REGIONAL SCIENCE EDUCATION WORKSHOP ONLINE THROUGH THE COLLEGE OF EXPLORATION

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ABSTRACT

Six days of interactive on-line programming brought the science of the Great Lakes of North America to workshop participants from 20 U.S. states and four countries. Regional leaders of the Center for Ocean Sciences Education Excellence [COSEE] for the Great Lakes region partnered with The College of Exploration, an international not-for-profit educational organization that develops, delivers and evaluates web-based workshops for collaborative learning. They assembled materials and experiences for a regional overview plus topics of resource allocation, life in the lakes, climate change, and invasive species, followed by suggested ways to blend Great Lakes and ocean learning. Each day's programming included a suggestion for "flow" to make sense of the materials, streaming video programs providing information or demonstrating curriculum activities, and lists of additional resources. In addition to bringing over 350 educators into conversational contact with scientists, the program catalyzed teachers and provided the opportunity to share and organize many resources from each of the COSEE Great Lakes states. The most exciting component was the interaction of participants with the resources and each other. Online entries demonstrated that learning was being constructed with each day's experiences and perspectives were broadened by discussions among the diverse learners. All workshop materials remain on the College of Exploration web [http://www.coexploration.org/coseegreatlakes/] for continued use.

INTRODUCTION

With each annual arrival of new students and teachers in schools, the Internet becomes more entrenched in classroom education and the expectations of the technology increase. While some fear that the medium has become the message, others are embracing Internet delivery as the most useful and desirable means for propelling their message into audience consciousness. "If you web it, they will come," to paraphrase the *Field of Dreams* philosophy. Indeed, teachers from elementary through graduate school are noting that the learners they work with are looking first at the "wiki" way of learning, going first to the synthesized information sources of the Internet for what used to be scholarly research in original literature (the library!). If the web is the medium of choice, how can we use it effectively for professional development?

We have known for some time that the level of public and student knowledge about the Great Lakes region and its science is not at levels consistent with science literacy (Fortner and Mayer, 1991; Fortner and Meyer, 2000). At the same time, research based on use of curriculum materials for guided inquiry in Great Lakes science has shown that teacher preparation using those materials can translate to student gains in science process achievement (Fortner, Corney and Mayer, 2005). With proven materials and a demonstrated need, educators in the Great Lakes region explored the potential of an online workshop for in-service education of teachers.

Virtual learning takes many forms, and emerging practice has changed rapidly with a resultant lag in research on format effectiveness. While most research has compared virtual learning with equivalent

information and experiences delivered face-to-face, developers of both strategies would quickly point out that such comparisons represent "apples compared to oranges." If the techniques applied in the virtual learning are compared, student achievement in courses using email and web-based learning appears slightly better than in traditional instruction, while student achievement is either the same or slightly lower with video based virtual learning (Fadel and Lemke, 2006). Those who attempt meta-analysis of research on technology in education note that video based learning often fails to capitalize on the potential strengths and features of videoconferencing, such as facial expressions, effective use of video clips, and speakers brought in from distant areas.

Some research has looked at the determinants of virtual learning success and found them to be based within the structure of the experience (learner support, opportunities for direct learner involvement) and characteristics of the participant (willingness to exercise control, exploratory action, and such) (Coomey and Stephenson, 2001). In reviewing the body of research extant in 2006, Fadel and Lemke concluded that "Virtual learning today is a breakeven proposition (i.e., gets the same results as face-to-face learning), while at the same time providing flexibility to its users. In general, researchers find that students in distance-learning situations perform as well as their counterparts in face-to-face traditional schooling" (p. 9). Success in virtual learning may depend on the desired "performance" outcome.

Research specific to workshops developed through The College of Exploration, a partner in the program reported here, includes reports on other outcomes of the experience provided by web-based video streaming as a professional development mechanism for science education (Walters, Bishop, and Luketic, 2004). In particular, use of the medium for teacher enhancement has special attributes for adult education that are as important to success as the media content (Knowles, 1990). These include the flexibility of scheduling and opportunity for adults to feel supported and validated in their efforts to learn. In addition, of particular importance in science education is recognition of a perceived gulf between teachers and scientists. Workshops that are able to facilitate communication between teachers and scientists produce results that are satisfying for both, and teachers indicate that the excitement of this direct communication created a "virtual collegial setting" for them (Bishop and Walters, 2003).

