

ED32D-07 1510h

Fine Tuning the IRIS Education and Outreach Program: Choosing an Optimal Balance of Activities

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The IRIS Education and Outreach (E&O) Program is committed to making significant and lasting contributions to science education, science literacy and the general public's understanding of the Earth, using seismology and the unique resources of the IRIS consortium. The E&O program has activities that span all educational levels from public outreach to K-12 and college education. The activities are designed for a wide range of individual interaction time, from minutes for a museum display to an entire summer for an undergraduate research internship. In general, the longer the interaction time, the smaller the audience. The educational goals for a particular audience, as stated in the E&O Program plan, define whether an activity is focused more on breadth of audience or depth of content. An activity's ability to meet the educational goals of the E&O program is the most important criteria in assessing its value. However, to help determine which activities are most worthy of continued support and to help select new activities to engage in, we have begun estimating the cost of providing each hour of interaction time for an activity. The lower the cost for each person-hour of interaction, the more efficient the activity, assuming maximum effectiveness of each activity. Thus the importance of assessment is magnified, as a more effective activity could cost more per person-hour and still be supported if no equally effective but more efficient activity is viable. As an example of how resources are divided between different activities, two activities that have similar budgets but very different goals, content depth and audience sizes are our museum program and our professional development workshops. The museum program, a partnership between IRIS, the US Geological Survey, and several major museums across the nation, reaches large audiences (up to 16 million people per year) via 1 traveling and 4 permanent exhibits. The exhibits include real-time earthquake location maps and continuous seismograms from multiple global seismograph stations, providing wide exposure to seismology, though for a very limited time per individual. One-day professional development workshops provide content knowledge and classroom activities modeled using inquiry-based instructional practices. Approximately 140 teachers and college faculty attended IRIS-led workshops in the past year. The time spent with a limited number of teachers is leveraged through each teacher's interactions with a much larger number of students. When teacher-student interactions for 1-2 years after attending a workshop are included in the estimation of person-hours of interaction time, the museum and workshop programs generate a similar total interaction with the target audiences. Thus by this simple measure, the two programs are roughly equally efficient uses of E&O program resources, even though the target audiences, level of content depth and number of people engaged are very different. Using this measure, it is possible to assess if the relative cost of different activities matches the relative importance of the goals they are addressing.

URL: <http://www.iris.edu/about/ENO/>

ED32D-08 1525h

An Overview of Education Outreach From the Graduate School of Oceanography at the University of Rhode Island

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The Office of Marine Programs (OMP) at the University of Rhode Island Graduate School of Oceanography (GSO) is a national leader in ocean science education and outreach. Current and planned efforts target grades K-16 and a variety of public audiences. Funding from a host of federal agencies, foundations, and industry has allowed OMP to serve as a bridge between its audiences and GSO scientists and graduate students for over 25 years. From museum exhibits to scientist/educator partnerships and interactive educational Internet sites, OMP projects cover a wide range of activities. Successes and lessons learned will be discussed, in particular with regard to engaging the scientific community in education and outreach. Implications for the impact on science education will be highlighted.

URL: <http://omp.gso.uri.edu>

ED32E MCC: 3012 Wednesday 1600h

Education and Outreach Efforts of Major Research Facilities and Organizations II (joint with OS, P, T, C)

Presiding: K Ellins, Institute for Geophysics, University of Texas; M K Hall-Wallace, University of Arizona

ED32E-01 1600h INVITED

Facilitating Participant Success: Teachers Experiencing Antarctica and the Arctic Program

