**10:30 AM** Prothero, William A.

LEARNING FROM EARTH DATASETS IN A LARGE GENERAL EDUCATION OCEANOGRAPHY COURSE

Prothero, William A, Dept. of Geological Sciences, C. Julie Esch, Graduate School of Education, Gregory Kelly, Graduate School of Education, University of California, Santa Barbara, CA, 93106

Incorporating real earth science data into the learning environment helps students experience the activities of practicing scientists and the excitement of scientific discovery. Our goal is for students to increase their understanding of the work of scientists and enable them to more effectively interpret scientific claims that affect public policy.

Students are provided with elevation, earthquake hypocenter, seafloor age, heat flow, island age and volcano data on the 'Our Dynamic Planet' CDROM and use its display tools to find evidence to support the theory of plate tectonics. Students complete a series of exercises that result in a scientific paper that counts for 30% of their course grade. In order to successfully complete the paper, they must pose a solvable problem, gather relevant data, present preliminary results, and write the paper ( about 1800 words long).

Our teaching and research indicate that students are poorly prepared to conduct and report on a sciencific investigation. Students have difficulty: a) getting started soon enough, b) choosing a problem, b) interpreting data plots and graphs, c) arguing from evidence, and d) the format of a scientific paper. Our approach to these issues is to develop exercises that explicitly show students the rhetorical elements of a scientific argument and provide 'live' and online practice for them. These exercises concentrate specifically on a) making and describing observations, b) naming and classifying geological features, c) making meaning from the data, and d) correlating and interpreting features relative to a model.

Work on the evaluation of these methods is in progress by Ms. C. Julie Esch. Preliminary results for Spring 00 shows that student papers and attitudes are improved, and that further work on our approach will increase its effectiveness further. Wide variations in student abilities, motivation and other conditions makes it difficult to compare learning improvements between different classes. However, a steady improvement in student writing has occurred as the teaching methods have improved since the writing assignment was first initiated in 1995.

See: http://oceanography.geol.ucsb.edu/

**10:45 AM** Sweeney, William

INNOVATIVE APPROACHES TO TEACHING INTRODUCTORY VOLCANOLOGY

HARPP, Karen S., kharpp@mail.colgate.edu; SWEENEY, William; OTTO, Robert H.; and WANLESS, Virginia, Colgate University, Geology Dept., Hamilton, NY 13346.

Many of the principles encountered in introductory volcanology are sufficiently abstract that students have difficulty applying them to real situations. Consequently, we have developed a series of hands-on, discovery-based activities to make the concepts behind volcanology more dynamic and accessible. Examples include: a) investigation of the principles behind magma properties through student-designed viscosity experiments (e.g., how does temperature or phenocryst abundance affect viscosity?); b) exploration of the effect of cooling rates on crystal size using CuSO4 precipitation experiments; c) examination of real seismic datasets to elucidate magmatic plumbing systems; d) exploration of processes behind volcanic landforms through construction of models reproducing actual volcanic structures, which students choose through study of volcano website images. Other activities run throughout the term, such as monitoring the behavior of a currently active volcano through subscription to the VOLCANO Listserver and access to appropriate websites.

The difficulties involved in making decisions regarding volcanic risk are explored through a detailed case study that can extend from 2 weeks to the entire semester. Participants are divided into groups representing the major players in an actual volcanic risk assessment situation, and are oriented to a real volcano and its surrounding area (e.g., Mt. Rainier). Over the course of the exercise, each group receives data drawn from real examples (e.g., seismic and eruptive events), tailored to the information each group would receive in an actual situation. Students are faced with constantly evolving conditions requiring them to analyze data as it becomes available and to come to a consensus periodically regarding the safety of the region's inhabitants. The exercise culminates with students debating the proper course of action as events begin to unfold rapidly, culminating in a major volcanic (and class) event (or not!). The tactics chosen by each group are then analyzed and critiqued by the class, with special emphasis placed on the problems associated with risk assessment.

Many of the exercises we will present are grounded in the use of actual data, which students collect from web-based sources; the development of a resource such as DLESE is essential to foster further evolution of such integrated, investigation-driven activities.