FORCES BEHIND THE WORKHOP

The Centers for Ocean Sciences Education Excellence [COSEE] have as their goals to inspire citizens to become more scientifically literate and environmentally responsible through standards-based science curricula and programs that bridge the ocean and freshwater sciences, and to create dynamic linkages between the education and research community. There are ten COSEEs in the United States (Figure 1). They are supported by funds from the National Science Foundation of the U.S., with some support from NOAA, the National Oceanic and Atmospheric Administration.
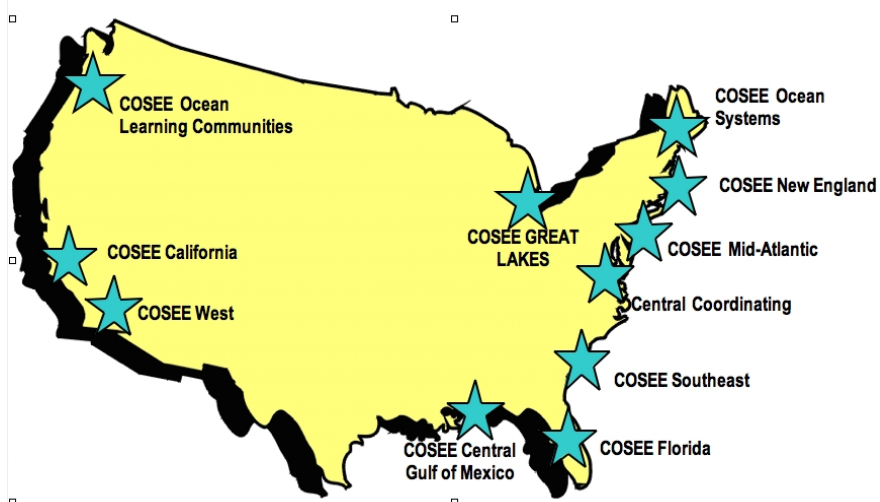

Figure 1. Locations of Centers for Ocean Sciences Education Excellence

The program reported here is the product of COSEE Great Lakes, in the region which is home to one quarter of the nation's population. COSEE Great Lakes has the additional goals of speaking for the Laurentian Great Lakes as an inland sea (Figure 2), and improving Great Lakes education in the eight-state region. The Great Lakes coastline is as long as the U.S. coastline on the Atlantic Ocean. Five COSEEs are located on the Atlantic shore and only one is on the Great Lakes. The COSEE Great Lakes task of teaching about the inland sea (or Fourth Coast) is a geographically immense and scientifically essential one.

Figure 2. Satellite image of the Great Lakes (Credit: NASA)

COSEE Great Lakes (http://coseegreatlakes.net) is staffed by seven educators identified through their affiliation with Great Lakes Sea Grant programs. Sea Grant is a federal-state partnership for conducting marine and aquatic research and disseminating research results that will benefit users of the aquatic resources of the United States. The National Sea Grant College Program has its Federal home in NOAA, in the U.S. Department of Commerce. The COSEE Great Lakes program is housed in a science research consortium, the Cooperative Institute of Limnology and Ecosystems Research (CILER), and works with scientists in NOAA's Great Lakes Environmental Research Laboratory (GLERL).

Activities of COSEE Great Lakes focus on bringing scientists together with educators, students, and the public. A multifaceted five-year program of teacher education and curriculum enhancement involves scientists not only as resources for science information but also as individuals preparing for outreach and engagement with schools. Federal support for science research in many cases requires that scientists participate in programs that bring their work to others through education and outreach. COSEE also seeks to involve the public in science education programs, so informal education institutions and Internet program developers are seen as valuable partners in that regard.

