PolarTREC ensures up-to-date climate change science will permeate the K-12 education system long after the IPY. By infusing education with the cultural context.

We present the preliminary results of a collaboration between a middle school Environmental Science class, taught by an ARMADA Master Teacher, and a college Marine Environmental Science program using Oceanography topics and laboratories to reinforce New York City science standards. Specific topics within the regular middle school curriculum are chosen. After students have received regular instruction from the middle school teacher, including hands-on experiments, the college instructor visits the classroom and reinforces the object lesson. This is followed up by a visit to the college oceanography laboratory where students participate in a different hands-on experiment that reinforces the original topic. Students can use these experiences to develop and design simple research projects. Example using density and buoyancy will be presented.

ED13C-0613
Methods of Science Investigation Part 2: Results of Implementation of a Curriculum Fostering Original Scientific Research

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Originally designed to allow secondary students with special needs to participate in original scientific research, the Methods of Science Curriculum was piloted in 2008. Students participating included those with special needs, English language learners, and the general population. Students were incrementally graduated from traditional inquiry activities towards authentic student-generated research projects. Students were evaluated via class work grades, a pre/post test. 100 percent of participants successfully completed and presented their original research. The pre/post evaluation demonstrated improvement for 91 percent of participants. An unanticipated result was the performance and growth of English language learners, possibly because of the emphasis on the creative and active process of science rather than vocabulary. A teacher-training program is being developed for expansion of the curriculum to additional schools in 2009.

ED13C-0614
Downhill Connections: How Does Development Impact Southeastern Watersheds? COSEE-SE Professional Development Opportunity

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The patchwork design of meandering tidal creeks is a defining characteristic of the Southeastern coastline. The estuarine ecosystems that these creeks eventually flow into are revered for high biological productivity, ecological and economical value. Because of their intrinsic value, these areas are often preferred sites for human development which can be evidenced from the earliest coastal Native American settlement, the rice culture of the colonial south, and present day industrial and residential areas. In June 2008, the Center for Ocean Sciences Education Excellence SouthEast (COSEE-SE) conducted a week-long teacher professional development workshop using tidal creeks and estuaries as environmental teaching platforms to emphasize the interconnectedness of watersheds and impacts to their overall health. Formal and informal educators from North Carolina, South Carolina and Georgia interacted with local marine scientists to understand associated developmental impacts to water quality parameters, the health of resident and indicator species, and the introduction of non-native species. Educators were engaged with scientists in a variety of field experiences, laboratory exercises and lectures. Relevant classroom applications complemented the scientific information, facilitating the transition of information to students. This workshop is part of the Coastal Legacy series which occurs each summer and fosters relationships between the local science and education communities within a cultural context.

ED13C-0615
PolarTREC: Successful Methods and Tools for Attaining Broad Educational Impacts with Interdisciplinary Polar Science

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PolarTREC--Teachers and Researchers Exploring and Collaborating, a program of the Arctic Research Consortium of the U.S. (ARCUS), is a National Science Foundation (NSF)-funded International Polar Year (IPY) project in which K-12 educators participate in hands-on field experiences in the polar regions, working closely with IPY scientists as a pathway to improving science education. Developing long-term teacher-researcher collaborations through PolarTREC ensures up-to-date climate change science content will permeate the K-12 education system long after the IPY. By infusing education with the cutting edge science from the polar regions, PolarTREC has already shown an increase in student and public knowledge of and interest in the polar regions and global climate change. Preliminary evaluations have shown that PolarTREC's program activities have many positive impacts on educators and their ability to teach science concepts and improve their teaching methods. Additionally, K-12 students polled in interest surveys showed significant changes regarding the importance of understanding the polar regions as a person in today's world. Researchers have been overwhelmingly satisfied with PolarTREC and cited several specific strengths, including the program's crucial link between the teachers' field research experiences and their classroom and the
extensive training provided to teachers prior to their expedition. This poster will focus on other successful components of the PolarTREC program and how researchers and organizations might use these tools to reach out to the public for long-term impacts. Best practices include strategies for working with educators and the development of an internet-based platform for teachers and researchers to interact with the public, combining several communication tools such as online journals and forums, real-time Internet seminars, lesson plans, activities, audio, and other educational resources that address a broad range of scientific topics. These highly relevant, adaptable, and accessible tools and resources are available to educators across the globe and have connected thousands of students and citizens to the excitement of polar science. PolarTREC provides a tested approach and a clear route for researcher participation in the education community, facilitating increased educator, student, and community understanding of science and the polar regions during times of intertwined global change. For more information, visit the PolarTREC website.