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Through the NSF-funded Teachers Experiencing Antarctica and the Arctic (TEA) Program K-12 science teachers participate as members of polar field projects. Objectives of the program include: immersing the science teacher in the experience of research; 2) leveraging the research experience of the teacher to better inform teaching practices; and 3) sharing the experience with the broader educational and general community. The polar field experience is an exciting opportunity accompanied by a daunting number of responsibilities. In addition to preparing for field research, TEA teachers bring their experience to colleagues, classrooms, and communities. Before going into the field, they give presentations, help plan how students can connect to the polar regions, and share the expedition with the public. In the field, the TEA teacher is a team member and educational liaison, responding to questions by e-mail, and posting e-journals describing the research experience. Upon return, the TEA again shares the experience broadly with the community. In addition, they work closely with 3 colleagues for 140 hours to bring the experience of research into classrooms. Formative evaluation of the TEA Program underscores the need to support teachers in accomplishing their responsibilities; this support is necessary to achieve program objectives. TEA teachers are responsible for sharing the science content of their research. While many broadcast the excitement of the experience, they may not have the scientific background to convey the content. This is due, in part, to many teachers having to be generalists in their classrooms. Shifting into the role of specialist can be challenging. In the year of preparation before the field experience, TEA teachers attend orientation, meet with their research teams for several days, and are encouraged to learn more about their science topic. Understanding builds through the field experience. It may take two or more years after the field work for the science content to solidify. This is illustrated by the changing emphasis of presentations. Presentations after the field season progress from being "experience" based to being "content" based as the teacher continues to develop understanding through interactions with researchers and teaching colleagues. The participants bring a wide array of skills to the program; rarely is one individual accomplished at every responsibility. Some participants are gifted speakers, others are talented writers, and others are exemplary mentors. The TEA Program has attempted to put into place support mechanisms to help build skills, and to leverage the strengths of the participants by providing opportunities for them to collaborate. Presentations are practiced within the TEA community before being presented at conferences. Classroom resources are identified, analyzed, and/or developed by teams of teachers in collaboration with curriculum writers at workshops. The mentoring requirement, considered the most challenging responsibility, is supported by bi-monthly conference calls that include several TEA teachers. Through these mechanisms, TEAs share successes, brainstorm solutions, and help each other with challenges. Facilitating the interaction and support of TEAs by each other is, perhaps, one of the strongest mechanisms for achieving success.

URL: <http://tea.rice.edu>

ED32E-02 1615h

Paving the Road to Broader Impact: California Center for Ocean Sciences Education Excellence (CA COSEE)

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It's hardly surprising that new requirements to address how their research will have impact beyond academia send many ocean and earth scientists reaching for the aspirin. Sympathetic to the increasingly heavy demands on researchers' time, we at California COSEE work to make scientists' education and outreach efforts easier, more effective and more rewarding. Strategies we'll describe include: a) identifying and efficiently meeting the needs of the individual scientists and educators we serve; b) finding the right "tool" for the job, i.e. connecting scientists with the educators and organizations best positioned to incorporate elements of their research into widely-disseminated resources for teachers, students and the public; and c) building institutional and community-scale support for scientists' outreach contributions. We'll describe specific CA COSEE-facilitated collaborations between scientists and educators, as well as share lessons we're learning about the catalytic process we've undertaken. The value of the services we provide in terms of leveraging limited resources and forging partnerships that ultimately make ocean research relevant to non-scientists will be reflected in the quality of education resources generated as well as scientists' changing attitudes toward outreach. We invite all those interested, especially ocean scientists (including technical staff and graduate students) and informal science educators to visit www.cocosee.net, and click on **Engaging Scientists**.

URL: <http://www.cocosee.net>

ED32E-03 1630h

Ridge 2000 Education and Outreach: Past, Present and Future

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Ridge 2000 is a multidisciplinary NSF sponsored research initiative to explore Earth's spreading ridge system as an integrated whole. The program's science plan aims at a comprehensive understanding of the relationships among the biological, geological, and chemical processes associated with plate spreading at mid-ocean ridges. Ridge 2000 replaces its predecessor program RIDGE, started in 1989, and begins a new decade of mid-ocean ridge research. Two main research themes of the new program are Time Critical Studies and Integrated Studies. The Ridge 2000 community is comprised of scientists from universities and research institutions across the country, and administration of the program rotates among institutions every three to four years. Several exemplary education outreach efforts (e.g., REVEL, Dive and Discover, Extreme 2000, NeMO, Voyage of the Deep Sea IMAX film) have been developed by individual scientists to share various aspects of deep-sea ridge research with the public and K-12 audiences. However, no RIDGE program outreach effort has been developed. Since 2001, the new program has sought ways to develop a coordinated, community-wide education outreach plan to help promote Ridge2000 research to the public. Our goals include helping Ridge2000 researchers develop ideas for their own outreach efforts as well as orchestrating community-wide efforts entraining scientists from multiple institutions. Community-wide efforts offer the advantage of serving larger audiences and provide an avenue for those individuals interested in E&O but with less time or experience. These programs also offer a means of developing program recognition. To identify ways to use the uniqueness and excitement of deep-sea research to enhance science education throughout our nation, we conducted a 3-day teacher workshop with 26 invited participants. The workshop was designed to obtain expert opinion on how to help meet the needs of students in today's science classroom with the unique skills and resources of our research community. As a result of the workshop, we have identified a plan for outreach to the K-12 community that includes educational products, dissemination and teacher professional development to ensure the offerings reach the students in an effective manner. Four Ridge2000 community outreach efforts currently in development include (1) SEAS - Student Experiments At Sea, (2) a coordinated outreach effort for the Lau Integrated Study Site expeditions, (3) R2K-based Data Tips, and (4) a Ridge2000 Distinguished Lecturer Series. We are also developing plans to work with COSEEs to disseminate these and other Ridge2000 outreach products.