The College of Exploration [TCOE] is a not-for-profit educational organization that designs, delivers and evaluates education programs and events using collaborative learning environments for learners of all ages. With facilities and staff in the UK and U.S., they emphasize short courses using web-based video streaming technology and software that allows participant interaction (Caucus®). Several COSEE programs have partnered with the College of Exploration for web broadcasts of guest lectures, but none had attempted the level of programming used in the Great Lakes workshop.

The remarkable media-based education partnership opportunity reported here began with the annual conference of the North American Association for Environmental Education [NAAEE] in October 2006 in St. Paul, Minnesota, USA. COSEE Great Lakes leaders conducted a face-to-face workshop for 1.5 days that received enthusiastic program evaluations and generated interest in COSEE events and

materials. The audience was small, however, and the setting was not the best for educational programming. Fortunately, this workshop did not end with the required evaluation survey. All parts of the St. Paul program were videotaped by staff of The College of Exploration, with the idea that some of the footage might be useful in a planned online workshop later in the year. Indeed, TCOE was able to capture formal science presentations and actual teacher preparation activities that demonstrated how curriculum materials could be implemented in middle school classrooms.

ON-LINE PROGRAM OVERVIEW

"What's so great about the Great Lakes? Inland Seas Environment and Education" was the title of the on-line course that gave COSEE Great Lakes educators the opportunity to discover how interactive collaborative learning could bring information and opportunities to groups much larger than we imagined possible. The goals of the workshop were to
- explore the outreach potential of web-based in-service education,
- bring Great Lakes information to educators and the public,
- support Great Lakes teaching with great programs and teaching materials, and
- enhance science literacy through study of the interacting systems of the Great Lakes ecoregion.

The online course used a web environment that consisted of a set of five "rooms" where people could interact with each other and with the workshop information and resources. The web environment was built on Caucus® software. The rooms had a list of items for discussion, and within each item the participants could add their responses to what was happening with the topic or the discussion. The rooms for "What's so great..." included
- a Great Lakes Room where the RealPlayer presentations of science and teaching techniques were streamed, and discussions about them were held,
- a Resources room for sharing materials and posting information about web sites, books, curricula, music and other teaching aids related to the science topics,
- a CEU (continuing education) room and a Credit (university credit) room where people who were taking the workshop could post and discuss their assignments with a course moderator, and
- a "Cafe" where participants could visit and talk about whatever they wanted. A starter topic of "share a memorable Great Lakes experience" brought in photos, life events, and wonderful perceptions of the lakes. New topics were added as participant interests emerged.

With the software components assembled, and the experience of TCOE staff to answer technology questions, post and release each day's content, and tolerate many disparate learning curves, the week of learning proceeded thus:

Sunday - Great Lakes Overview presentation. A formal PowerPoint lecture with side screen that allowed participants to see streaming video of the speaker as the slides changed. This was the primary content segment of the program, assembling in one presentation the key facts and figures about Great Lakes geography, science and environmental issues.

Monday - Regional resource distribution. The topic explored how the population of the watershed, land uses, water volumes, fish resources and pollution were distributed regionally. A curriculum activity illustrated a high-interest way to focus on these issues. In addition, a Native American speaker and a story-telling activity introduced the culture, history and philosophy of the Ojibwe people in the Great Lakes region, relating their views of and respect for its land and water.

Tuesday - Great Lakes food pyramid and biodiversity. The goals for the day were to introduce the types of organisms found in the Great Lakes of North America and explore an example of how they are interrelated. Instructional activities included identification and classification of fish with a dichotomous key, and a board game based on a food pyramid of lake organisms.

Wednesday - Climate change impacts on the Great Lakes. The day's goal was to provide an overview of global climate change and relate what scientists believe will be the impact on regional systems. A PowerPoint program with text narration from the Union of Concerned Scientists provided background information for an activity of visualizing impacts on Great Lakes commodities and

environment. Participants also graphed temperature anomalies over time as an indicator of atmospheric changes in progress.

Thursday - Aquatic invasive species in the Great Lakes were the focus of the day, with instructional activities and discussion designed around Illinois-Indiana Sea Grant's ESCAPE curriculum materials (http://www.iisgcp.org/edk-12/escape/escape.htm)   and a student web site for Nab the Aquatic Invader (http://www.sgnis.org/kids/).

