Learning Through Collaborative Visualization
A National Science Education Collaboratory

Overview of the CoVis Project

Traditionally, K-12 science education has consisted of the teaching of well-established facts. This approach bears little or no resemblance to the question-centered, collaborative practice of real scientists. Through the use of advanced technologies, the CoVis Project at Northwestern University is attempting to transform science learning to better resemble the authentic practice of science.

The CoVis Project explores issues of scaling, diversity, and sustainability as they relate to the use of networking technologies to enable high school students to work in collaboration with remote students, teachers, and scientists. An important outcome of this work will be the construction of distributed electronic communities dedicated to science learning.

Participating students study atmospheric and environmental sciences through inquiry-based activities. Using state of the art scientific visualization software, specially modified to be appropriate to a learning environment, students have access to the same research tools and data sets used by leading-edge scientists in the field.

The CoVis Project provides students with a range of collaboration and communication tools. These include: desktop video teleconferencing; shared software environments for remote, real-time collaboration; access to the resources of the Internet; a multimedia scientist’s notebook; and scientific visualization software. In addition to deploying new technology, we work closely with teachers at participating schools to develop new curricula and new pedagogical approaches that take advantage of project-enhanced science learning.

“Collaborative Visualization” thus refers to development of scientific understanding which is mediated by scientific visualization tools in a collaborative context. The CoVis Project seeks to understand how science education could take broad advantage of these capabilities, providing motivating experiences for students and teachers with contemporary science tools and topics.

The next decade will bring widespread, networked multimedia interpersonal computing. The CoVis Project is a blueprint to inform educators, researchers, and policy makers on the effective and sustainable use of interpersonal, collaborative media in science education.

School Participants
• 50 schools in the U.S. working towards project-based approaches to science learning; connected via Internet videoconferencing and other computer mediated communication and collaboration tools and scientific visualization tools; using medium to high speed data networks.
• Hundreds or thousands of schools utilizing a Geosciences Web Server for curriculum support, project and activity ideas, and access to datasets and analysis tools.

Research Emphases
• Remote Collaboration
  Student-to-student
  Student-to-mentor
• Scientific Visualization for learning
• Networking Infrastructures
• Classroom Management
• Assessment Strategies
• Desktop audio/video teleconferencing
• Documenting concepts and skills acquired through Project-Enhanced Science Learning, and how teaching-learning processes are transformed

Sponsors
National Science Foundation program in Networking Infrastructures for Education
Illinois State Board of Education/Eisenhower

Research Partners
• The Exploratorium Museum
• Department of Atmospheric Sciences
  U. of Illinois at Urbana-Champaign
• SRI International
• Bellcore

Industry Partners
• Aldus Software
• Ameritech
• Apple Computer
• Farallon Computing
• ScienceKit/Boreal Labs
• Sony
• Spyglass, Inc.
• Sun Microsystems

Software Systems
• Collaboratory Notebook
  Multimedia shared database
  Collaborative inquiry environment
  Structured support for group and individual projects

• Internetworking Tools
  Audio/Video teleconferencing
  Electronic Mail
  Usenet News Groups
  Internet file-transfer
  World Wide Web
  Screen Sharing

• Scientific Visualization Tools
  Weather Visualizer
  Greenhouse Effect Visualizer
  ClimateWatcher

9/1/96
The Mentor Database (diagram below) is a web-based utility to help teachers identify volunteer mentors to participate in their students' projects. Mentors enter data about themselves into the database, and teachers can search for mentors that meet their needs. The database helps both mentors and teachers manage their workload with respect to mentoring.

The Weather Visualizer (below) is the premiere on-line tool for producing weather imagery. It provides a web-based front-end to real time data, and generates custom images for the user. Extensive on-line help is available, including detailed interactive modules on a variety of atmospheric science topics. Not pictured are tools for drawing your own weather maps (The Weather Graphics Tool) and the Java version of the visualizer.

The Collaboratory Notebook (at left and below) is a hypermedia tool to support group project work in science. Scientific reasoning is scaffolded via specific link types that are used to construct arguments and record the inquiry process.

Points of Contact

Louis M. Gomez
Co-Principal Investigator
phone: 847-467-2821
e-mail: gomez@ils.nwu.edu

Roy D. Pea
Co-Principal Investigator
SRI International
e-mail: pea@nwu.edu

Daniel C. Edelson
Senior Researcher
phone: 847-467-1337
e-mail: edelson@ils.nwu.edu

Barry J. Fishman
Project Manager
phone: 847-467-2405
e-mail: b-fishman@nwu.edu

The CoVis Project
School of Education & Social Policy
Northwestern University
2115 N. Campus Drive
Evanston, IL 60208
Fax: 847-467-1930

CoVis Information On-Line

The Mentor Database, Weather Visualizer, and more information about CoVis can be found on the world wide web using a browser such as Netscape.

URL: http://www.covis.nwu.edu/