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Bugscope: Magnifying the Connection Between Students, Science, and Scientists

Author: Milton Chen, Edutopia.org | October 8th, 2006

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By Milton Chen

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"What if expensive but important scientific instruments such as the Hubble telescope, electron microscopes, or even remote sensing satellites were on the network, and students could queue up requests for their use? This is not a farfetched scenario." -- Dr. Elliot Soloway, professor of computer science and education, University of Michigan, 1994

In 1996, Jim Dieckmann's fourth- and fifth-grade students in Chula Vista, California, studied insects by collecting specimens, obtaining information from Web sites on entomology, and creating multimedia reports. Together with their teacher, the students developed a set of guidelines, known as an assessment rubric, to evaluate their reports according to use of text, images, graphics, and sound.

A special school-university partnership provided these students with even more powerful learning experiences. Students sent their insects to nearby San Diego State University, which was connected to their school via fiber optic cable. Through two-way audio and video, scientists Steve Barlow and Kathy Williams guided the students in examining their insect specimens under an electron microscope. The students were visibly excited as they prepared for each online session with the scientists. While many fourth graders may never have heard of an "electron microscope," these 10- and 11-year-olds were actually using one. A related multimedia feature (digital video clips) shows how this project unfolds.

Partnership Provides Low-Cost Access to Advanced Technology

Five years ago, that project's use of advanced technology might have seemed out of reach for most schools. However, in 1999, another innovative partnership with the scientific community made the project done by Jim Dieckmann's class available to potentially every school in the country with an Internet connection.

With funding from the National Science Foundation, Illinois Consolidated Telephone Company, and others, the University of Illinois's Beckman Institute for Advanced Science and Technology launched Bugscope, where students around the country capture insect specimens, send them to the university, and then, through the Internet, control the university's \$600,000 environmental scanning electron microscope (ESEM) for a two-hour period to view their insects. With the encouragement of funders in business and government, this partnership is one of a growing number making remote operation of sophisticated scientific instruments available to K-12 schools.

Beckman scientists designed Bugscope as a Web-based project to be low-cost and sustainable by a small research group. They designed a Web interface for a remote control panel so that students, using their classroom computer and a Web browser, can control the microscope as they discuss their insects with the university's entomologists. Bugscope also helps to close the Digital Divide -- classrooms with minimal equipment, whether in the inner-city or an isolated rural area, can utilize Bugscope. Some schools have accessed Bugscope using a single computer and modem. Others have sophisticated computer labs with high-speed Internet connections. The project is available to K-12 schools at no cost.

photo
Bugscope capitalizes on students' fascination with insects, like this hairy-legged water bug. Credit: Beckman Institute, Bugscope Project

Channeling Enthusiasm For Bugs

Since the first classroom logged onto Bugscope in March 1999, more than 1,500 students in almost 60 schools have participated, from kindergarten through high school. In 1999 alone, students collected over 4,000 images from the electron microscope. Bugscope's goal is to reach up to 100 classrooms a year. Dr. Clint Potter, project co-director, believes that "for most youngsters, bugs are second in popularity only to dinosaurs. We are hoping to channel that enthusiasm for bugs to get students interested in and excited about scientific research..

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[Beginning A Documentary](#)

At a school in the Ozarks, a 10th-grade biology class used the electron microscope to examine small aquatic insects as indicators of water quality. The region faces issues of water pollution caused by runoff from chicken, hog, and cattle operations. The high school students collected insect larvae, daphnia, and snail eggs from local water sources and examined them under the microscope, making a total of 230 images. photo
Teachers can apply to participate in Bugscope from the project's Web site. Credit: Beckman Institute, Bugscope Project

Doing "Real Science"

Teachers submitting evaluations emphasize the students' excitement and motivation and comment on the project's effective use of the Internet. As Pam Van Walleghen, a teacher at Urbana Middle School in Urbana, Illinois, testified, "Giving students the opportunity to do 'real science' using state-of-the-art technology is about as exciting as education can get." Bugscope engages students in the scientific process and gives them experience with the realities of scientific research.

Bugscope grew out of Chickscope, another Beckman Institute project that allowed students to study magnetic resonance images (MRI) of developing chicken embryos via the Web. Chickscope encountered problems with the high cost of the technology and the time commitment required from professional scientists. It now continues as an image database.

High School and College Students Act as Bugscope Staff

One key to the sustainability of Bugscope is the training of local high school students, who prepare the specimens and perform the initial microscope setup. Given the high cost of professional staff, a University of Illinois entomology major is employed to participate in the online discussion with students. Teachers report that their students respond very positively to communicating with the Bugscope team in real time while they are controlling the microscope.

The Bugscope project has also automated many project administration and data handling tasks. Online applications from teachers are automatically archived into a database for review and scheduling by staff. During each online session, images are stored for later retrieval by the classrooms or other interested groups.

This developing movement to place high-powered scientific instrumentation in the hands of students continues. Other remote-access projects involve students in using the Goldstone Apple Valley Radio Telescope and in exploring simulated Martian terrain using a Lego micro-rover.

In just seven years, Professor Elliot Soloway's vision of the Internet has become a reality, connecting students and teachers to scientists and their own high-tech tools.

The following Web sites appeared in this article:

- * multimedia feature: www.glef.org/php/school.php?id=Clearview
- * Bugscope: bugscope.beckman.uiuc.edu
- * Chickscope: chickscope.beckman.uiuc.edu
- * Lego micro-rover: planetary.org/rrrr/index.html

An adaption of this article is published in Edutopia: Success Stories for Learning in the Digital Age.

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[Todd Seal](#) | May 26

About a month ago, Speech announced that they wanted to make a video. We quickly went to work on the AFI curriculum and watched several versions of The Door Scene that we shot. We did one where we just walked around campus, one where we walked up to the door without going through it, another...

Frankie 95 Festival Day 5: Chazz dances for his dad, Battle of the bones, Big Apple Lindy Hoppers! We love you, Frankie!

[Rik Panganiban](#) | May 26

Tonight was the final night of the Frankie 95 Birthday Festival, and what a lovely way to end an incredible five days of celebration! Here's Chazz Young, Frankie Manning's son, dancing on behalf of his dad with 95 follows. Continuing the tradition started at Frankie's 80th...

Gripping documentary about the International Criminal Court premieres in New York June 12 & 13!

[Rik Panganiban](#) | May 26

I got the exciting news that June 12 and 13 is the New York premiere of The Reckoning: The Battle for the International Criminal Court for the opening night of the Human Rights Watch Film Festival. There will be two screenings: Friday, June 12, 7:00pm: Filmmakers and ICC Deputy Prosecutor Fatou...

Worldwide Microwave Equipment Trends

[David H. Deans](#) | May 25

Infonetics Research released its microwave equipment market size, market share, and forecast report. The report tracks access and backhaul/transport PDH/SDH microwave equipment and Ethernet and dual Ethernet/TDM microwave equipment."The big trend in the microwave equipment market is the...

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