Friday - Inland Sea vs. Salty Sea Comparisons. The goal for the day was to introduce curriculum information and information sources that have both marine and Great Lakes applicability. Presenters demonstrated Internet sites such as Water on the Web (http://waterontheweb.org/) and the COOL Classroom (http://www.coolclassroom.org/home.html) for excellent applications of real time data and science information. Participants saw curriculum activities of Hurricane Bingo and Water Hyacinth Jeopardy, which are easily adaptable for freshwater equivalent topics.

Saturday - COSEE Great Lakes: Looking back and looking forward! This was a day for catching up on missed topics and opportunities to converse with scientists on line. It also offered a PowerPoint program on coming COSEE Great Lakes events that might involve the participants in person.

Broadcasts were completely asynchronous, so participants could come in and out at any time for as long as they chose, controlling both the sequence and content of their own learning experience. Broadband connections were required for efficient downloading of streamed program elements. Each day, participants first downloaded streaming video of the presentations to view the subject matter or curriculum demonstrations or both (e.g., Figure 3). They also downloaded pdfs of the curriculum activities, unless those were resident on the Internet. Regional scientists were on line to answer questions about their topics, participants could ask questions of presenters and share ideas with each other, and COSEE leaders were able to interact with their state participants.

The Caucus® software collected responses in acquisition order, not as threaded discussions. While this was a new approach for those accustomed to "threaded" discussions, the process was quickly adopted as a valuable one because it initiated access to a wider range of conversations than simply the ones in chosen threads. The underlying philosophical and pedagogical foundations of the software, as well as the College of Exploration approach, are in constructivist, interactive, Systems and learning theory. Thus the questioning, responding and sharing of ideas and resources demonstrated dynamic examples of how the approach can be implemented. At the same time, the elements of the programming strove to take advantage of videoconferencing's best features, showing facial expressions, speaking directly to the audience or to others present in person, presenting sequences of teaching and learning as they might occur in a classroom, and opening discussions on both the content and methodology.
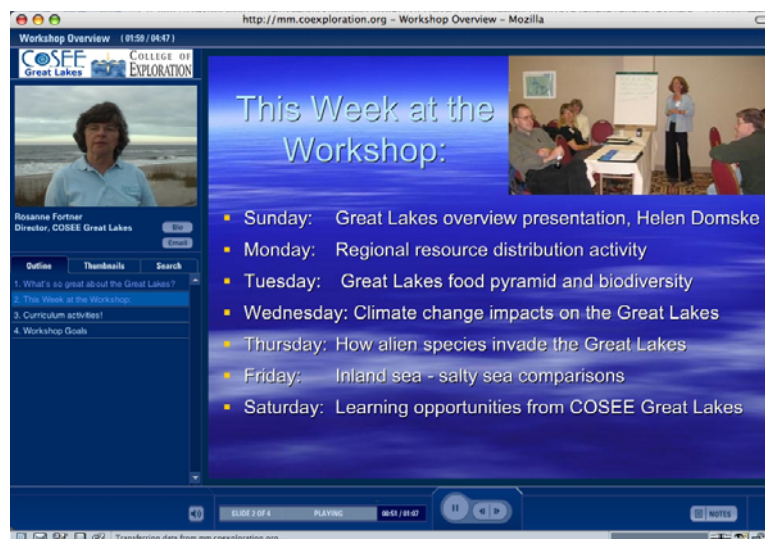

Figure 3. Screen view as PowerPoint slides were accompanied by a speaker's video streamed narration

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AUDIENCE

Since this was the initial attempt at this type of intensive on-line involvement for regional education, the advertising was limited to network contacts of the COSEE Great Lakes staff. Sea Grant educators emailed information to the educators with whom they work, and to state science/environmental education groups. The U.S. Environmental Protection Agency announced the workshop in its monthly regional mailing, and the National Marine Educators Association discussion board ("Scuttlebutt") was also notified. The University of Minnesota Duluth announced the course for credit, and two states worked with Continuing Education providers to offer credit as well. As an added incentive for enrollment the program offered a Great Lakes Basin map suitable for posting in classrooms.

