# Classrooms without Walls

Environmental research indicates that human impacts on biodiversity (the variety of genes, species, and ecosystems that exist in our biosphere and allow us to keep evolving and enjoying "life" as we know it) threaten our "living" planet. The urgent need to protect our quality of life through promoting awareness and advocacy for protecting biodiversity requires biological educators to commit themselves to fostering an environmental advocacy among students. This sense of advocacy is best fostered through the development in our students of an educational outcome—environmental ethics.

Biology teachers looking to foster environmental ethics face a huge barrier—most students are estranged from the natural world. They lead a "buffered" existence within manufactured environments or techno-ecosystems that fail to engage students in understanding the relationship of living organisms and the natural environments that support their lives. Students' primary exposure to living organisms takes place in zoos and aquariums or (even more remotely) through gazing at figures in packaged textbooks. Students can successfully matriculate through biology courses absent observing living organisms in natural environments.

To nurture our students' knowledge of and affection for the land, we need to do more than merely transmit biological concepts. Sure, for students to understand the urgency of the challenges our biosphere is up against, they need an understanding of biological concepts to appreciate the severity of environmental risks. However, students also need the opportunity to contextualize their learning by engaging in activities that demonstrate how living organisms and their environments are mutually dependent.

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What I am preaching here is the movement away from classrooms with walls, to classrooms without walls—settings that are outside, untamed, and alive. My experience and research has shown that promoting experiences in rich environmental contexts through experiential learning is a quintessential pedagogical approach that promotes understanding of biological concepts and instills an environmental ethic.

I've always felt that the walls of my classroom were too confining and that teaching in the classic *lecture-notes-memorize* paradigm was ineffective. What was needed, I felt, was a teaching method that went beyond colored chalk and transparencies, fill-in-the-blanks, and multiple-choice. So, for a long time I concentrated on creating visual animations—so-called "interactive" web-based modules that helped explain complex concepts.

The computer animations, which were designed to be independently manipulated by students, complemented students' love of technology. In addition, the format was well-suited for relaying complex issues and scenarios. For example, one module called for students to build a weather station in Brazil (by gathering real data and plotting a climatograph); another required students to construct a field station at Hubbard Brook (students used a lithotripter to study a watershed).

The modules are effective because most students don't understand something they can't see. If they can't see something directly, like the chromosomes moving during mitosis or electrons flowing along the thylakoid membranes of the chloroplast during photosynthesis, they simply won't "get" it. When these processes are "brought to light" via technology, students are encouraged and become engaged. And that engagement elicits the correct comprehension of key biological concepts (it also corrects any misconceptions resulting from memorizing colored-coded diagrams).

What interactive modules *don't* do is instill a land ethic. I've found that only a wall-less classroom can do that. Once the traditional classroom boundaries are removed, students are faced with the biological reality of the jungle, open savannah, temperate deciduous forest, alpine tundra, and taiga—to name just a few settings.

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But I'm not talking about a free-for-all picnic here. The key when going "wall-less" is to incorporate multiple learning components.

Stam Zervanos, Professor of Biology at the Penn State Berks-Lehigh Valley College, and I have co-developed parameters for field courses in biodiversity and conservation biology that use experiential, interdisciplinary, and international teaching and learning components (see the Penn State website at *www.lv.psu.edu/jxm57/explore/costarica*).

The parameters can be divided into three main parts:

- Pre-trip assignments—primarily innovative web-based activities that provide essential background knowledge.
- Field work—which includes hands-on experience, journal keeping, conservation research, and participation in discussion groups.
- Post-trip assignments—again, primarily web-based activities that encourage the integration and application of key concepts.

Courses that incorporate these elements create opportunities for students to delve into biodiversity and conservation issues firsthand. For instance, while hiking with my students through the lush primary Monteverde Cloudforest in Costa Rica, we encountered a tree that had fallen along our path. This simple observation sparked discussion of a complex concept. The fallen tree served as tangible evidence of a "natural disturbance" and had resulted in the creation of open space. This open space now allowed light into the understory, which in turn was creating new niches for organisms to repopulate the area.

The natural disaster had effectively kept competition at a maximum and biodiversity high—particularly as compared to an adjacent old growth understory. But the bigger lesson for the students was that nature, when left unscathed, was "wired" to oversee its own intricate population dynamic. Students understood, too, that the "unnatural" disturbances of humans—such as clear-cutting and slash-and-burn harvests—work in the opposite way, diminishing biodiversity.

Assessment findings from these experiences provide evidence that students' observations and activities in the field yield tangible cognitive development. Results indicated, for example, that students can apply factual knowledge gained in pre-trip activities to field observations. This process documents how students are moving beyond simple rote learning to a deep understanding of environmental science and biodiversity concepts including disturbance, succession, and adaptation. Additionally, students demonstrate the ability to observe critically the effect of human activity on the environment.

Our research shows how intentional design of field experiences promotes student cognitive gains in conservation biology and environmental science knowledge domains. Additionally, students show strong gains in critical thinking domains as they wrestle with the effects of human and environment interactions and then describe those interactions in field journals.

What's more, assessment data show that students learning in this way are far more likely to become lifelong advocates for the environment. These gains support the need for training teachers to design experiences that require students to leave artificial environments to experience the natural environment as part of their learning experience.

Teachers and teachers-to-be will discover that it's hard to go back to a traditional classroom once they've been exposed to the wall-less model. That's definitely been the case for me!


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