

Making a Science Connection: Bringing Smithsonian Science and Environmental Education to Schools Internationally

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Located on the western shore of the Chesapeake Bay just south of Annapolis, MD, the Smithsonian Environmental Research Center (SERC) has, for over 35 years, been a prime location for various groups to get hands-on experience with environmental science and ecology. Since 2001, SERC has dramatically increased its efforts to educate a larger population about the Bay and its watershed by providing distance learning programs for K-12 teachers and students. The programs are designed to complement, not replace, the existing hands-on education programs, offer students nationwide an opportunity to learn about an important ecosystem, and go behind the scenes of SERC where even conventional visitors seldom have access.

Distance Learning: Exploring the Bay from Miles Away

The Distance Learning program at SERC (www.serc.si.edu/education/dl) is based on the idea that—although everyone enjoys visiting the Bay and SERC—sometimes getting there can be impractical. Geographic distance, cost, and limited time can prevent people, especially schoolteachers and students, from making the trip. Communication technologies developed for distance learning, however, can connect students and teachers from across the country to Smithsonian scientists who study the Chesapeake Bay and its watershed. These videoconferences and electronic field trips use teacher-developed curriculum and student-centered activities and allow audiences unprecedented access to the labs and field stations of SERC.

How does it work? Using a camera, monitor, and unit to decode the transmission signal, SERC connects over ISDN or T1 (Internet) lines to a remote site with similar equipment. A point-to-point connection such as this is generally referred to as a videoconference (VC). Because of the equipment, a limited amount of sites are able to connect at once, but the advantage is that the interactivity among the sites is very high. An electronic field trip (EFT), on the other hand, connects SERC to a large, nationwide audience, usually by satellite, live webcast, and/or PBS, but because of the large number of participating sites, interactivity is more limited.

A Direct Connection to Science

The content of SERC's distance learning programs is a direct reflection of the scientific research carried out at SERC, as well as its innovative hands-on education programs. SERC is a 2700-acre environmental research and educational facility of the Smithsonian Institution located on the shore of the Chesapeake Bay, the nation's largest and most productive estuary. Here SERC is strategically situated for scientists and educators to explore the biological and physical processes that sustain life on Earth. Since 1965 scientists have been researching the aquatic, terrestrial, and atmospheric components of complex ecosystems, and applying this knowledge on local, regional, and global scales for the improved stewardship of the biosphere.

Closely connected to the scientific research, SERC's Education Department provides programs for K-12 students, teachers, special interest groups, and the general public. Educators demonstrate the active process of research to audiences, infusing this research in a hands-on approach to experience the wonders of the Chesapeake Bay. SERC's Education Program is committed to broadening society's understanding of the environment, communicating an awareness of how human activities influence ecosystems, and training future generations of environmental scientists. The distance learning technology now provides SERC with an opportunity to reach out to an even larger audience *and* allow this audience unprecedented access to its environmental science.

Videoconferences

For example, *Watershed Connections: Tales of the Blue Crab* is the first in a series of VC's that examine the natural, inseparable connections between land and water. This VC focuses on the fascinating life and role of blue crabs, incorporating water chemistry and invertebrate research conducted in the Bay by SERC scientists. Students then interpret the scientific data to learn how the state of the blue crab population is connected to the overall state of the watershed.

SERC and Project VIEW of the Schenectady City School District recently developed a videoconference about climate change and global warming. The VC describes processes such as greenhouse effect and global warming by analyzing data from SERC. This data seeks to understand the effects of increased carbon dioxide on plants. Students also engage in a discussion of the political aspects of global warming. The accompanying curriculum was developed by Project VIEW teachers and may be viewed at www.projectview.org.

SERC recently connected students in Colorado, Illinois, Texas, Kenya, South Africa, the Dominican Republic, and the Czech Republic to learn about aquatic ecosystems and watersheds. Schools in these areas identified their local watershed and performed water testing at a local body of water. Students also identified threats within the watershed and developed action plans to deal with the environmental threats. In this respect distance learning connected students from different geographic regions, and by comparing and contrasting their local watersheds, students were able to learn about watersheds in general.