The expectation was that the program would attract a wide regional audience of educators. With free registration, and an instructional materials incentive, about 380 individuals registered for the program. They represented 20 of the United States, plus Puerto Rico (a Territory of the U.S.). Canada and China had one representative each. Since the online course planners had primarily done regional recruitment, we suspect the additional audience had been present at other College of Exploration events and were curious as to what this one would add to their previous learning experiences on line.

Most of the participants were classroom educators. For some other groups, demographic questions did not always capture information clearly, but indicators suggest about 15% were informal educators, from museums, parks, aquaria, and educators from science agencies. The informal educators gave valuable feedback about how the curriculum activities would work in their settings. About 20 scientists participated from various disciplines. Two scientists made formal presentations, and others responded to participant questions about daily topics and expanded on the subject matter of the curriculum activities. Fewer than 30% responded to an optional demographic item and only nine participants self-identified as non-Caucasian. However, 120 participants indicated that their student audiences included 40% or more who were members of minority groups. Recipients of U.S. funds for scientific research always try to assure that their programs are accessible to groups that are considered "underserved" by special programs, or "underrepresented" in science professions. Thus while the primary participants may not have met minority recruitment goals, there is a good possibility that a secondary audience of greater racial and ethnic diversity will be recipients of the information and materials from the program.

PARTICIPANT INTERACTION

The most exciting aspect of the workshop was the quantity and quality of participant interaction. At any moment during day or evening hours from December 3-9, 2006, thirty to eighty individuals might have been on line, actively conversing with their peers, downloading files of video to watch or curriculum to print. The Caucus® software tracks participant involvement, "remembering" what discussion responses have been viewed by a particular log-in name and announcing to the returning participant how many new items are available for viewing. It also compiles individual time on line for each log-in, and can aggregate group data by item and page to give a measure of what program components received the most attention. In the example below, sorted by the highest number of visits among the participant group (log-in information deleted), the Resource Room had 15 different items for discussion, and within those were 166 different responses over the time indicated. Not all participants read all the items, but we can track how many responses were read and added by each individual. The data show which participants were browsers or information seekers and which chose to interact with other participants and the system – thus engaging in a more authentic form of learning (Charles & Griffin, 2007).

Table 1. Example of participant interaction with the Resource Room materials

Activity Report: COSEE-GL: Resources (2006-12-02 thru 2006-12-13)							
Student	visits	hours	Available items	Read Items	Available responses	Read Resps	Added Resps
1	94	3.69	15	15	166	166	12
2	65	2.22	15	15	166	164	8
3	59	3.19	15	15	166	166	3
4	54	1.16	15	15	166	154	4
5	48	0.99	15	15	166	154	2
6	40	3.23	15	15	166	164	14
7	36	3.37	15	10	166	109	8
8	29	3.96	15	15	166	140	19
9	25	1.29	15	15	166	164	1
10	25	1.08	15	15	166	160	3
11	24	0.42	15	15	166	156	0
12	23	1.76	15	15	166	125	2
13	20	2.39	15	10	166	77	1
14	16	1.71	15	14	166	144	6
15	14	1.29	15	13	166	117	1

The entry page for each Room added more information for tracking usage, in addition to providing navigation bars and quick reminders to participants of how to track their own progress. Within a discussion item, participants made brief comments about the subject, asked questions, or contributed new materials. For example, responses to the first lecture included (copied verbatim):

> *This helps to show how the whole earth is a closed system and the damage being done to the great lakes is an example of what could soon happen to the oceans. Hopefully people will see what's happening to the lakes and start taking preventative measures. [Christopher]*

> *This presentation opens up a pandora's box of issues to look at. I'm looking forward to updates on the effect of zebra and quagga mussels on the ecosystem (and Lake Erie), recent legislation concerning ballast water, and all of the other issues facing the Great Lakes. I'm excited to tackle all of these issues in detail. [William]*