ED32E-04 1645h

Building A Collaborative And Distributed E&O Program For EarthScope

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EarthScope's education and outreach (E&O) mission is to ensure that the EarthScope experiment creates as its legacy a public more knowledgeable and understanding of the scientific and societal contributions made by the EarthScope experiment and Earth science. It will fulfill this commitment by developing and disseminating programs and products that utilize the data, models, technology and discoveries of EarthScope. The EarthScope Education and Outreach Network (EON), consisting of local EON alliances, the EarthScope facilities, partner organizations and a coordinating office, will facilitate this E&O mission. The local EON alliances, which will vary in size and purpose to respond quickly and to meet the specific needs in a region, will carry out the bulk of the effort. Thus, EarthScope EON can provide customized services that engage culturally, economically and geographically diverse audiences at the national and local scales. The EarthScope facilities and research community will provide access to data, models, and visualization tools for educational purposes. Partnerships with other national and local science education and outreach programs at colleges, universities, research facilities and professional societies within the EarthScope community as well as relevant programs at museums and parks, state geologic surveys and emergency management agencies, and K-12 schools are critical to EON's success. These partnerships will allow EON to use existing resources, networks and expertise to gear up quickly and efficiently. As EON develops, it will reciprocate by contributing new resources and expertise to the partnerships that help improve public understanding of Earth systems overall and promote effective application of EarthScope discoveries. In this presentation, we will outline major programs and products envisioned for EarthScope, plans for evaluating those programs locally and nationally, and mechanisms for collaborating with existing E&O programs.

URL: <http://www.earthscope-eon.org>

ED32E-05 1700h

IODP's Educational Potential: U.S. Scientists and Educators Speak Out

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A new era of scientific ocean drilling began in October 2003 with the launching of the Integrated Ocean Drilling Program (IODP). The U.S. science

community's participation in IODP will be facilitated and enhanced by a NSF-funded successor program to the existing U.S. Science Support Program (USSSP). In preparation, an education workshop, sponsored by USSSP was held in May 2003, opening a dialogue among 75 experts in science education, ocean drilling science, and communication. Its purpose was to propose a U.S.-focused education strategy for the IODP, partly as guidance for a future USSSP and partly as a U.S. contribution to educational planning efforts elsewhere in the international IODP structure. The workshop report is available at: www.joiscience.org/USSSP/education.html. The workshop's overarching recommendations aim to expand the role of education throughout IODP by building upon the successes of the activities that accompanied IODP's predecessor, the Ocean Drilling Program (ODP). A workshop consensus was that both IODP and the USSSP-successor program should have a clear commitment to education and outreach. Specifically, the U.S. program office should have sufficient staff to implement the following: 1) making ocean drilling research findings accessible to broad audiences through material and content; 2) creating avenues for professional development and teacher training; 3) offering K-20 student experiences; 4) identifying and fostering educational partners, networks, and opportunities for leveraging funds; 5) developing and maintaining an effective website for use by educators and other audiences; and 6) assessing its education activities. The potential for educational activities in IODP is promising on multiple levels. Planning for the international component of education in the IODP Central Management Office is underway, and additional educational opportunities will be available through the NSF-funded operation of a non-riser drill ship, which the U.S. is contributing to IODP. In addition, NSF is currently considering the response to their solicitation for proposals to manage a successor to USSSP, which will support the involvement of U.S. scientists in the new drilling program.

