Understanding Tsunamis 2005 Online Workshop Evaluation Report

INTRODUCTION

The *Understanding Tsunamis 2005 Online Workshop* was implemented by the College of Exploration, with fiscal support provided by the National Science Foundation. The College of Exploration (COE) is a not-for-profit education, technology, and research organization in Potomac Falls, Virginia, and has a lengthy history of designing and implementing online professional development programs for formal and informal educators across a broad range of physical, biological, and social science disciplines. The overall goals of this specific online workshop series included (note— the term *workshop* typically denotes non-academic credit training; however, the COE facilitated participant graduate credit as a voluntary option for this project):

GOALS

- To help educators promote public awareness and knowledge about tsunamis;
- To provide an opportunity for educators to interact with scientists whose current research relates to tsunamis;
- To assist teachers in understanding the nature, causes and impacts of recent tsunamis;
- To assist scientists in communicating research results to the education community;

- To help teachers and their students realize that the tsunami is not only a scientific event, but has implications to human health, economics, technology, and other academic and social concerns; and
- To highlight the value of scientific content knowledge in preparing for and responding to tsunamis and other natural disasters.

METHODOLOGY AND SPEAKERS/SCIENTISTS

To facilitate the accomplishment of these above delineated goals, COE personnel designed and implemented the online workshop as a three week, online experiential learning environment. Participants received facilitated guidance to interact with a cadre of keynote speakers through formal presentations, follow-up question and answer sessions and discussion, and with a variety of resource materials and web links established by the project directors with support from the project scientists. Additionally, the workshop included virtual field trips for participants to further engage with researchers. The research scientists who served as the keynote speakers and resource personnel with affiliations and the topics of each individual's presentations included:

- **Dr. Margaret Leinen**
  Assistant Director, Directorate for Geosciences
  National Science Foundation
  Welcome and Introduction to the Online Workshop
- **Dr. Ellen J. Prager**
  President, Earth2Ocean, Inc , author of *Furious Earth: The Science and Nature of Earthquakes, Volcanoes, and Tsunamis*
  Earthquakes and Tsunamis: Frequently Asked Questions about the 12/2004 Asian Event
- **Dr. Jody Bourgeois**
  Professor, Earth and Space Sciences, University of Washington
  Tsunami Deposts: What They Are and What We can Learn from Them
- **Dr. John Orcutt**
  Deputy Director for Research, Scripps Institution of Oceanography
  Assoc. Vice Chancellor, UCSD
  Director, UCSD Center for Earth Observations and Applications
  President, AGU
  Secretary of the Navy/Chief of Naval Operations, Oceanography Chair
  Tsunami Warning Systems: The Intersection of Research and Policy

- **Dr. Tricia Wachtendorf**
  Assistant Professor of Sociology
  The University of Delaware
  Disaster Research Center
  Social Impacts of the Indian Ocean Tsunami: Preliminary Findings from India and Sri Lanka
- **Dr. Harry Yeh**
  Professor, Ocean Engineering
  Oregon State University
  Tsunami Propagation and the Onshore Effects: Theories, Experiments and Field Observations
- **Dr. John Lahr**,
  Emeritus US Geological Survey Geophysicist specializing in seismology and earthquake location programming.
  Classroom Connections: Lessons and projects related to earthquakes and tsunamis.
- **Dr. Daniel Cox**
  Associate Professor, Coastal and Ocean Engineering
  Director, O.H. Hinsdale Wave Research Laboratory, Oregon State University
  Largest Tsunami Wave Basin in the world. Modeling tsunamis waves and exploring coastal mitigation.
- **Dr. Gerard Fryer**
  Associate Geophysicist
  Hawai`i Institute of Geophysics & Planetology; School of Ocean & Earth Science &Technology
  University of Hawai`i at Manoa
  Tsunami advisor to Hawaii State Civil Defense
  Warning the Public

An external evaluator was engaged to assist the College of Exploration with developing and implementing evaluation of the workshop throughout its implementation and summatively. The evaluator, Dr. Howard Walters, has significant experience evaluating regional and nationally scaled education programs for formal and informal educators in the ocean science community. He was registered as a participant in the workshop and monitored discussion groups and presentations. Additionally, he reviewed and revised project participant surveys and developed analyses and interpretations of this instrument. Finally, he established independent communications with the keynote scientists to discuss their perceptions of the workshop.