> *I was amazed by some of the information on how much water is in the Great Lakes. I think everyday how lucky I am to live five miles from Lake Erie. I also feel that it is important in protecting rivers and watersheds that run into the Great Lakes. I just took my students on a four mile hike from our school to Ashtabula River that is one of the rivers that is contaminated and is on the list for clean up. There is actual dredging going on. [Michele]*

> *Very interesting presentation, especially for this East-Coaster who has so little knowledge of the Great Lakes. I was particularly interested in the discussion of the benthification of Lake Erie. What does that mean? How has that taken place - is it a change in the organisms or in the abiotic factors of the lake? [Louise]*

> *All I can say right now is WOW! This is completely new information for me. The chart with statistics is incredible.   Coming from France, I never imagined the lakes being that GREAT!!!! (I always believed the lakes were large but not the length of the Atlantic coast) This is a new perspective to me. [Marie-Pierre]*

As they encountered new terminology or discrepant information, participants asked questions, some directed to specific individuals, but others just for anyone. Scientists and other Great Lakes experts responded directly to participant questions in the open forum where all could see:

Re smallest and largest fish in the Great Lakes. Lake Sturgeon are the largest fish in the Great Lakes (record stands at 8 feet, but more typical adults at 3-5). Muskellunge can also exceed 5 feet. Not counting larval fish (just hatched can be microscopic for many species) the top candidates for smallest fish in the Great Lakes are the central mudminnow - reported maximum size of 80millimeters and the appropriately named least darter at 2.5 centimeters. [Dr. Sturtevant]

Re Asian carp. Yes, steps are being taken, albeit slowly. An electric 'dispersal barrier' is in place in the Chicago Shipping and Sanitary Canal. Funding to keep it operating and to rebuild the temporary 'pilot' barrier (now well past its original intended operational life) into a more permanent one have repeatedly run into problems - (1)everyone agrees its important, but no one wants to pay for it and (2) safety concerns. [Dr. Sturtevant]

Re treatment for pharmaceuticals... Most municipal water treatment systems are not designed to remove pharmaceuticals - they rely on filtration (for removal of particles and easily-bound organic contaminants) and chlorine or ozone (to kill biologicals). High-end reverse osmosis systems probably do remove most of it. [Dr. Sturtevant]

Participants contributed their own ideas for resources and instruction, thus demonstrating their own expertise and developing collaborative conversations with peers:

The fish hatchery in Kalamazoo is located on West Main Street, just outside the city limits. Great field trip. And when the salmon run at the Allegan Dam, that's another good fish site. [Ginny]

You might be interested in the sturgeon habitat project that Michigan Sea Grant, USGS and others have been working on, see http://www.miseagrant.umich.edu/sturgeon. [Elizabeth]

Has anyone used the Lake Superior Game in their classrooms? It is a great way of looking at choices people have to make while living near or on a body of water and realizing these choices are not easy to make. [Jo Ann]

After watching teachers in the video presentations showing how classroom activities were done, experienced teachers sometimes discussed what appeared to work well and ways they would modify the activity for their own situations. The comments below relate to the concept webbing activity "Visualizing changes in the Earth system: What Great Lakes factors will increase and what will decrease as a result of global warming?" (Figure 4). They demonstrate high levels of pedagogical content knowledge being applied to the curriculum opportunity.

Figure 4. Scene from streaming video of teachers debriefing a curriculum activity

In doing the activity Visualizing Changes....I would have students work in small groups 4-6. Each group could come up with their own interconnected web and justifications for placing their cards. Each group would present their web and reasons to the class. This way all are engaged and waiting time is lessened. I would also incorporate the graphing activity in, Is The Globe Warming? and would give them some more information on which to draw from. We emphasis inquiry and this is a great activity for this process. [Jo Ann]

Although wait time was visible in the activity, it appeared to give participants an opportunity to discuss together what was developing in front of them. By building outwards from the beginning point of climate change would students have had the flexibility to move cards if they felt differently about how or where a card was placed? I felt it appeared to be somewhat challenging in creating a logical concept map but follow-up allowed good discussion for agreement, justification, and/or interpretation of thought processes arrived at in creating the concept map. [Cindy]

