the future. Perhaps even more important, I am beginning to understand the ocean and can "think" about the new information with more insight and understanding. I hope to pass this knowledge and enthusiasm on to my students.*

> *The feedback from Francesca Cava has been extremely helpful throughout the course. You really know someone is reading the responses to the credit requirements. I also appreciate the flexibility built into the course. I have a hard time reading the keynotes from my monitor so I always read from a printable version. Thanks for realizing that offline learners are putting in the time to fulfill the requirements.*

I must comment on the surprise I had when I signed up for this "free" course only to discover that it is of extremely high caliber in the educational value, the truly spectacular keynote speakers, and the resources. I did not at all expect such an advanced course to be offered for free.

I have taken an online course before this and quite frankly, I did not want to participate in your program because of the bad experience I had with this previous online course. I quickly changed my mind after only the first week. This course was not only extremely informative on science but also worked around teaching schedules. The articles were always totally fascinating and being able to "talk" with the people who wrote those articles was such an honor.

Perception of Online Learning for Graduate Credit

To obtain a better picture of the participants' views of online learning, Dr. Virginia Little examined responses to questions required for graduate credit. She compiled, analyzed, and summarized data gathered from participants in the third workshop of the series. The data were gathered from a sampling of 70 archived responses to Workshop Three, question of the week, reflections posted from June 23-27, 2003. Participants were primarily K-12 in-service teachers, but included some pre-service teachers, and some "others," such as librarians or health care workers. As science teachers and as online students, experience ranged from beginning to advanced levels. Online courses were taken for the purposes of graduate study and/or personal and professional development. Most participants appeared to need certification credits to maintain active status; others were involved primarily for their own growth as educators.

Facilitators asked participants to respond to the following:

The use of the Internet as an emerging resource is dramatically impacting our access and use of teacher resources. Discuss what you believe to be the pros and cons of the Internet as: a) a teaching tool, b) a professional development tool for educators. Participants were also asked "How did you feel about the online process and/or environment?"

All answers were reviewed and coded for emergent themes and patterns, as identified by the researcher (Little). Samples were clustered and significant quotes representing generalized group consensus extracted and organized for the purposes of this report.

Evaluation of the Internet as a Learning Tool by Graduate Students

The most frequently cited positive use of the Internet identified by the participants was the ability to connect to additional resources often not otherwise available. These resources included:

- Connection and communication with experts and educators from diverse backgrounds and experiences but with similar interest in the field of oceanography.

- Immediate access to current and updated information sources. Broadened range of ideas from varied participants, both students and guest lecturers, and also an environment conducive to teachers and students as co-learners.

Other positive aspects included: convenience of access to knowledge not otherwise readily available including students in rural locations, the defrayed costs of learning online, individual time and needs flexibility, useful classroom links to online sites. Online education motivates learners because it is "new, exciting, cool, and current." It is the "way" of the future.

From a critical perspective, teachers and students expressed being overwhelmed by the volume and scope of information discovered online. There is a perceived gap between the quantity of information and the quality, veracity and accuracy of information. The question becomes: How do we learn to process, comprehend, and apply this information, and in turn, how do we teach students to do the same? Critical thinking, reading with a discerning eye and a questioning mind, time management skills, and self-motivation are all necessary to become proficient online learners.

Using technology is often time intensive and requires careful planning and organization on the part of the teacher. Technical glitches contribute to frustration and difficulty. There is not equal access or equipment for all schools, classrooms, or students. Technology is expensive. Connecting to the Internet, upgrading equipment, teacher professional development in the use of technology, the constant upward learning curve—all contribute to differentials in who benefits including how and why—and who does not.

Finally, a few respondents suggest the depth of learning online may not equal that of real time courses. Pedagogical approach is a key factor to catalyze student interest and achievement levels. Distinctions should be made between distance and online learning models. Online communication can lack physical qualifiers, be disembodied, and may not catalyze energy like "face to face" connections. A new literacy is being formed requiring highly specialized reading, thinking and technology skills. It should be noted, in the overall survey of the CEO workshop—respondents were generally of the opinion that the design, both technically and instructionally, of the CEO workshop series substantively overcame these potential barriers to online learning. Consequently, it seems likely the source of these barriers is in prior experiences of these graduate students—which would likely be in more traditionally, course-oriented settings using commercial course-ware which is frequently viewed negatively as one respondent did here.

