Moving Data Based Inquiry Learning to the Internet, DUE-0231414
by William Prothero and Gregory Kelly University of California, Santa Barbara
http://oceanography.geol.ucsb.edu/~gs4/

Major activity:
The specific goal of this project is to create a well-researched oceanography course, live and online, widely disseminated, with a modern inquiry based pedagogy. The design focuses on science literacy using real earth data, collaboration between learners, and a strong connection to societal issues.

Approach:
This project involves the refinement of existing and new software and course materials that enable online auto-graded homework assignments, scientific writing activities, on demand grade calculation, peer interaction, integrated access to real earth data, with powerful instructor assessment capability. It has been tested, refined, and evaluated in 4 live oceanography classes at UCSB. New capability is being created to support fully online courses. It will enable collaborative online projects with strong peer to peer interactions, and calibrated peer review writing activities.

Online technology offers:
- access to live and archived earth data
- online collaboration
- auto-graded homework assignments
- on-demand grade calculation
- student progress tracking by the instructor and TA's.
- accountability for doing work on time
- management of the products of student work e.g. writing assignments and presentations

Goals for online support software:
- support maximum student learning with minimum instructor effort.
- accountability for students, teaching assistants, and the instructor.

EarthEd Online is:
- Authored with Macromedia Director
- A stand-alone browser, delivered on CDROM
- connected to a web server through the internet
- automatically upgraded from server
- cross platform: Macintosh and PC
- modular: new modules can be added easily
- easily configured for the needs of a variety of courses. Assignments are stored on the class web server.

Dissemination:
1) EarthEd Support Team: an advisory board of 10 experienced teachers meets in a yearly workshop to evaluate and advise the PI's on future directions. Two of these have agreed to implement the EarthEd Online software in their classes in Fall 2004.
2) Workshops at professional meetings: A workshop at the Fall 2004 GSA meeting is planned. It will focus on the implementation of data exploration and writing activities using the "Our Dynamic Planet" and "Global Ocean Data Viewer" CDROMs.
3) Software source code will be made freely available.

Dissemination challenges:
1) Maintenance: software needs regular upgrading in response to technology changes, evolution and bugs.
2) Evolution: ideas evolve, added features and refinements provide a constant challenge for the developer.
3) Support: faculty need technical support for implementation issues.
•• Some kind of economically sustainable support system must be developed.

Threaded discussions:
threaded discussions facilitate class interactions. EarthEd is unique in its support for graphics and graphics editing. Each student has a personal graphics library, which contains images that can be linked to their postings.

Online writing:
The "Writer" supports guided writing exercises. Students write, edit and link graphic images to their writings, and hand in the work online. Papers are graded and returned online.

Plug-in Earth data modules
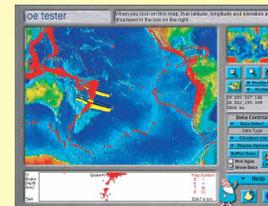
Our Dynamic Planet:
This provides the student with access to earth data in support of plate tectonics. Elevation, seafloor age, volcanoes, heat flow, island ages, and other data can be displayed, captured, and images uploaded to the student's personal graphics library.
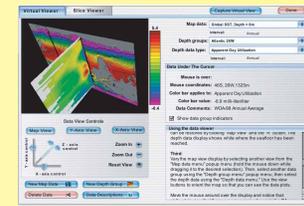
World Ocean Data Viewer:
This displays data from the World Ocean Atlas-98. It uses the ESRI imaging engine to create images using IDL programs. It was a cooperative project with New Media Studio. The figure above shows a 3D display of a depth slice.

Marine Virtual Explorer:
A virtual tour of the East Pacific Rise at 9N. Students navigate a virtual "Alvin" and make a geological map of the area.

World Ocean Data Viewer:
Slice viewer that allows quick data browsing.

Evaluations, and lessons learned:
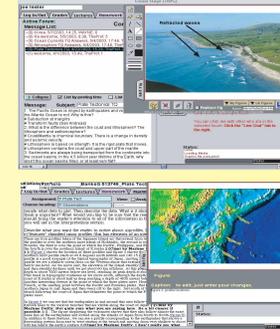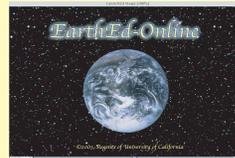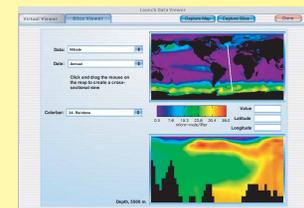1) Students rate the course activities according to their perceived contribution to their learning.

Student Feedback

	High: A	B	C	D	E : Low
Lecture	17,	10,	27,	18,	27
Labs	**42,**	**28,**	**21,**	**8,**	**1**
Kyoto Conf	26,	31,	23,	14,	6
Thought questions	14,	22,	27,	27,	11
Questions of the Day	9,	25,	27,	23,	16
Weekly quizzes	18,	33,	25,	15,	9
Weekly homeworks	19,	28,	27,	15,	11
Writing assignments	31,	37,	19,	6,	6
Course was difficult	16,	22,	37,	14,	11
Interesting and relevant	20,	42,	23,	9,	6
Worked hard	40,	24,	22,	9,	5
Learned a lot	28,	30,	14,	17,	11

2) Studies of student writing: we have published 6 papers where we analyze student writing to identify issues that will help us teach scientific writing more effectively. The latest development we are focussing on is the incorporation of "Calibrated Peer Review" (see http://cpr.molsci.ucla.edu/) activites. This method allows students to analyze examples of writing and effectively evaluate their peers' writing. We expect this to improve student learning whle reducing TA workload at the same time.

3) Activities are based on practices already established through research on learning (e.g. *How People Learn*, Nat Acad Press, 2000. Writing which includes analysis and synthesis requires acvtivities at the highest cognitive level (Bloom, *Taxonomy of Educational Objectives: The Classification of Education Goals*, 1956)