I thought the activity was valuable as a demonstration of cause and effect, interconnectedness and human impact on the environment. My greatest concern in using activities on global warming is also addressing the doomsday message and the childrens' concern for their future in a world that will be drastically changing. Any thoughts on how to address their concerns/fears? [Jill]

While the learning potential was great and the resource bank was seemingly inexhaustible, participants still found time to talk about their own lives and experiences, sharing photos and small talk in the "Café." Responses such as these demonstrated the social aspects of the community developed within the workshop, as had been noted by Bishop and Walters (2003):

The weather has changed-it is 13 degrees. I'll just stay inside and wait (until spring) for the sunshine! [Roberta]

It was a beautiful sunny day, perfect for skiing, just don't lose your mittens. [Mary]

It was 85° and sunny in Naples, Florida today. I was lucky enough to go on a river cruise through the locks of the Caloosahatchee near Fort Myers. I'm sorry you couldn't all be here with me. The weather couldn't have been more perfect for my thin snowbird blood. [Susan]

Wish I was there right now! Sounds lovely. My parents have a condo in Ft. Myers so I will be down there at some point this winter. Did you see any manatees on the river cruise? [Tina]

Participants logged over 1000 responses in the Great Lakes Room, Resource Room, and Café, and those enrolled for credit or CEUs worked on assignments in other on-line rooms. While the participants were engaged in the public rooms, COSEE Great Lakes staff and TCOE were working behind the scenes in a COSEE Great Lakes Blueroom (restricted for project staff use), developing next steps, responding to issues, making decisions on formats and dealing with management issues. The Internet environment, then, served both the workshop developers and participants with places for productive interaction.

PROGRAM EVALUATION

With so many components to this complex desktop inservice program, evaluation also needed to take multiple forms. TCOE opened a discussion item in the Great Lakes Room as an obvious place to volunteer: Your FEEDBACK and Comments. This page opened on December 8, before the workshop had posted all the components, and most comments were posted after the official closing date. Only 14 comments were received, uniformly offering thanks and praise, with one suggestion of stretching the program over more days to allow more time for processing the information. Typical of the comments was one from a Russian born teacher working in Virginia (outside the Great Lakes region):

I joined the workshop with hope to see the beauty of the Great Lakes, and blue sky, and blue water, and may be a blue fish somewhere between. Instead you have shown me the zebra-mussels (looks ugly), sea lamprey (brrr....) and if it was not enough, you made me to learn about exotic species and why suddenly they decided to be invasive.... I learned a lot. And I really enjoy this workshop. I build a new vision of the Great Lakes' ecosystem and am eager to share my new knowledge with my students. Thank you for your high expectation of us and for teaching us with patience and care...Great learning experience! [Lena]

Anecdotal evaluative comments appeared as unsolicited notes throughout the workshop rooms, further reinforcing the notion that the participants were pleased with what they received and enjoyed the learning experience. Content analysis of comments shows positive responses to learning new content, being able to collect new resources for teaching, and the value of workshop interaction.

For more quantitative evaluations the COSEE staff constructed an on-line questionnaire linked from the College of Exploration site to www.SurveyMonkeycom. Participants were encouraged to complete the voluntary form to provide information for improvement of future on-line workshop experiences. Forty-six people answered the questions. Of those, 26% indicated that they learned about the workshop through a listserv; others noted their first encounter with workshop information was through personal communication with friends or colleagues (22%) or a website (20%). Individual mailings, Sea Grant newsletters and "other" accounted for the remaining respondents' information sources.

Another item asked respondents to "Name a few of the types of information, activities, and resources you reviewed as part of this opportunity. Which are you likely to use?" Nearly all (98%) of the respondents could specifically identify two resources they were likely to use. Seventy-six percent of respondents named three activities and/or resources that they were likely to use. There was limited agreement on which resources were identified as most usable, which could be expected given the wide range of ages and subjects taught by participants.