http://www.polartrec.com

ED13C-0616

FOREST WATCH: A K-12 OUTREACH PROGRAM TO ENGAGE YOUNG STUDENTS IN AUTHENTIC, HANDS-ON SCIENCE

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The Forest Watch Program is a K-12 science outreach program developed at the University of New Hampshire (UNH) in 1991. The program engages pre-college teachers and their students in assisting researchers at UNH in the assessment of the state-of-health of white pine (Pinus strobus), a known bio-indicator species for exposure to elevated levels of ground-level ozone. Students participate in three types of activities: 1. selection, collection, and analysis of needle samples from five permanently tagged white pine trees near their school; 2. Study of needles in their classroom and sending a set of needles to UNH for spectral analysis; and 3. analysis of remote sensing data (Landsat TM) provided of their local area using freeware software (MultiSpec). Student-derived foliar symptomology, needle length, needle retention, and tree biometrics, plus the spectral indices, allow UNH researchers to characterize annual variations in tree state-of-health, and to correlate that state-of-health with annual summer ozone levels collected by the EPA and state environmental monitoring networks. The results suggest that regional air quality and state-of-health of trees has improved dramatically since 1991. Annual student data and the yearly spectral variations, for the same trees, suggest that white pine health has improved dramatically since 1997/8. This improvement in tree health corresponds with improved regional air quality. An evaluation of student data reliability has been conducted and suggests that the DBH measurements are a most reliable indicator of tree growth. Student data are more reliable if multiple sets of measurements are made and averaged together, compared with single sets of measurements. Based on both student data and spectral analysis of student-provided branch samples, the greatest damage (chlorosis) occurs in trees located along the vaccinated areas. Participation in Forest Watch introduces students to the scientific method via an authentic research program. The program is designed in partnership with participating teachers, and thus meets New England state science and mathematics curricula for K-12 education. Student participation in Forest Watch has resulted in an improved understanding of inter-annual white pine state-of-health response to improved air quality across the New England region.

ED13C-0617

A Teachers at Sea Program on Board the R-V Marion Dufresne (IPEV) in the Atlantic Ocean.

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With the support of the French Polar Institute (IPEV) and of the European Geosciences Union (EGU), a program for High Schools was conducted along side the scientific work on board the Marion Dufresne, during the MD168 AMOCINT, IMAGES-XVII cruise. 5 teachers from France, Norway, Portugal, Spain and the United States of America, were invited to participate to the cruise. The teachers' program was to participate to the scientific activities on board and to relate these activities to many schools around the world. In order to be fully immersed in the scientific work, the teachers participated together with the scientists and technicians on board to two 4-hours shifts per day (8h total per day). During these shifts, they were involved in every step of the process of selecting the cores, cutting, opening and labeling them, archiving, and measuring some of the physical parameters, and finally sediment description. It was possible to establish almost daily reports of the scientific progress of the cruise and to send regular logs to the participating land-based teachers in different schools mainly in Europe and in the USA, taking advantage of a list of addresses of teachers having participated to the Geosciences Information for teachers (GIFT) workshops of the European Geosciences Union. Although many schools were already closed for summer vacations during most of the cruise, we received some enthusiastic responses from many teachers, and the material sent will be used in the classrooms from the beginning of the 2008-2009 school year. Also, taking advantage of the large amount of sediment collected by the CASQ corer, we have systematically taken part of the sediment for the schools. We have written some simple instructions on how to extract foraminifera from the sediment, how to identify the clearest warm and cold species, so that the teachers will be able to show that at any particular site there have been significant climatic fluctuations in the past. This should bring authentic science in the classrooms.