PARTICIPANT REGISTRATION INFORMATION

The *Understanding Tsunamis* workshop invitations to participate were circulated initially using the educator databases of the COE. Prior research has indicated this is an effective mechanism to communicate with participants from previous workshops (Walters and Bishop, 2004). Additionally, given the international importance of this topic, following the December Tsunami in Indonesia, the workshop information was circulated via NSF, NOAA, and a variety of other ocean and scientific interests. Consequently, registration was overwhelming, with approximately 800 formal and informal educators from the United States and internationally registering and participating at some level.

REGISTRATION DEMOGRAPHICS

Following circulation of the registration information for the workshop, significant interest was demonstrated from two different groups of individuals. First, COE has maintained databases of previous online workshop participants—classroom teachers and informal educators from nearly all U.S. states and dozens of foreign countries. From among this group, approximately 350-400 individuals registered for the workshop. Second, a significant group, i.e. approximately 450 individuals who had not previously participated in an online workshop through COE registered for the workshop. The approximate final registration count of 800 is viewed as accurate within a caveat that as with face-to-face workshops, some individuals will register and ultimately never participate, or participate at a minimum level. Selective counting of logins and screen names within discussion groups during the workshop suggests the n=800 is a valid count.

Of interest in considering the recruitment and registration information, the participant survey summarized below was completed by 75 of the participants, of which approximately 74% registered for graduate credit and 26% participated for personal learning reasons. Of these 75 individuals, 17% had previously participated in COE programming. Given the fact that nearly 50% of all participants and a significant percentage of credit participants are alumni of COE programs—the opportunities to leverage this network of individuals through enhanced programming, expanded programming, or through cooperative efforts with a variety of federal, state, and professional association-partnerships is evident, i.e. based on its history of working with large groups of teachers nationally and internationally as described below, the COE has no difficulties recruiting and filling its workshops.

Based on registration fields from the new participants and archived registration information for returning participants, the following bulleted lists indicate the 44 U.S. states and 34 foreign countries from which participants were representative:

Countries of Participants

- Argentina
- Australia
- Austria
- Bermuda
- Brazil
- Canada
- China
- El Salvador
- Germany
- Guernsey, Channel Islands
- India
- Israel
- Italy
- Japan
- Kenya
- Kuwait
- Malaysia
- Mexico
- Nepal
- Netherlands
- Nevis, West Indies
- New Zealand
- Pakistan
- Panama
- Peru
- Phillipines
- Scotland
- South Africa
- Sri Lanka
- Switzerland
- Thailand
- Togo
- United Kingdom
- US

States and Territories

- AL
- AK
- AR
- AZ
- CA
- CO
- CT
- DC
- DE
- FL

- GA
- Guam
- HI
- IA
- ID
- IL
- IN
- KS
- LA
- MA
- MD
- ME
- MI
- MN
- MO
- MS
- NC
- ND
- NE
- NJ
- NM
- NY
- OH
- OK
- OR
- PA
- Puerto Rico
- RI
- SC
- SD
- TN
- TX
- UT
- VA
- Virgin Islands
- WA
- WI
- WY

This geographic distribution is strong support of the broadly national representation of U.S. participants, and the truly global scale of this workshop. Such geographic representation was viewed by participants via narrative responses as a strong, positive characteristic of this workshop—as they were able to discuss science and social issues from a variety of global dimensions. Additionally, this geographic distribution supports a conclusion that the workshop leveraged its fiscal support substantially, as logistics and travel costs required to implement a face-to-face workshop for such a geographically and globally diverse audience would have been insurmountable.

Inspection of the two databases for registrants, i.e. past COE participants and new registrants, suggests an approximate 70/30% distribution of female to male participants (again the caveat of level of participation precludes greater precision than this demarcation). Further, the distribution of total participants seems nearly approximate to the demographics observed in the survey responses with respect to years of teaching experience, grade level and/or course of instruction for classroom teachers, and the partitioning of participants into classroom teacher versus other professionals, i.e. 77% classroom teachers versus 23% other. Again, the strength of this workshop with respect

to teacher longevity issues is noted: the workshop provides support for novice teachers, but in the main, recruited education professionals who have successfully moved beyond the early career mortality issues observed in the U.S. teaching profession. These participants who are classroom teachers will generally be "in the classroom" for a significant number of future years service, based on career-path research.