Finally, participants were asked, "How useful were the sessions in helping you to meet your goals?" They responded on a scale of 1-5, with 1 = the course was not useful in meeting this goal, 5 = the course was very useful in meeting this goal. The participants found the workshop useful in meeting

most of the workshop goals. Ninety-two percent of the respondents felt the workshop was useful or very useful in helping them find materials for their teaching. A large majority (74% to 89%) indicated the workshop was useful or very useful in meeting each of the three learning goals: learning about the science and culture, about human impacts, and about integrating the information into their teaching.

The workshop goal of helping participants get credits toward certification or salary increments gathered a skewed, but somewhat bimodal response. Fifty percent of the respondents felt the workshop was useful or very useful in meeting that goal. But 30% found it "not useful" in contrast to 48% who found it "very useful." In considering workshop registration data we know that the participants included a wide range of participants, from classroom teachers to agency personnel, non-formal educators and higher education faculty. Teachers may be most likely to use the workshop for credits towards certification or salary increments. However, the demographics of respondents were not requested in the online survey and we can't identify any possible correlations among participants' teaching situation and their responses on this survey item.

Table 2. Participants' perceptions of workshop goal attainment

The course helped me to:	1	2	3	4	5	N	mean
Find materials for teaching	0% (0)	2% (1)	7% (3)	22% (10)	70% (32)	46	4.6
Learn more about the science and culture of one or more of the Great Lakes.	0% (0)	4% (2)	7% (3)	28% (13)	61% (28)	46	4.5
Learn more about human impacts on Great Lakes	0% (0)	4% (2)	9% (4)	26% (12)	61% (28)	46	4.4
Learn how to integrate Great Lakes information into my teaching	2% (1)	4% (2)	20% (9)	37% (17)	37% (17)	46	4.0
Get credits toward certification or salary increment	30% (12)	5% (2)	5% (2)	12% (5)	48% (19)	40	3.4

Still to come in evaluation is an interview of the workshop leaders regarding the perceived values of the program for reaching participants and achieving subject matter goals, and a detailed questionnaire for randomly selected participants to assess program expectations, materials use, and perceived gains in Great Lakes/marine knowledge. Participants will be asked to describe any plans they have for infusing Great Lakes information in their teaching, or for following up with contacts made in the workshop. This combination of evaluations will allow us to compare our outcomes with those of previously reported College of Exploration workshops (Bishop and Walters, 2003; Walters, et al., 2004).

SUMMARY AND CONCLUSION

COSEE Great Lakes staff and participants were astonished by the program's ability to allow in-depth discussions, to expand the limits of what people thought the Internet could do, and to bring to everyone a much richer array of materials, contacts and experiences than a traditional workshop. We found that, as Charles and Griffin (2007) predicted, we hated to relinquish our face-to-face interactions with the audience, but "realize that our loss is not their loss." Our initial impressions were based on the ability of the medium to attract more educators than a traditional workshop could, with no expense to participants and no travel costs for staff. Expanded evaluation efforts will document concerns of both staff and participants, and will provide data to assist with the planning of future online in-service events.

One of the most exciting aspects of this effort is that all the material remains on the Internet for others to review and use simply by registering for free at http://www.coexploration.org/coseegreatlakes/. It is unclear at this point if the Caucus® software can identify registrants who arrived after the program closed and provide participant tracking equivalent to that during the workshop. As the material now resides in static form, it is equivalent to Level 2 online professional development, capable of being structured by individuals for their own needs, but without interaction (Charles and Griffin, 2007), and is less likely to achieve its potential for fostering authentic learning. However, it will retain its

characteristics as an individualized learning environment (Howard et al, 2004) and offer other learners the freedom to explore the resources and examine the science principles.

The College of Exploration hosts many interactive programs for educators every year, and registration for one will put interested teachers and others on an email list to learn of other events that might be of interest. COSEE Great Lakes was impressed with every aspect of our first experience with the talented group of TCOE professionals, and will be offering other workshops with them in coming years. As Charles and Griffin (2007) suggested, there are two useful realizations to be made in considering the future of teaching science in the 21st Century. First, virtual professional development will be a significant option in the future, and second, most online professional development has not reached its full potential for being what the medium can be. Our initial attempts in the process of development and implementation have been instructive as much for us as for the participants, and future productions will be built on what we have learned.

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