EarthEd Online: Open Source Online Software to Support Large Courses
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Context:

General education science courses serve as one of the few science courses most of college students take. These students become politicians, lawyers, accountants, and teachers. As such, they may be the most important audience for increasing science literacy in our general population.

General education science courses have evolved, in many institutions, into very large, lecture-based classes with a small number of graded activities and machine-graded exams based on multiple choice questions. Education research shows that this environment is ineffective when compared to "hands-on" or "inquiry" pedagogies where students take an active role in their learning.

Large lecture classes present enormous obstacles for the teaching faculty. Among these are:
- passive students who do the minimum
- students cannot track their progress
- instructors cannot track student progress
- simple assignments lead to time-consuming and tedious secretarial work
- minimal communication
- poor attendance at lectures
- instructor out of touch with students

Online Technology offers:
- auto-graded homework assignments
- on-demand grade calculation
- student progress tracking by the instructor and TA's.
- accountability for doing work on time
- on-line discussions
- 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.
- incorporate accountability for students, teaching assistants (the instructor is already accountable).

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.

About Macromedia Director:
Director is a powerful multimedia authoring system that is an industry standard for the delivery of rich multimedia content. It can be delivered as a stand-alone application or over the internet within a web browser ("Shockwave").

Important features are built-in 3D, internet connectivity (get, put, post, etc), and external code expandability using modules called "Xtras." A helpful developer community provides ideas and support through a listserve.

EarthEd History
- Began development of "Our Dynamic Planet" in 1993, using Hypercard, and used since 1994.
- EarthEd used in a large general education oceanography course for 3 quarters (1/year)

EarthEd Modules

Login: The student selects the class and enters a name, a 6 digit ID, and a password. the login time is recorded in the class database.

Work a homework assignment:
EarthEd accommodates multiple choice, multiple choices from a list, numeric entry, and thought question entry. Numeric entry requires the correct units and significant figures (if desired). Except for thought question entry, all are automatically graded.
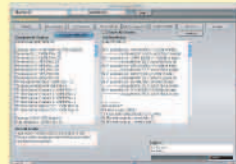
Calculate a grade:
Students can calculate their current course grade at any time. This is highly motivating. Students may work the homework assignments multiple times to get the highest score. Penalties are automatically applied to late work. This solves the difficult problem of distributing grades but maintaining privacy.


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.
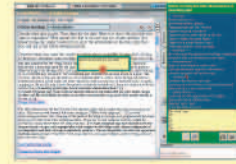
Online commenting and grading:
The TA or Professor enters online comments and grading rubric scores, and returns in online. This is not only efficient, but maintains a record of all actions by both student and TA.

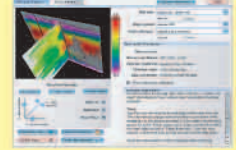## Plug-in Earth data modules
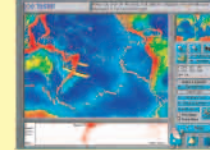
Our Dynamic Planet:
This provides the student with access to earth data in support of plate tectonics. Elevation, seafloor age, volcanoes, heat flow, island ages, and other data can be displayed, captured, and images uploaded to the student's personal graphics library.
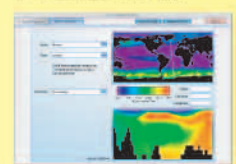
World Ocean Data
Viewer: This displays data from the World Ocean Atlas-98. It uses the ESRI imaging engine to create images using IDL programs. It was a cooperative project with New Media Studio. The figure above shows a 3D display of a depth slice, using the Macromedia 3D capability.

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.

Other EarthEd capabilities: normal and curved grade entry, assignment score summary, efficient collection of BBS entries and grade entry, integrated image upload,....

Open source: I invite others to collaborate with me in developing and using this software. NSF has the CCLI Adaptation and Implementation program, which is directed at this kind of project. Technical support is available through joint projects with New Media Studio. The World Ocean Data Viewer project was done in cooperation with them. They did the interface to IDL and the IDL coding. New Media Studio will be the interface between other users and the EarthEd software system.