EVALUATION RESULTS

The evaluation plan for the project was multifaceted and included the following three primary components:

1. Voluntary completion of an extensive participant survey following completion of the three week program;
2. Analyses of the content linkages between the keynote presentations, open-ended survey responses pertaining to classroom infusion of resource materials and science content in follow-up teaching activities among participants, and the lesson plans developed by the participants who engaged in the project for graduate credit.
3. Follow-up interviews with keynote scientists to ascertain their perceptions of the discussion and interactions with the teachers, and to ascertain the impact of the project on the scientists themselves.

Further qualitative narrative were obtained to assist in the interpretations of these above described evaluative components from the transcripts of the scientist/educator conversations archived on the workshop web site (note: the evaluator was provided full password access to the workshop materials for review.)

The demographic information obtained and reported below include information from 75 participants who completed the survey. The evaluator notes that this participation rate in the survey is typical for such workshops and has been reported in educational research literature. Of these individuals, 77% were classroom teachers, with the remaining 13% distributed nearly evenly across a variety of informal education and government agency science personnel. The classroom teachers were comprised by grade

level as indicated in the figure below. Comparison of the survey respondents to the overall registration database suggests that the larger group (n=800) of participants were comprised of nearly the same professional affiliations.

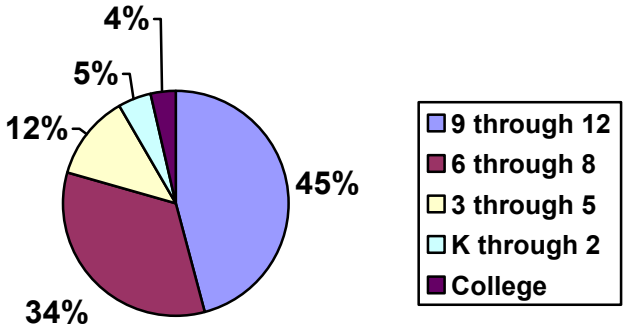

Figure 1. Percentage distributions of teaching levels of respondents.

For those respondents who indicated they were classroom teachers, the most frequently cited course of instruction in descending rank order include: Earth Science, Biology, Chemistry, Oceanography, Physics, Social Studies, Math, Marine Biology, and Technology. The additional 17 respondents who indicated "other" as the primary category of teaching may be inferred to represent elementary or grade school level teachers. The years of teaching experience reported by respondents indicate the largest group of teachers (33%) has taught from 8-15 years, followed by (26%) 16-25 years. These data are complemented by the age range of the responding teachers—43% are from 46-55 years of age and 32% are from 31-45 years of age. These data indicate the workshop teachers who responded to the survey are mid- to later-career teachers, and based upon teacher career research—are likely to remain in the classroom for the remainder of their careers—as opposed to early career teachers who typically leave the

profession prior to 5 years of service. Such an observation in the respondent data is strongly supportive of the potential of this project to evidence longer-term impact in these classrooms.

Additional demographics observed among respondents relate to geographic diversity, academic goals for participation, and the amount of time invested in participation. A large proportion of participants (12%), compared to typical ocean science related teacher programming, reported they were ethnic or racial minorities, with Hispanic comprising the largest group, and American Indian or Native Alaskan comprising the second largest group. The respondents were nearly equally divided geographically into those living closer than 100 miles from the ocean and those living inland from 100 miles. Additionally, approximately 74% of respondents were taking the workshop for the graduate credit.

The time on task to participate in the workshop varied greatly, which was somewhat expected based on a large component of survey respondents (26%) who were not obligated by credit requirements to complete particular workshop components. A great deal of personal choice and individual flexibility was designed into the workshop platform—such that some components were more time consuming than others. For example, participants could read only in the discussion groups, or read and respond. Additionally, a number of respondents reported they printed large quantities of materials, including keynotes and discussions, for reading offline. The largest respondent block (23%) reported that they participated from 4-6 hours weekly in the workshop, followed by the 10-12 hours per week block (19%). These were followed by the 2-4 hour block (16%), the 6-8 hour block (13%), and the 8-10 hour block (11%).

A follow-up question ascertained the number of hours participants engaged with workshop materials "offline." As noted above, numerous respondents made note of particular elements of the workshop which they printed for reading later or to use with students in classroom instruction. The largest proportion (63%) indicated an additional from 1-5 hours of additional time on task, followed by the 5-10 hour block (22%) and the 10-15 hour block (13%).