**11:00 AM** Massey, Christine A.

DIGITAL ARCHIVE OF HUMAN-INDUCED LANDSCAPE CHANGE WITH K-16 STUDENTS IN VERMONT

MASSEY, Christine A., Education and Geology Departments, cmassey@zoo.uvm.edu; MALLARD, Laura D., Geology Department; BIERMAN, Paul R., Geology and Natural Resources Departments, University of Vermont, Burlington, VT 05405-0122

With NSF funding, we provide research experiences for Vermont high school students and teachers in an ongoing project that documents 150 years of human-induced landscape change in Vermont. Students locate and scan historic photographs depicting local landscapes and rephotograph the sites digitally. Students help create digital versions of their findings for the University of Vermont (UVM) 'Digital Archive of Human-Induced Landscape Change' website (http://geology.uvm.edu/landscape). The website houses a statewide database of historical/modern image pairs with text describing the historical context. The database is searchable by location within Vermont (town, county, and school) and also by geomorphic process responsible for landscape changes (landslide, flood, deforestation, etc.). Our work with Vermont students and teachers transfers easily to other parts of the world, and the digital archive remains a permanent record for future researchers.

Pilot studies with two high schools provided 50 students and three teachers opportunities to investigate local Vermont landscapes in three counties and allowed us to hone the program. Summer research with a UVM undergraduate and a motivated high school student investigated another 67 towns in 14 counties. In the coming 2000-2001 school year, students from 16 more schools will participate, bringing the coverage to 50% of the towns in Vermont. At a culminating conference and poster session, over 300 students will showcase their research findings to their peers, teachers, and UVM faculty.

Our work with teachers and K-16 students provides interdisciplinary opportunities to explore earth science, environmental science, historical research, geographic studies, creative writing, and the scientific method. The Vermont Framework of Standards and Learning Opportunities outlines these content and skill areas as a required part of the Vermont curriculum for high school students. The Vermont Framework also helped shape the teacher and student manuals we created for use with the classroom technology (GPS, digital cameras, scanners, and iMac computers).

**11:15 AM** Kern, Doug 52334

TENNESSEE HOLLOW RESTORATION AND ENVIRONMENTAL EDUCATION PROGRAM

KERN, Doug, Urban Watershed Project, P.O. Box 29096, San Francisco, CA 94129, dkern@kernsite.com; MACKIE, Jannine, UC Berkeley, 16 Alalaya Terrace, San Francisco, CA 94117; BERRY, William, Geology Dept., UC Berkeley, 307 McCone Hall, Berkeley, CA 94720

The Tennessee Hollow watershed is a unique 250-acre natural setting in the Presidio of San Francisco, a former U.S. Army base and now an urban National Park. Nearly 150 years of human activities have altered the landscape and forced creeks into culverts and concrete-lined ditches. Invasive vegetation, crisscrossing roads and deteriorated utilities negatively impact the site. Despite the degradation, significant opportunities exist for habitat restoration and associated environmental education opportunities. The Urban Watershed Project (UWP), a non-profit environmental organization, is developing restoration plans for Tennessee Hollow. The restoration program will create rare, continuous riparian habitat from headwater springs to tidal marsh. Valuable ecosystems such as serpentine grassland and coast live oak riparian forest will be established. The project will eventually support diverse native plant and animal communities in a densely populated urban environment. High school and college students are involved in collecting data for water quality studies, eradicating invasive species and enhancing riparian vegetation. The Urban Watershed Project has produced a web site for geoscience education studies focusing on the hydrologic cycle, restoration planning, climate and wave height forecasting, pollution and contamination issues. We are actively working with high school environmental science leaders to develop web-based digital learning materials that are seamlessly integrated with in-class lectures, labs, field trips and on-going data collection efforts. Environmental data will be uploaded to a central web-site for further analysis by students from around the San Francisco Bay Area. This paper will describe web-based education efforts by the Urban Watershed Project and document the community/agency/institutional collaborations, water quality monitoring activities and environmental restoration and education programs now underway.

**11:30 AM** Mackie, Jannine A.

EASING ACCESS TO EDUCATIONAL RESOURCES

MACKIE, Jannine A., UC Berkeley, 16 Alalaya Terrace, San Francisco, Ca 94117, jannine@lycos.com; KERN, Doug, Urban Watershed Project, P.O. Box 29096, San Francisco, Ca 94129-0096; BERRY, William, UC Berkeley, 307 McCone Hall, Berkeley, Ca 94720-4767

