With the new wave of interest in the environment, will we finally give students the tools they need to become environmentally literate citizens?

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In just a few weeks, high school seniors all around the United States will walk proudly across stages, hoisting their diplomas as they graduate from formal K–12 education. As their teachers, we'll look on with some wistfulness, for the world into which they are graduating—one of spiraling financial crises coupled with huge international challenges—is vastly different from the one in which they started their senior year only 10 months ago.

But wait, it gets worse. If you place your finger on the pulse of the planet, this is what you'll discover: global surface temperatures rising, glaciers melting, oceans warming, sea levels rising, rain forests burning, coral reefs dying, old-growth forests disappearing, deserts spreading, the world's population increasing, and species vanishing at the highest rates since the extinction of the dinosaurs.

In short, the ecology that underpins our economy is also collapsing. And the solutions to this challenge elude not only most of our graduates, but also us—their teachers, administrators, and parents.

Will our graduates be ready for these new realities? Will they confidently stride into this world as college students, workers, voters,
consumers—in short, as competent, caring adults capable of making good decisions on the pressing issues of the day?

Environmental Ignorance
Forty years ago, in the first issue of the Journal of Environmental Education, William B. Stapp (1969) defined the goal of the nascent field of environmental education as producing a citizenry that "is knowledgeable concerning the biophysical environment and its associated problems, aware of how to help solve these problems, and motivated to work toward their solution" (p. 30).

Today, a new U.S. president actively seeks approval from the American people for repairing the economic collapse while preventing the ecological one. There will be fierce pressure on President Obama to forego environmental projects in lieu of economic ones. Have the past 40 years of environmental education met Stapp's challenge and created the environmentally literate citizenry we need to negotiate the coming trade-offs?

In a word, no.

A typical high school student is aware of environmental issues, has discussed and debated climate change or rain forest loss in some class sometime, and might have bumper-sticker answers to lapel-pin questions. But do our students know where the trash goes when it leaves their house? The leading source of greenhouse gas emissions? Why we recycle? (Glass and aluminum, after all, are not rare resources.) If you ask a group of students what we can do to combat the warming trend, several will chime in that we need to remove chlorofluorocarbons (CFCs) from hair spray. (Many high schoolers conflate global warming with ozone depletion and haven't been told that CFCs were removed from the market 20 years ago.)

My organization surveyed high school students on these questions and more and discovered that although students are overwhelmingly "pro-environment," they possess remarkably little information about breaking environmental issues. One small example: We asked them to name one bird they can identify by song. The leading answer? None. If local birds disappear from the landscape because of extinction, or arrive three weeks late because of warming climates, it’s possible that no one will notice.

Oh, there are numerous bright spots in the environmental education movement, but progress is hardly keeping up with the increasingly urgent issues that face us today. When Stapp coined his definition four decades ago, the United States was riding a wave of interest in the environment triggered by the Santa Barbara oil spill, Ohio's Cuyahoga River catching fire, Lake Erie being declared biologically dead, and charismatic birds like eagles and peregrine falcons vanishing. As we addressed these issues, the wave crested, and interest in ecology quickly ebbed.

Today, even though an interest in green ideas is resurging, the issues are far more global, complex, and intertwined with politics. Atmospheric carbon dioxide levels currently exceed 385 parts per million, almost 40 percent higher than
pre–Industrial Revolution levels, and they are rising every year. Consequently, the Arctic Ocean is changing dramatically as the Arctic warms more quickly than anyone expected, and our graduates may see an ice-free polar cap in the summer in their lifetimes.

An International Union for the Conservation of Nature report (2008) noted that one in four of the world's mammals are at risk of extinction from habitat loss, poaching, and climate change. Many critically important rivers—such as the Nile, the Yellow, and the Colorado—no longer empty water into the sea. Mountains of discarded cell phones and computers make their way to destitute Chinese villages, where they are picked apart for valuable metals, exposing the villagers to high concentrations of incredibly toxic materials.

To address today's geopolitically entangled world of large, complex eco-issues, students simply have to know more than they did 40 years ago.

What's the Problem?
Four issues have become huge obstacles to environmental literacy. First, students are extraordinarily disconnected from the environment. Richard Louv's revelatory 2005 book *Last Child in the Woods* called attention to a world of children rapidly retreating from outdoor play and time spent in nature. Instead, modern kids stay indoors, "'cause that's where all the electrical outlets are," as one 4th grader famously said (p. 10).

Viewing screens has become a child's full-time job. Kids are plugged in 24/7, watching an average of 25 hours of TV a week (Gentile & Walsh, 2002) and then logging additional screen time on the Internet, browsing the Web, playing video games, and engaging in whole new verbs, like IMing and Facebooking. Louv coined the phrase *nature-deficit disorder* to describe the "human costs of alienation from nature" (p. 34), including diminished use of the senses, attention difficulties, and higher rates of physical and emotional illness. Just when students need contact with nature more than ever, they have abandoned it.