URL: <http://www.joiscience.org/USSSP/education.html>

ED32E-06 1715h

Innovations in Ocean Sciences Education at the University of Washington

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A new wave of education collaborations began when the national science education reform documents (AAAS Project 2061 and National Science Education Standards) recommended that scientific researchers become engaged stakeholders in science education. Collaborations between research institutions, universities, nonprofits, corporations, parent groups, and school districts can provide scientists original avenues to contribute to education for all. The University of Washington strongly responded to the national call by promoting partnerships between the university research community, the K-12 community and the general public. The College of Ocean and Fishery Sciences and the School of Oceanography spearheaded the creation of several innovative programs in ocean sciences to contribute to the improvement of Earth science education. Two of these programs are the REVEL Project and the Marine Science Student Mobility (MSSM) program that share the philosophy of involving school districts, K-12 science teachers, their students and undergraduate students in current, international, cutting-edge oceanographic research. The REVEL Project (Research and Education: Volcanoes, Exploration and Life) is an NSF-funded, professional development program for middle and high school science teachers that are determined to use deep-sea research and seafloor exploration as tools to implement inquiry-based science in their classrooms, schools, and districts, and to share their experiences with their communities. Initiated in 1996 as a regional program for Northwest science educators, REVEL evolved into a multi-institutional program inviting teachers to practice doing research on sea-going research expeditions. Today, in its 7th year, the project offers teachers throughout the U.S. an opportunity to participate and contribute to international, multidisciplinary, deep-sea research in the Northeast Pacific ocean to study the relationship between geological processes such as earthquakes and volcanism, fluid circulation and life on our planet. <http://www.ocean.washington.edu/outreach/revel/> The Marine Science Student Mobility program is a FIPSE-funded program that fosters communication and collaboration across cultural and linguistic boundaries for undergraduate students interested in pursuing careers in marine sciences. A consortium of six universities in Florida, Hawaii, Washington, Belgium, Spain and France offers a unique way to study abroad. During a six month exchange, students acquire foreign language skills, cultural awareness and ocean sciences field study in one of the four major oceanographic areas: the Atlantic, the Pacific, the Gulf of Mexico and the Mediterranean. The program not only promotes cultural understanding among the participant students but among faculty members from different educational

systems, and even among language and science faculty members. Understanding how different cultures approach, implement, and interpret scientific research to better study the world's oceans is the cornerstone of this educational approach. <http://www.marine-language-exch.org/> Similar collaborative, educational activities could be adapted by other research institutions on many campuses to provide many opportunities for students, teachers and the general public to get involved in Earth and ocean sciences.

ED32E-07 1730h

Education and Outreach Programs Offered by the Center for High Pressure Research and the Consortium for Materials Properties Research in Earth Sciences

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Major research facilities and organizations provide an effective venue for developing partnerships with educational organizations in order to offer a wide variety of educational programs, because they constitute a base where the culture of scientific investigation can flourish. The Consortium for Materials Properties Research in Earth Sciences (COMPRES) conducts education and outreach programs through the Earth Science Educational Resource Center (ESERC), in partnership with other groups that offer research and education programs. ESERC initiated its development of education programs in 1994 under the administration of the Center for High Pressure Research (CHIPR), which was funded as a National Science Foundation Science and Technology Center from 1991 to 2002. Programs developed during ESERC's association with CHIPR and COMPRES have targeted a wide range of audiences, including pre-K, K-12 students and teachers, undergraduates, and graduate students. Since 1995, ESERC has offered inquiry-based programs to Project WISE (Women in Science and Engineering) students at a high school and undergraduate level. Activities have included projects that investigated earthquakes, high pressure mineral physics, and local geology. Through a practicum known as Project Java, undergraduate computer science students have developed interactive instructional tools for several of these activities. For K-12 teachers, a course on Long Island geology is offered each fall, which includes an examination of the role that processes in the Earth's interior have played in the geologic history of the region. ESERC has worked with Stony Brook's Department of Geosciences faculty to offer courses on natural hazards, computer modeling, and field geology to undergraduate students, and on computer programming for graduate students. Each summer, a four-week residential college-level environmental geology course is offered to rising tenth graders from the Brentwood, New York schools in partnership with Stony Brook's Department of Technology and Society. During the academic year, a college-level Earth science course is offered to tenth graders from Sayville, New York. In both programs, students conduct research projects as one of their primary responsibilities. In collaboration with the Museum of Long Island Natural Sciences on the Stony Brook campus, two programs have been developed that enable visiting K-12 school classes to investigate earthquakes and phenomena that operate in the Earth's deep interior. From 1997 to 1999, the weekly activity-based Science Enrichment for the Early Years (SEEY) program, focusing on common Earth materials and fundamental Earth processes, was conducted at a local pre-K school. Since 2002, ESERC has worked with the Digital Library for Earth System Education (DLESE) to organize the Skills Workshops for their Annual Meeting and with EarthScope for the development of their Education and Outreach Program Plan. Future education programs and tools developed through COMPRES partnerships will place an increased emphasis on deep Earth materials and phenomena.