Additional likert-type response items ascertained that survey respondents were largely satisfied with the workshop experience, reporting Strong Agreement (68%) or Agreement (28%) with statements to that effect. There was additional strong agreement that the mixed media format of the keynote presentations was effective (61% and 36% Strongly Agree and Agree)—although a small number of responses noted initial difficulty with some of the technical formats. Generally, respondents found the workshop easy to use (with an apparent learning curve for the technology probably associated with those participants with the least experience in online learning.) There were comments from participants who had previously participated in other COE implemented workshops that this workshop was very easy to work with—again, most likely evidence of both the quality and experience of COE's work in online learning, and the learning curve associated with technology-mediated learning. The open-ended item (Q15) which solicited comments on ways to improve the course contained further data to support both the perceived quality of the workshop by respondents, and the learning curve for participants. Select narrative which illustrates this includes:

- *This was my first online course. I was a little nervous about navigating, although I use technology a lot in my job. I was pleasantly surprised how easy/user*

friendly this workshop was. When I did have a problem and asked a question about it, I received an answer right away.

- *This was my first experience with this type of format, and it got much easier once I was familiar with the ins and outs of what to do when. With my limited experience so far, I don't really have any better ideas for you, but wish to say that for me at least, it was an excellent way to go about it.*
- *Once you get the feel of the course, it is easy to navigate.*
- *I see no room for improvement. This was the best online course I have taken because of the ease of use.*

Based on prior research on similar online workshops, the evaluator concludes with respect to the technical issues associated with the workshop that they were perceived as effective, that where there were difficulties a COE professional (Dr. Bragg) was "on hand" to provide support, and that in general, some aspects of the technological knowledge and skill-base required to participate must simply be learned through the "trial and error" of experience.

The second major area of analysis in the evaluation plan (item two as delineated above) included data provided in the participant survey (item 19 and select demographic items) with the content in the individual keynote presentations and the specific science content included in the lesson plans which the graduate credit participants created. The evaluator compiled a data file containing 63 pages of lesson plans and lesson ideas to include student activities, resource materials and links, and specific examples of content for use in a variety of K-12 courses and classes. Figure two below reports the distribution of respondents who have already implemented or have indicated they have plans to implement instruction based directly on science content received during the Tsunami workshop.

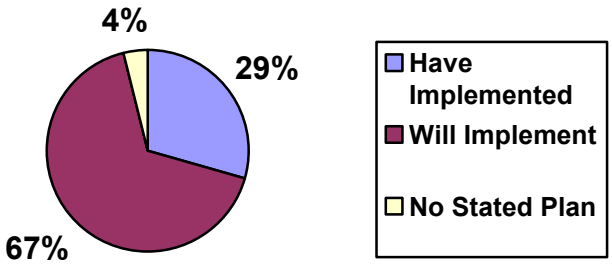

Figure 2. Percentages of Respondents indicating they have or will implement instruction in their classrooms based on workshop content.

The respondents further indicated the specific classes or grade levels in which/at which they either have implemented or intend to implement the lesson plans they provided. These courses/classes include:

- Physics
- English as Second Language
- Physical Science
- Integrated Science
- Library Resources
- Environmental Science
- Geography
- English
- Social Studies
- Marine Science
- 8th Grade Online Science
- Earth and Space Science
- Elementary Grades
- Oceanography

The breadth of these courses and the grade levels indicated, as further observed in participant discussions and in the lesson plans they created in the graduate credit folders, supports a conclusion that the keynote presentations—while conceptually complex and potentially difficult without the interactive explanations from the scientists—were appropriate to support teachers from a broad array of physical and biological science areas, as well as the social sciences and even humanities, and from the lowest grades through college level. Additionally, numerous teachers reported that the virtual field trips

were highly valuable, and that these would become components of their classroom instruction, or already had been infused.