Perceptions of Workshop Presenters

A survey was prepared and disseminated to the workshop keynote presenters to collect

feedback with respect to their perspectives on the CEO program. While this was only a small group of individuals, collectively a few consensus points seem to focus in their replies. First, there is a clear consensus that the workshop series was a strong, interactive learning experience. One presenter commented that the experience was not much different than a face-to-face encounter, except that the discussions were more concise and focused. This idea was mirrored by several other presenters: the time to respond allowed them to formulate a reply that was targeted and on topic. The range of time allocated or required to maintain the flow of information during the week was from slightly less than an hour to several hours daily. This seems quite beyond the typical time allocated in a real conference experience, where participants and speakers generally are required to move on to other events.

With respect to preparation for participating as presenters, a clear consensus that the online format requires more lead time, for a variety of reasons including technological, formatting, and the nature of discussion-through-print. One presenter indicated a group of peers had reviewed his/her presentation to very positive comments. An additional presenter indicated some further, professional use would come of the effort and product of presenting. Several presenters noted an overall positive perception of the experience and a desire to participate again.

Conclusions

As noted previously, the response rate for the CEO survey was substantive, suggesting the observations and evaluative comments made by these individuals could be generalized accurately to the broader group of educators who participated, with two caveats. First, the level of participation in the workshop series will delimit the potential benefits to the participant, and the pool of science content and resources from which they can draw for classroom infusion. Second, there is some relationship between an overall positive view of a learning experience and the degree of participation to include completion of the evaluation instrument; however, this may have been counterbalanced by the credit students who were required to complete the survey. Consequently, little is known from this assessment whether other, more negative views of the learning experience may have been perceived by those who did not fully engage with the workshop or the evaluation instrument.

Nevertheless, from the narrative and quantitative responses provided by the respondents, there is a highly positive sense of value associated with the CEO workshop and the supplemental electronic and print materials development and provided with the workshop. There is a further, highly positive opinion with regard to the technical quality of the CEO workshop in design and usability—and particularly with the attentiveness of the technical managers of this online program to monitor and respond to user comments and suggestions features of the programming or presentation.

It seems, however, the strongest thread to be identified in the evaluation is the

observation that increasing numbers of teachers are looking to the CEO partners for education and curricular support to infuse ocean science content and activities into the broader K-12 curriculum in the United States. Further, as these teachers engage with online learning, they are highly likely to return for subsequent online programs, to follow up the online program with continued, personal interactions with colleagues met "online," to seek out and purchase print materials and resources first identified online, and to infuse their classroom instruction with additional quantity and quality of ocean science teaching. These teachers perceive and have expressed that the CEO series was a highly sophisticated social experience directly related to their professional learning needs as K-12 and informal educators and provided access to high quality electronic and print curriculum and lesson plans.

Finally, evidence now exists that previous online workshops (primarily the *Coral Reef* program) continue to result in infused ocean sciences content and activities in the classrooms of those former participants. This suggests the agencies which funded CEO are effectively linking oceanography and geography in conceptually meaningful curriculum and materials to directly reach students in classrooms through their teachers. From this survey, it appears National Geographic/NOAA and "online learning" are increasingly viewed by teachers as the primary source and mechanism, respectively, for ocean education nationally.

Themes for Further Research

Two, noteworthy themes emerged through analyses of the narrative comments in the survey: individualized structuring of the learning experience, and development of a social community. First, through a combination of time constraints and a relatively endless quantity of material to access via the world wide web, the survey respondents demonstrate a high degree of self-directedness in structuring their individual learning environments. This capacity appears highly related to the technical approach, facilitation, and software used by the College of Exploration to organize and manage the instructional platform. Narrative reflecting this individualizing trend among respondents/participants includes:

> *There were so many questions asked in response to the lectures that it seemed appropriate to read all of the lecturer's responses…rather than to start a conversation….there was so much to learn—every site lead me to other sites. There is such a wealth of information that it requires so much time…much of it I printed and read later….I spent more time surfing the links that were provided.*
>
> *I read all of the information from the keynotes and workshops, but did not have time to participate…I wanted to participate in the interactive chats and questions, and access the lesson plans more.*
>
> *Everything is so interesting that I like to go back and get more information and check my own understanding. I also like to go back to get information to share*

with others.