ED13C-0618

Graduate student involvement with designing inquiry-based Earth science field projects for the secondary-level classroom

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In a secondary-level Earth System Science (ESS) curriculum, the most authentic learning is achieved through the inquiry-based application of real-world research methods in the context of modern understanding of the interconnected components of the Earth System (e.g. lithosphere, hydrosphere, atmosphere, and biosphere). Following the intensive ESST-1 summer institute at UNH, during which teachers enhance their ESS content knowledge via interactions with UNH faculty, staff, and graduate students, each participating student is paired with one graduate student fellow for the duration of the school year. This graduate fellow provides a continuing link between the secondary-level school teaching environment and university resources, facilitating the implementation of new content knowledge and current scientific research methodology into the classroom setting. According to the National Science Education Standards (1), scientific inquiry is the central strategy for teaching science. "In successful science classrooms, teachers and students collaborate in the pursuit of ideas... Students formulate questions and devise ways to answer them, they collect data and decide how to represent it, they organize data to generate hypotheses, and they test the reliability of the knowledge they have generated. As they proceed, students explain and justify their work to themselves and to one another, learn to cope with problems such as the limitations of equipment, and react to challenges posed by the teacher and by classmates." To speak to these goals, an ongoing local wetland field study has been conceptualized and implemented in three example classrooms (seventh grade general science, ninth grade physical science and tenth grade biology) in two school systems (Oyster River Middle School in Durham, NH and Berlin
I-LLINI Partnerships for 21st Century Teachers

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I-LLINI Partnerships is a two-year State funded program to initiate enhance communication between the faculty at University of Illinois and K-12 teachers in the surrounding communities. The program focuses on math and science with a particular emphasis on the use of technology to teaching math and science to middle-school aged children. The Partnership provides participating teachers with a suite of technology including a computer, digital camera, and software, as well as a small stipend. University partners include representatives from the Departments of Mathematics as well as the Department of Atmospheric Sciences and the Department of Geology. The Atmospheric Sciences and Geology faculty have partnered to provide content using an Earth System Sciences approach to presenting content to the teachers. Additionally, teachers provide feedback to university faculty with relation to how they might better prepare future science teachers. Teacher participants are required to attend a series of workshops during the academic year as well as a summer workshop. The first workshop was held June 2008 at the University of Illinois campus. Our poster will highlight the first workshop providing a discussion and photographs of the activities, an analysis of the benefits and challenges - both to the university representatives as well as the teachers and a summary of future changes planned for the 2009 summer workshop. During the second morning of the workshop, the science teachers participated in an EcoBlitz via a field trip to a collect data from a stream near campus. During the EcoBlitz, math teachers attended tutorial sessions on TinkerPlots software. The EcoBlitz teachers were provided with instruments and equipment necessary to collect data on the weather conditions and water quality of the stream. Instruments included a temperature probe, turbidity sensor, dissolved oxygen sensor and a hand held weather instrument. Data was recorded with Vernier LabQuest data loggers. The participants also took pictures with the digital cameras provided through the partnership. During the afternoon session, water and air data was analyzed using TinkerPlots. The science teachers helped the math teachers understand the process of data collection, the physical environment where data was collected and the limitations of the instruments. The math teachers helped the science teachers to use the TinkerPlots software and find statistical representations of the data. A group discussion ensued with regard to the meaning of various statistical measures such as average and median and what they really mean when using real data. Feedback from the teachers was overwhelmingly positive, in particular the modeling of using science data to understand mathematical concepts. Several teachers planned to borrow the instruments and conduct similar activities in their science and math classrooms. Future work include conduct workshops for the participating teachers throughout the academic year to solicit from in-service teachers how university level science classes can be better tailored to pre-service teacher needs.


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Earth science provides an ideal opportunity to integrate authentic research into middle and high school curricula by providing a context for teaching scientific content, promoting a sense of intrigue through the inquiry process, and sharpening skills needed for future scientific endeavors. The University of New Hampshire's offerings as part of the Transforming Earth System Science Education (TESSE) program provide for the professional development of in-service and pre-service middle and high school science teachers. A centerpiece of the TESSE program is an entry-level accelerated course in Earth Systems Science (Earth System Science for Teachers, ESST-1). Participants in the ESST-1 course include current and prospective teachers wishing to improve their Earth science content background or those interested in updating their traditional content background to include a systems approach. Time scale and system interactions significant in the Earth System are introduced through authentic research conducted during field trips, research experiences and working with long-term datasets. Teachers are trained in keeping a field notebook, making field observations, and drawing conclusions based on this evidence. Combining these techniques with digital photography, teachers document evidence of Earth system processes and their associated timescales, presenting their findings in a peer-group poster session. Teachers also participate in research-based field trips to the local estuary and a wetland research site. During the following school year, the teachers are paired with science graduate fellows to integrate inquiry-based research with existing curricula. These classroom collaborations include measurement techniques, process skills and methods of communicating evidence learned during the summer institute that are then incorporated into the classroom activities. In addition to effecting change at the curriculum-development level, the graduate fellows paired with the first cohort of ESST-1 teachers were also able to work with students individually on mini-research projects.