Second, ask any environmental educator and he or she will
bemoan No Child Left Behind, whose pressures have caused many schools to trade outdoor field trips for test prep. Science teachers routinely eliminate such concepts as environmental education, which do not appear to relate directly to questions on the tests. The Chesapeake Bay Foundation's Web site (2009) bluntly states, "No Child Left Behind is contributing to an increasing environmental literacy gap by reducing the amount of environmental education taking place in K–12 classrooms."

Third, students' exposure to environmental education depends on the luck of the draw and the amalgam of the interests of whichever teachers they happen to have throughout their school career. In my daughters' school, there were two 5th grade teachers, one contagiously obsessed with birds and bird-watching and the other in love with Broadway musicals. One class went on an all-day birding trip; the other performed a play for the entire school. Both are equally interesting and important activities, but why didn't the two cross-pollinate and give all 5th graders equal access to both? My daughters caught the birding bug, but one-half of the 5th grade never saw a nesting piping plover.

And finally, the downside of the large nonprofit universe of environmental education facilities—zoos, museums, aquariums, nature centers, parks, arboretums, children's gardens—is that schools approach environmental education like a Chinese menu. They pick a field trip from column A and a lesson plan from column B; toss in an occasional Earth Day assembly, litter pick-up, and letter to the president; and assume that their charges are now environmentally literate. And the nonprofits, wanting students to return the following year, emphasize fun over content, immersing the students in activity-based education that is designed to serve as an appetizer for environmental literacy but ends up becoming the main course.

**What Every Student Should Know About the Environment**

There are scores of possible models of environmental education programs, and most have many of the following large concepts in common. As students go from kindergarten through high school, they can work their way down the list.

1. **Earth overflows with life.**
   One of science's biggest mysteries is how many species share this planet—estimates range from 5 million to 100 million species. Many environmental education programs begin with the premise that life is vanishing; young learners should first know that Earth teems with a huge number of creatures.

2. **Each creature is uniquely adapted to its environment.**
   Every species evolved to possess a unique set of adaptations that enables it to survive and thrive in its ecosystem. Students should be on a first-name basis with many local creatures.

3. **The web of life is interdependent.**
   Organisms evolve complex relationships, each depending on numerous other species for their survival.

4. **Materials flow through ecosystems in cycles.**
   All creatures need water, air, and nutrients to survive. These materials cycle and recycle through ecosystems. The water we drink today is the same water we've always had, and always will.

5. **The sun is the ultimate source of energy flowing through ecosystems.**
   Food grows from sunlight energy; our houses are heated by fossil fuels created many millennia ago from ancient sunlight.

6. **There is no waste in nature; everything is recycled.**
   In nature, every waste product is used by other creatures. Humans have bent those circles into straight lines, where things are used once and tossed.

7. **We consume resources to live.**
   Every student should know where the trash truck takes the trash, where water comes from, and how the nearest power plant makes electricity.

8. **Conservation is the wise use of finite resources.**
   We are physical creatures with real needs—to eat, drink, build houses, write on paper. But how do we use these resources sustainably?

9. **Humans can have a profound effect on environmental systems.**
   Fossil fuels pump carbon dioxide into the sky; habitat loss is causing the extinction of large numbers of species. Our actions profoundly affect the ecological systems that sustain living things—and us. Nature can often repair these systems (forests grow back, for example); but humans are changing systems faster than nature can adapt.

10. **Each of us can powerfully affect the fate of the natural world.**
    Because each of us is directly plugged into the planet, the actions we take—or fail to take—profoundly influence earth's systems.
They often retreat from tough concepts like water shortages and stay with politically lighter ones like the water cycle.

The upshot? Even though there are more centers for environmental education and more college degree programs in environment-related fields than ever, and even though building green schools has suddenly emerged as an important idea (pre-economic meltdown), we are perhaps even farther from environmental literacy than we were in 1969.

Students are graduating from our schools thinking that green is good. But we haven't given them the tools they need to become environmentally literate citizens.

New Research May Turn the Tide
Fortunately, several important research efforts are threading their way through the education system. For example, the Children and Nature Network, a Web-based organization (www.childrenandnature.org) that reports a wide variety of data and activities related to repairing the nature deficit disorder, showcases data illuminating the educational benefits of immersing students in the outdoors and environmental education experiences. And there's tons of data.

The American Institutes for Research (2005) studied the effects of weeklong residential outdoor education programs in which most of the participants were at-risk youth. Comparing students who experienced the outdoor education program with those in a control group who had not had the experience, the researchers found a 27 percent increase in measured mastery of science concepts, plus enhanced cooperation and conflict-resolution skills, higher self-esteem, and gains in problem solving, motivation, and classroom behavior.