I print copies of all the talks and responses and use the resources as much as I can. So, I guess that I am participating in my own way, but not in the way the course is set up.

This course, unlike any other I have been involved with, has provided such rapid feedback and so much interaction amongst the students that I definitely feel like I am part of a virtual classroom.

These select citations from the narrative illustrate a range of involvement from reading only, to printing and reading offline, to cursory reading of keynotes and discussion—but significant "surfing" of links which were provided by the keynote speakers or in the CEO environment. The capability of the WWW to immerse workshop participants in an open-ended network of resource materials, lesson plans, content presentations, discussion groups, and seemingly limitless links—while producing some negative response based on time constraints—is clearly supporting individualized learning. The management system used in the CEO allowed the learners to freely navigate to materials of greatest interest, to participate at a personal comfort level (from fully interactive to read only), and to navigate "out" of the workshop to other related information if they chose this approach. The dynamic nature of this learning environment seems substantively different from typical, web-based courses reported in the literature, and may be associated to the very positive reactions of the survey respondents, as well as the observed trend of returning participants. Further, adult learning literature suggests that self-directedness is one of the dominant characteristics of authentic adult learning (Knowles, 1980a; Knowles, 1980b; Merriam and Cunningham, 1989). Consequently, the observation within the survey data that participants are engaging in intentional structuring and restructuring of the learning environment—and that the software system is supportive of this—is perhaps essential support that the CEO workshop is contributing to learning in a meaningful and durable way. Finally, this observation is clarified in the data from respondents who were also participants in the previous *Coral Reef* workshop and who have indicated they continue to infuse their current classroom practice with content and activities acquired in 2002 in that online workshop.

A second theme observed within the narrative data was similarly observed in the evaluation of the *Sustainable Seas Expedition* online workshop: the occurrence of social connectivity among participants, i.e. the development of a cohesive community of learners which seems to transcend the electronic, virtual and individualistic nature of a web-based experience. To follow this theme, evaluators identified narrative and vocabulary usage which supported social connectivity among participants and/or presenters. Select narrative which illustrates this theme includes:

I found this course very enjoyable with all the help and opportunities for discussion with keynote speakers.

I have enjoyed the interaction with the other participants and organizers…I

appreciate the concern and contact shown when questions arose…

Excellent selection of keynote speakers, very engaging and knowledgeable.

I really look forward to the classes. I like being able to read what others have written because sometimes their comments or experiences help me better understand some of the presentations that are totally new to me.

It is wonderful to have an online community of science educators to bounce ideas off and receive feedback on your ideas from.

The articles were always totally fascinating and being able to talk with the people who wrote those articles was such an honor.

This has been a wonderful workshop—I have learned so much and made so many contacts.

My benefits came from not only learning and exploring so much more about the oceans but also in the interactions with other members and instructors.

The opportunity to interact with so many other educators and experts in so many aspects of oceanography all without the need for school system additional funding [is a great benefit.]

The greatest benefit for me is seeing what the various scientists work on and then being able to ask them about it.

I enjoyed all the interaction that has happened so far. I never thought that an online course could be so interactive and the different responses that can help you through any problems were a great surprise as well.

Meeting people who love science was great.

The greatest benefit was working with leaders within the scientific community and having the opportunity to interact with colleagues and hear ways in which they teach marine science to their students.

I enjoyed participating in discussions and learning about people who are so enthusiastic about their chosen professions.