MRO’s HiRISE Education and Public Outreach during the Primary Science Phase

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Looking back over one Mars year, we report on the accomplishments of the HiRISE EPO program during the primary science phase of MRO. A highlight has been our student image suggestion program, conducted in association with NASA Quest as HiRISE Image Challenges (http://quest.arc.nasa.gov/challenges/hirise/). During challenges, students, either individually or as part of a collaborative classroom or group, learn about Mars through our webcasts, web chats and our educational material. They use HiWeb, HiRISE’s image suggestion facility, to submit image suggestions and include a short rationale for why their target is scientifically interesting. The HiRISE team gives priority to obtaining a sampling of these suggestions as quickly as possible so that the acquired images can be examined by the students. During the challenge, a special password-protected web site allows participants to view their returned images before they are released to the public (http://marsweb.nasa.gov/hirise/quest/). Students are encouraged to write captions for the returned images. Finished captions are then posted and highlighted on the HiRISE web site (http://hirise.lpl.arizona.edu) along with their class, teacher’s name and the name of their school. Through these HiRISE challenges, students and teachers become virtual science team members, participating in the same process (selecting and justifying targets, analyzing and writing captions for acquired images), and using the same software tools as the HiRISE team. Such an experience is unique among planetary exploration EPO programs. To date, we have completed three HiRISE challenges and a fourth is currently ongoing. More than 200 image suggestions were submitted during the previous challenges and over 85 of these image requests have been acquired so far. Over 675 participants from 45 states and 42 countries have registered for the previous challenges. These participants represent over 8000 students in grades 2 through 14 and consist primarily of teachers, parents of homeschoolers and student clubs, college students, and life-long learners. HiRISE Clickworkers (http://clickworkers.arc.nasa.gov/hirise), a citizen science effort is also part of our EPO where volunteers identify geologic features (e.g., dunes, craters, wind streaks, gullies, etc.) in the HiRISE images and help generate searchable image databases. We’ve also developed the HiRISE online image viewer (http://marsweb.nasa.gov/HI/HiRISE/hirise_images) where users can browse, pan and zoom through the very large HiRISE images from within their web browser. Educational materials include an assortment of K through college level, standards-based activity books, a K through 3 coloring/story book, a middle school level comic book, and several interactive educational games, including Mars jigsaw puzzles, crosswords, word searches and flash cards (http://hirise.seti.org/epo). HiRISE team members have given numerous classroom presentations and participated in many other informal educational and public events (e.g., Sally Ride Science Festivals, CA Science teachers conference workshops, NASA’s Yuri’s Night, Xprize events, University of Arizona’s Mars Mania and Phoenix public events). The HiRISE operations team maintains a blog (HiBlog) (http://hirise.lpl.arizona.edu/HiBlog/) providing insights to the pulse of daily activities within the operations center as well as useful information about HiRISE.

ED13C-0622

Bring the Process of Science to Life! Use Galileo's Historic Observations to Celebrate the International Year of Astronomy 2009

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The International Year of Astronomy 2009 was conceived to honor the 400th anniversary of Galileo’s first telescopic observations in 1609. Galileo gave priority to evidence over popular belief. This completely changed the existing world view and formed the basis for the modern scientific process. Galileo’s work provides an example of how science is grounded in evidence rather than belief or opinion. The goal of this project is to present K-16 instructors with an alternative to the traditional scientific method unit. We will briefly describe two activities that model Galileo’s telescopic observations of Jupiter and Venus and simultaneously build abilities and understandings of scientific inquiry. Participants will learn about activities where students record and analyze data, make predictions, use multiple forms of evidence, and use a variety of models to find support for a heliocentric solar system. Materials will be available for download for those interested in using this in their classroom as well as for the purpose of training other teachers.

http://www.astrosociety.org/education/slooh/teachers.html

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