Content analysis of the lesson plans and lesson materials developed by those participants who took the workshop for credit also indicates that the keynotes, while addressing a range of scientific and social science issues, met the content needs of the teachers. Further and perhaps the most important observation in the evaluation report—each of the keynote presentations, following discussion and refinement of teacher understanding in the discussion spaces, has been interpreted into specific lesson components by teachers. The following bulleted list delineates the specific keynote presentations which are clearly observed in lesson plans which were developed by participants. It is noted that a significant number of additional lessons combined information from a number of these keynote presentations, but the evaluator could not localize those lessons to one specific keynote as with the following. The number in parentheses denotes the number of lessons in which the keynote was observed:

- Dr. Prager's presentation (5 lessons)
- Dr. Bourgeois' presentation (6 lessons)
- Dr. Wachtendorf's presentation (6 lessons)
- Dr. Yeh's presentation (8 lessons)
- Dr. Orcutt's presentation (5 lessons)
- Dr. Fryer's presentation (16 lessons)

Taken together, it is observed that a significant number of the respondents have already implemented instruction based on the keynote scientist presentations (n=22) or have developed plans to do so (n=50). Importantly, those plans are not described only through self-reported data, but also in specific written lesson plans which have been developed and submitted to COE personnel, and which include the specific science content, student activities, and resources to be incorporated. Further, the workshop

discussion groups consist of transcribed narratives in which teacher/participants asked follow-up questions of the scientists to expand, define, and refine their understanding of the science content to enhance their (teachers) capacity to lead instruction through the lessons developed. It is concluded then, that these observations are strong evidence that the workshop was a highly effective vehicle to enhance the understanding of formal and informal educators for the content selected. Further, the workshop was highly successful in attaining its goal of providing scientists a platform to diffuse their results to the education community—and that this infusion at the first tier has been sustained and continued in the classrooms of those teachers who responded to the participant survey.

Select narrative from participants which illustrates these concepts includes:

- *For my 12th grade geology class, I am planning several applications incorporating…graphics and animations into my classes throughout the topics of earthquakes, volcanic activity, tsunamis, plate tectonics, and environmental geology.*
- *I teach integrated science to middle schoolers and I will use so much of the information that I learned. I knew very little about tsunamis before this workshop. I have downloaded most of the keynotes and plan to use some of the diagrams and illustrations in my class discussions.*
- *My own understanding of Tsunami generation, propagation, inundation and post survey's has increased tremendously. Before I spent very little time teaching on this topic not having a strong understanding myself. Now I have understanding—am confident and can't wait to teach Tsunamis.*
- *This is the best online course I have ever taken. It provides me everything I need as a science teacher—content knowledge and interaction with experts, cutting edge/current data, resources galore and even matched to standards. In incredible opportunity.*
- *…learning so much…not just about tsunamis either—there was so much supporting information on earthquakes, simulations, disaster relief, patterns in the past, applications in the classroom…There is a great benefit to being able to ask a question and have it answered quickly—and also to read questions from others that may not have occurred to me! The variety of experts and participants gave a wonderful balance of perspectives and experiences.*

The survey further asked respondents to delineate or describe how they intended to use or integrate into their classroom the knowledge they gained from the workshop. The responses to this survey item clustered nearly equally in several areas. The largest clusters of responses indicate participants: 1) have substantively increased their own content knowledge; 2) plan to infuse this new content knowledge (or have already done so) by developing new constructivist activities for students, i.e. labs; 3) will use the content to enhance and extend discussions in lessons and units which had already been adopted for use; 4) will adopt or have adopted virtual field trip components from the workshop in classroom instruction; and 5) will share the content learned with other teachers or education professionals. Select narrative which illustrates respondent perspectives on this item includes:

- *I will for the first time teach about tsunamis*
- *My goal was to increase my knowledge of tsunamis, gather information to put together a presentation to use with Exceptional Education and ESL students at my school, and become a knowledgeable resource for the science teachers I work with…I met all these goals, plus!*
- *I have shared information with colleagues already and will definitely include the science of waves from tsunamis*
- *I have a deeper understanding of the science of tsunamis that will help me next year with my students. I also have a new vision of the sociological impact that I can pass on to my social studies teacher for multidisciplinary connections.*
- *After seeing all the great information available on line, I will update numerous lesson plans to make use of the keynote presentations' great graphics, animations, explanations and links.*
- *This information is becoming part of our physics unit on waves. Differences between ocean swell and tsunamis will be emphasized. Career opportunities in oceanography/physics will be demonstrated using examples of the presenters in this workshop.*

From a broader perspective, respondents were asked to identify and discuss specific benefits they received as educators from participating in the workshop. Select illustrative and typical responses include:

- *I was able to learn about tsunamis from professors I never would have met because we don't live in the same area. I could communicate with other teachers from around the world and I saw pictures, read discussions, learned how to care, and the wave lab was phenomenal.*
- *WOW! Do you have a few hours? The amount of information provided in this workshop will probably take a good part of the summer for me to digest, organize, and have available for teachers to use next year. I found that I not only explored links in the evening, but during spare minutes at school. And, I haven't gotten to everything I want to look at. I guess I am saying that just because the workshop is over this week, all the benefits available from this workshop will not end there. I will be exploring and trying out things for quite a while.*
- *I learned that the social aspect and preparedness for natural disasters is just as important as the scientific understanding of the natural disaster itself.*
- *I consider myself a life-long-learner and I was just really interested in the topic and learning more about it. I also can share my knowledge with my earth science students next year. We can do a whole unit on tsunamis, rather than one lesson, because I now understand so much more.*
- *Participating online is a major benefit because the kinds of discussions and questions from everyone that participated is monumental. People from other countries and states, each sharing their knowledge and experiences as well as ideas, has been wonderful. What better way to learn.*

TECHNOLOGY RELATED EVALUATION ITEMS

Survey respondents were asked to complete evaluative items describing select technology related aspects of the workshop. These items contribute to an understanding of several specific environmental factors unique to the online workshop as different from face-to-face workshops. It is important to gauge participant perceptions of the technology skills required to engage in the workshop as the skills contribute to or potentially challenge the individuals' capacity to fully engage in the workshop. In this vein, there were strong statements from survey respondents that the technology required

by the Caucus platform used by the COE, while clearly possessed of a learning curve for new users, is in fact manageable and does not appear to interfere with learning.

Of the survey respondents, 94%, or 69 individuals, expressed Strong Agreement or Agreement that they possessed the technology knowledge-base or skills required to effectively participate in the workshop. Additionally, 87% of respondents found the workshop web site easily navigable—only three individuals suggested they could have used tutorial support to assist in interacting with the site. This small number seems offset by numerous references that when they posed specific use questions, the COE project facilitator provided near-immediate feedback. One keynote scientist responded to the project evaluator with a comment related to this facilitation support that "Dr. Bragg must not sleep during the entire three weeks of the workshop—he was always available." This type of participant and speaker support is noteworthy.

One comment related to technology use did occur more frequently than others. Thirteen (13) references are observed in the item related to technical or implementation improvement suggestions from participants which appear roughly related to each other. This item related to the use of RealPlayer and Flash Media formats and the difficulty which some users perceive in differences between the two formats. The evaluator notes that in the context of multiple format options for technology-based learning such as currently exists for web-based programming, it is impossible to satisfy the individual preferences of every user. And certainly, this number of responses does not rise to a level of concern—particularly as at least some of these responses are also tied to novice online learners overall deficiency in use of technology. Nevertheless, this observation is included in the report for COE consideration in future programming. Finally, this

observation should be contextualized by the item reporting 97% of respondents Strongly Agree or Agree that the multimedia format was effective.

An additional paired set of response items, i.e. likert-type with follow-up open-ended response, measured the perceptions of the workshop layout and physical organization. From the likert-type response, 80% of respondents were satisfied with the structure and organization of the workshop as implemented. A group representing 15% of respondents would have preferred more structure, and 5% less structure. To ascertain the constructs behind these rankings, an open-ended item was provided to ask respondents to explain their prior scoring. Two themes emerged from this response item, although in both cases, the number of responses did not rise to a level of concern. Eleven respondents indicated that they would have preferred additional "up front" explanations of how to use the system or some type of tutorial to the workshop environment. While this suggestion seems reasonable—it does not seem to occur frequently enough to "over shadow" the learning curve. In short, a tutorial might be a valid approach to acclimating new users, but "time on task" and the technology learning curve seems to be effectively solving these problems already. The second theme that emerges in this open-ended item seems to reinforce some of this prior conclusion—nine of the respondents (second in magnitude to the thirteen above) noted specifically that they received close monitoring support from the project facilitators to keep them "moving in the right direction." This response of project facilitators would also address the issue of a tutorial or new user information in that as long as COE is providing this type of support to novice participants, i.e. the group most likely to use a tutorial, then the tutorial approach is

probably not necessary. These comments are conveyed, however, to COE for consideration.