A Canadian study found that children whose school grounds include diverse natural settings are more physically active, more aware of nutrition, more civil to one another, and more creative (Bell & Dymeni, 2006). Another study discovered that children playing in green settings have reduced symptoms of attention deficit disorder (Taylor, Kuo, & Sullivan, 2001).

The more studies are published, the more they agree: Exposure to nature raises test scores; increases creativity, cooperation, and self-confidence; reduces stress; and enhances cognitive abilities.

Promising Models
When the next wave of environmental interest washes over our schools, as it inevitably will, this body of research will support the new ideas for truly fulfilling Stapp's dream of environmental literacy. Here are a few intriguing efforts now underway.

No Child Left Inside
In response to Louv's book, more than 1,000 nonprofits with almost 50 million members have launched a variety of efforts loosely organized under the title "No Child Left Inside." For instance, the National Audubon Society has pledged to place a family-oriented nature center in every congressional district.
Connecticut governor M. Jodi Rell launched a special Web site (www.nochildleftinside.org) promoting state parks, an idea copied by many other states. And the U.S. Congress has considered a No Child Left Inside act that would provide federal funding for environmental literacy plans and for state efforts to train teachers in model environmental education programming, including outdoor learning. In the last session, the act passed the House, and supporters are eager to try again in the new Congress.

Green Charter Schools
For better or worse, the charter school movement has been sweeping across the United States in the last decade. A growing number of charter schools have been designed around the simple premise that the entire science curriculum can be taught through environmental education.

The Green Woods Charter School in Philadelphia is located on the campus of the Schuylkill Center for Environmental Education, a 340-acre living laboratory of forests and fields, streams and ponds. The center's naturalists are integrated into the science faculty of the school, and the students spend quality time immersed in the woods.

Wisconsin's River Crossing Environmental Charter School, located in a one-room schoolhouse, provides a hands-on curriculum with subjects integrated through environmental studies. Students in 7th and 8th grade participate weekly in field trips and real-world ecosystem restoration projects, such as restoring the prairie and building rain gardens for storm water.

Other sites include California's Environmental Charter High School, Connecticut's Common Ground High School, and Florida's Academy of Environmental Sciences. A Green Charter Schools Network (www.greencharter schools.org) has formed to assist teachers and staff. Sadly, precious few students are fortunate enough to attend these schools.

Environment as an Integrating Context for Learning
Another innovation that has grown in popularity in the last decade is the Environment as an Integrating Context for Learning movement, a cumbersome name for a simple concept. In place of the rigorously scheduled school day of science, English, and gym periods, these programs use the environment and the outdoors as the centerpiece of students' curriculum. This format breaks down barriers between disciplines, stresses team building and individualized learning, and involves students in real-world community issues.

Many environmentalists worry about a vanishing window of opportunity.

In suburban Philadelphia, for example, the pioneering Watershed program at Radnor Middle School engages students in outdoor field studies all year, including stream testing, canoeing, trout rearing and release, and more. Students in the program spend all day together, except for math and foreign language classes, in which they are integrated with the rest of the school. Students hone their communication skills at conferences and youth summits.

One analysis of 40 Environment as an Integrating Context for Learning programs (Lieberman & Hoody, 1998) discovered that students in these programs outscored their peers on standardized tests, had better grades, and acted more independently and responsibly. At one school using this approach, reports to the principal's office declined 91 percent in the three-year study period.

Wood Kindergartens
A rather radical movement has leapt across the pond from Europe and, coupled with Richard Louv's work, has begun making inroads in the United States. In the Wood School model, childcare workers and youngsters ages 3–6 spend the entire day outdoors in nature. The program is held outdoors in all seasons, although the group moves indoors in extreme weather. Proponents of this process assert that playing outside for prolonged periods strengthens the students' immune systems and improves development of manual dexterity, physical coordination, tactile sensitivity, and depth perception.

Here in the United States, many nature centers, such as the Chippewa Nature Center in Midland, Michigan, have begun opening variants of Wood Kindergartens, versions that might not strictly adhere to the European's outdoor component but still allow the students full and frequent access to natural areas and nature-based play (Reynolds, 2007).

Greening of the Culture
U.S. schools teach what American culture considers important. Once society decided that computer literacy was central to a solid education, computer classes invaded schools at warp speed, and the "digital divide" became an important and contentious issue.

As environmental issues heat up (pardon the pun), the culture is coming to consensus—again—on the importance of the environment. Green cable channels, green Web sites, eco-chic clothing, green roofs on green buildings, and innumerable products made from
recycled objects are beginning to infuse the culture with a newfound interest in sustainability—an interest that ideally will create a ground swell of support for environmental improvement.

But the four horsemen of the global apocalypse—warming, species loss, water scarcity, and population growth—are bearing down on us, and many environmentalists worry about a vanishing window of opportunity for addressing these issues. Science fiction writer H. G. Wells was prophetic when he wrote in 1920 that “human history becomes more and more a race between education and catastrophe.”

Environmental literacy is one race that education must win.

References


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