A typical VC lasts approximately 45-60 minutes with ample time for questions and answers. The goal is to make each broadcast as interactive as possible, engaging the students through the use of hands on objects, data sets, and inquiry based learning. Audiences range from K-12 classes, teacher training, summer camps, and convention demos. SERC currently offers three VC programs, is developing more, and can provide custom-made VC's upon request.

Electronic Field Trips

On April 30, 2002, the structure and content of *Estuary Chesapeake*, SERC's most popular hands-on Bay ecology education program was converted into a highly successful EFT, *Where the River Meets the Sea: Exploring Life in the Chesapeake Bay with Smithsonian Scientists* for students of Grades 3-7. In this live broadcast from the SERC dock, students and SERC scientists explored where the salt water from the oceans and the fresh water from the rivers meet and mix, investigating the physical and biological environment of the Chesapeake Bay ecosystem. To learn about residents of the Bay, viewers fished, crabbed and sifted through an oyster bar community alongside SERC staff. Then to better understand aspects of water quality, demonstrations of salinity, pH, were conducted, allowing viewers to experience where the river meets the sea and research meets the Bay.

Approximately 20 million students from 18 states watched the live broadcast - a much larger audience then could ever be reached through videoconferences. A high level of interactivity was maintained through live telephone and email questions, connections to specific schools for related demonstrations, and the involvement of school children on site at SERC throughout the EFT. The strong presence of the students in the show and the teacher-developed curriculum that supplements the broadcast make the program a highly effective educational tool, one that is more engaging than a one-way TV program.

The EFT was broadcast live at 10 am and 1 pm EST (two shows to accommodate schools in different time zones) and distributed via satellite, Internet, and local PBS stations. The program has since been archived on the Apple Learning Interchange: *Where the River Meets the Sea* website (<http://ali.apple.com/events/river/>). Schools may purchase a videotape of the broadcast as well.

Enhancing the Experience: Teacher-Developed Curriculum

Teacher-developed curriculum provide activities, experiments, and information to be used before, during, and after an EFT or VC, thereby enhancing the distance learning experience. With an EFT, a \$75 registration fee enables schools nationwide to receive online, teacher-developed curriculum developed and tested in the classroom by teachers. Each VC also has a \$75 fee and is accompanied by hands-on materials for use during the VC and curriculum aligned with science content standards. Curriculum may be viewed through www.bsu.edu/eft.

Technology Collaborations

Because distance learning relies heavily on technology, SERC is able to offer VC's and EFT's through collaborations with other institutions. One such institution is Project VIEW (www.projectview.org) of the Schenectady City School District (SCSD), through a Federal Technology Innovation Challenge Grant. Project VIEW works with informal education providers such as museums, libraries & cultural institutions to develop innovative, replicable models for delivering high quality content from distant locations. These models provide students (grades K-12) the opportunity to study and learn through interactive observation as well s engage students with scientists, historians, curators, librarians and content experts as they experience artifacts & resources though interactive videoconference & electronic technology.

Another partner is the New York Institute of Technology (NYIT), along with its Educational Enterprise Zone (EEZ), a consortium of schools, community centers, and educational institutions through which training and technology are provided to make videoconferencing possible. The EEZ is anetwork linking museums and related institutions to public schools, making the vast collections of artifacts, objects, and human resources of informal learning institutions available nationwide.

To produce the electronic field trips, SERC partners with Ball State University (BSU) and its Insite Distance Learning Program (www.bsu.edu/insite). Using the latest satellite telecommunications and web technology, Insite Distance Learning delivers effective educational solutions to students and teachers at the K-12 level throughout the United States. In an EFT, SERC provides the content, and BSU provides the technology necessary to make the EFT possible.

Author

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