An additional paired set of items, i.e. one likert-type and one open-ended, queried respondents specifically on time as a barrier to workshop participation, and then in open-ended format, for any other barriers or challenges to participation. The time item was inserted based on prior workshop evaluation where time to participate was viewed as a constraint for participation. This item is possessed of irony—in that participation is voluntary and the scale and scope of participation is entirely self-chosen by participants. Nevertheless, the response pattern for both items is similar to that of prior workshop evaluations. Nearly 62% of respondents state that time is a barrier to participation in the workshop. In the open-ended item, 37 responses—by far the largest category of responses—indicated that time was the single largest barrier to participation. Within these time-related responses, numerous individuals noted that there was "too much material and too many links" to explore for the time they had available. These responses are certainly explicable by the nature of the world wide web—which is in fact inexhaustible regardless of available time. The important contextual characteristic of this tsunami workshop on this point is the equally large number of responses which describe the individualized learning strategies employed by participants to enhance their use of time: numerous respondents indicated they printed materials to read later; numerous respondents indicated they would continue to access the archived workshop materials over the summer to continue their studies; numerous respondents indicated they became highly selective in their use, sometimes ignoring things they would have liked to look at to maintain time for "essentials." This highly individualized learning capacity of the

COE instructional approach remains a unique contribution of the COE among the variety of learning platforms available in online environments.

SCIENTIST PERCEPTIONS OF WORKSHOP PARTICIPATION

As a final step in the evaluation process, Dr. Walters contacted the scientist/keynote presenters directly to ascertain their perceptions of the workshop with respect to their interactions with COE personnel, their interactions with teachers, and their overall view of this workshop experience/format as a mechanism to infuse their research into the education community. Three of the principal keynote speakers provided written reports to the project evaluator for consideration. Overwhelmingly, these individuals spoke positively of the support they received by COE personnel in preparing for their online keynotes, and during the process of the workshop implementation itself. One of the presenters noted that the process of preparing for this keynote resulted in his updating his own speaking materials in a way that was already proving beneficial for other speaking engagements.

With respect to their interactions with the teachers, the scientists were uniformly positive in their estimation of the academic rigor and depth of interaction. One researcher noted, "we were impressed with the questions posed on the discussion board…I must admit that I found myself going onto the site somewhat frequently after my shift was complete simply because I was intrigued with the questions that were posed." Another researcher noted a highly positive aspect of the workshop was the manner in which it accommodated "a wide range of content knowledge and backgrounds" among teachers…"some with stronger backgrounds could ask higher level questions, while others without much background could address more basic questions."

This researcher further noted, "I would highly recommend this as an effective means of training the trainer and helping teachers to get up to speed on important topics."

Based on these communications directly to the project evaluator and in the context of the lengthy transcripts of scientist/participant discussions in which the scientist made other similar statements "on the record," it is concluded the overall project goal of facilitating scientist access to the education community for their research was met.

CONCLUSIONS

Evaluating the impact of the Understanding Tsunamis workshop is nearly an overwhelming task given the incredible scale of reaction by the education community to this workshop. Not only did approximately 800 educators register for the workshop—but given the approximately 2,000 response postings in the various discussion sites, the level of participation seems very high. Literally hundreds of questions have been typed into the discussion spaces following the keynote presentations. Scientist/keynoters—in responding to the breadth of the questions—have produced in discussion form a body of content knowledge in question/answer format that exceeds the original keynotes themselves. And following the refinement of understand tracked through these responses and discussion groups, participants, as represented by the survey respondents, invested significant online and offline time to follow links to other web pages provided by the keynoters and the various ocean and science interested agencies. Survey respondents indicate a desire to infuse this content into their classroom, frequently citing specific activities, powerpoint presentations which keynoters provided, or virtual simulations. Numerous survey respondents indicated they have already infused these materials. The lesson plans provided by the participants who registered for graduate credit are clearly

linked to specific content provided by keynote presenters interpreted through frequently constructivist activities designed by the teachers—thereby demonstrating both content understanding and the capacity to interpret the content in instructionally meaningful ways.

These observations support a conclusion that the topical interest created by the unfortunate catastrophic tsunami in December 2004 was captured in an educational and socially meaningful way—and contextualized with recent scientific understanding. In turn, the participants as represented by the survey respondents and through narrative from several hundred additional participants recorded in the discussion groups seem highly likely to infuse this content into follow-on classroom instruction. Finally, given the demographic characteristics of the participants, i.e. mid-career teachers in primarily middle and secondary grade classrooms and a significant number of returning participants from previous COE workshops, it is highly likely that the impact of this educational experience will be leveraged into at least several years of classroom instruction.