The Environmental Science Interactive University project unites the outreach efforts of UC Berkeley and the Urban Watershed Project, a nonprofit environmental organization. The cooperative effort of these two organizations works to create enriched educational opportunities for students from inner city K-12 schools so that they may be more appropriately qualified to enter undergraduate studies. The World Wide Web has played an integral role in this effort by facilitating constructive dialogue between educators, students, scientists and curricula designers in addition to providing greater access to and distribution of valuable resources that enhance Geoscience education. Our website (http://www.kernsite.com/uwp/waterqua.htm) contains lessons and modules covering such topics as the hydrologic cycle, water quality, climate and wave height forecasting and watershed restoration planning. This site hosts the data exchange of water quality data compiled on spreadsheets where they are made available to others for comparative analyses and used in the planning of the watershed restoration. Students unable to come to the Presidio National Park are able to experience a 'virtual tour' where they are asked to think critically about ground and surface flow, human impact, riparian vegetation and current management practices. Educational resources made available via the website include online syllabi, discussion boards between teachers and chat rooms with professionals in various scientific fields. The downloadable environmental science syllabus and teacher's guide includes a scope and sequence, reference materials, case studies, hyperlinks to related sites, visual aids to be used during lecture, lesson plans, and laboratory activities. The discussion boards between teachers acts as an arena for sharing successes, supportively offering solutions to classroom challenges as well as keeping all participants abreast of current events. The weekly online chat room consists of an expert who is interviewed by students who are given current periodicals and biographical information on the expert and their field. The success of these outreach efforts lies in the increased dissemination of eduactional resources via the WWW.

**11:45 AM** King, Helen L.

THE NATIONAL SUBJECT CENTRE FOR GEOGRAPHY, EARTH AND ENVIRONMENTAL SCIENCES: PART OF A NEW LEARNING AND TEACHING SUPPORT NETWORK IN THE UK

KING, Helen L., National Subject Centre for Geography, Earth & Environmental Sciences, University of Plymouth, Drake Circus, Plymouth PL4 8AA, UK, h.king@plymouth.ac.uk

In January 2000, the higher education funding bodies of England, Wales, Scotland and Northern Ireland launched the Learning and Teaching Support Network (LTSN: http://www.ltsn.ac.uk). The Network consists of 24 Subject Centres supported by a Generic Learning and Teaching Centre and a Technology Integration Centre. The aim of the Network is to promote high quality learning and teaching in all subject disciplines in higher education throughout the UK.

The National Subject Centre for Geography, Earth and Environmental Sciences (GEES: http://www.gees.ac.uk) is based at the University of Plymouth. The Centre intends to become a major national and international hub in the exchange of knowledge on learning and teaching across the three subjects. Its principal aim is to encourage and disseminate good practice and it will achieve this through conferences, workshops, newsletters and other communications.

The Centre was developed through a collaboration of professional bodies, Heads of Department Committees and senior academics from the three disciplines, and builds on a wealth of experience and expertise in learning and teaching practice and innovation.

The aims of this presentation are to inform the audience of this major UK initiative and to encourage the discussion of common issues and the sharing of resources between the GEES Subject Centre and relevant international bodies (such as the GSA and NAGT).



SESSION 93, 08

Tuesday, Noven

T147. From the Experience--Int Undergraduate Undergraduate National Associ

Atlantis

BTH 1 Allen, Jo

STUDENT-DESIGNED FIEL CLASSROOM

ALLEN, Joseph L., Dep 24712-1000, allenj@co

ntroductory geoscience cou r thematic or integrated sc Concord College, the introdu ogy course to a combined pl Earth Processes and the En science students, as an intro integrated science requireme

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College freshmen are ger mentally based fields in the p empirical nature of geologic and has helped students of a

BTH 2 Bazard, D

A STRATIGRAPHY PROJE NTRODUCTORY GEOLOG

BAZARD, David R., Sci Rd., Eureka, CA 95501.

A comprehensive, experienti out an introductory course a us subdisciplines. This expe is based on local field rese tions and laboratory analyse

This project is divided int the stratigraphy of one or mc levels, clinometers, sample c analysis. Samples are sieved ion tests. Measurement data general age and regional ge stratigraphic columns, locatic interpretation of results (e.g.,

Several educational goals through inquiry-oriented acti the importance of individual oratory methods, report writi and discover the interrelated stratigraphy, plate tectonics, with references to data has t their conclusions are 'right'. T ions, and the nature of hypo desirable. The project does r ods); however, I have observ here during other traditional hat they are doing science r disciplines and individualized

BTH 3 Bykerk-K

THE MOON PROJECT: STU COURSE FOR PRE-SERVI

BYKERK-KAUFFMAN, Chico, CA 96929-0205.

Students cannot fully unders must experience scientific re rience. But it is very difficult t boy-level classes typically ta

In an attempt to meet this the moon. The moon is intere ace required; and observatior period, students make daily data (such as moonrise/set t to the moon. Specific questic dents include:

-Which way does the moon