The evaluators' tracking efforts with respect to identifying levels of participation both quantitatively and qualitatively indicate the emergence of a Core Learning Community over the period of CEO implementation—which seems to have begun with the previous *Sustainable Seas* and *Coral Reef* projects. The circulation of program recruitment and registration information resulted in approximately 1,900 initial responses. The initial

implementation of each workshop, over a one-week period, resulted in an immediate 300 recurring and persistent readers during that week—from which group approximately 15% became proficient and regular in posting comments and questions. After the initial week of the workshop—defined as the direct implementation period—some overlapping audience of from 400-800 participants reviewed the archived materials at a variety of engagement levels. It should be noted the iterative and non-linear nature of the web environment makes it quite difficult to isolate actual participation numbers due to overlapping and circuitous "routes" through the workshop areas beyond these figures.

Some evidence exists that these participation numbers clearly did not represent the same pool of individuals from week to week. Further, and more importantly, based on survey respondent narrative discussed previously—the perception of "full participation" was defined in categorically different ways by respondents and certainly changed over time. One observation of this phenomenon was the registration database indicated only approximately 460 individuals pre-selected the "full participation—all sessions" category—a number far less than the 400-800 individuals who have persisted through the different weeks of programming. An area of further research with respect to online learning is highlighted herein: traditional conceptions of participation and Full Time Equivalency are increasingly irrelevant to the highly individualized use of online learning environments by participants. Facilitators of online learning will need to develop more rigorous and robust conceptual models for defining participation and tracking enrollment.

The above-cited selections from the narrative, and numerous others, illustrate that many participants were able to transcend the technological format of the workshop, and the relative isolation of individualized, distance learning. In total, the comments could be viewed in the context of a face-to-face workshop without editing. This suggests the emergence of a social network within the electronic workshop—and would be critical to the development of a community of ocean science educators using the web as the primary communications and learning delivery tool. Other key terminology included, "developing networks, sharing ideas, meeting with, talking with, responding to, hearing, and getting to know." These terms would be more closely associated with face-to-face encounters than distance settings. The evaluators conclude from this observation that the learners were in fact engaged on a social and community level. This would correlate with numerous other studies in adult learning that find a social network or community is essential for effective, transformative learning (Darling-Hammond and Sykes, 1998; Daley, 1999; Hoffman-Kipp, Artiles, and Lopez-Torres, 2003).

References

Bishop, Katrina and Walters, Howard D. (2003). Sustainable Seas Expeditions' Project Ocean Steward 2000 Online Workshop Evaluation. *Current: The Journal of the National Marine Educators Association*. 18(4).

Daley, B. J. (1999). Novice to expert: an exploration of how professionals learn. *Adult Education Quarterly*, Vol. 49(4).

Darling-Hammond, Linda and Sykes, Gary, eds. (1999). *Teaching as the Learning Profession: Handbook of Policy and Practice*. San Francisco: Jossey-Bass.

Hoffman-Kipp, Peter; Artiles, Alfredo J.; and Lopez-Torres, Laura (2003). Beyond reflection: teacher learning as praxis. *Theory into Practice*, 42(3).

Knowles, Malcolm S. (1990). *The Adult Learner: A Neglected Species*, 4th Edition. Gulf Publishing Company: Houston.

Knowles, Malcolm S. (1980). *The Modern Practice of Adult Education*. Cambridge: Prentice Hall Regents.

Merriam, Sharon B. and Cunningham, Phyllis M. (1989). *The Handbook of Adult and Continuing Education*. Jossey-Bass: San Francisco.

Report Authors

Howard D. Walters, Ed.D.
Assistant Professor in Educational Foundations, Measurement, and Research
Ashland University
Ashland, Ohio

Kristina Bishop, Ed.D.
Academic Director
The College of Exploration
Potomac Falls, Virginia

Virginia Little, Ph.D.
Beat Street High School Online Program Director
The College of Exploration
Potomac Falls, Virginia
Christine Luketic,
Doctoral Student in Educational Research

Virginia Tech University

Additionally, the authors would like to acknowledge the assistance of the following individuals who provided interpretations, analyses, and constructive criticisms during the development of this evaluation and report.

Francesca Cava
Classroom Exploration of the Ocean
Project Manager
The National Geographic Society

Peter Tuddenham
Executive Director
The College of Exploration
Potomac Falls, Virginia

William Bragg, Ph.D.
Director, Online Campus
The College of Exploration
Potomac Falls, Virginia

Nicole Le Roux
Education Researcher
The National Geographic Society