

Science Ends Where Environmental Education Begins: Putting Science into Perspective

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A B S T R A C T

This paper starts with an account of some of my childhood experiences, ones provided by my father, the original environmentalist in my life and a practising scientist. I continue with a discussion of the need for environmental educators to view science from an informed perspective. It is essential that we help our students to understand the workings of nature and that science has inherent limitations in its ability to explain those workings.

I indicate that what is needed if humans are to live in partnership with the Earth is sensitivity to and appreciation of the complexities and aesthetics of its environments from which a culture of nurturing and personal involvement should emerge.

I conclude that it is equally important that environmental educators include in their lessons current scientific views, and direct experience in thought-provoking and valuing exercises.

As I look back on my childhood, one figure looms large as the original environmentalist in my life—my father, who was into the green, the brown and the blue concerns.

He was, without having ever heard the term ecology, an organic gardener who grew roses and raised chickens and, you guessed it, fertilised the roses with the manure of his chickens. He removed aphids by hand, his hands and mine when he could draft me into the job. He dug a small 4 x 5 metre pond in our backyard and raised Tilapia there. He situated it under a tree which did not totally overshadow the pond, allowing sunlight to reach it. Thus the needed plankton was present, augmented by organic matter from falling and decaying leaves and as a 14-year old I would enjoy fishing in the shade when not climbing up the champaca or ilang-ilang trees trying to reach for their fragrant flowers.

On Sundays my father gave us more such joys when he brought us to visit a sister whose home could be reached by a 45-minute car ride at the end of which we had to traverse a river by wooden rowing boat. Her own property contained fruit trees and flowering plants which I now know was precious nature but which then we took for granted although we had the time of our lives as we gathered guava, mango, siniguelas, santol, duhat, balimbing, macopa and filled ourselves to indigestion. We collected jasmine, sampaguita, and other flowers of lovely tropical scents to bring home.

‘he would painstakingly hand-dye my white shoes every morning before I left for school’

My father was a great one to reduce, re-use and recycle. I do not recall ever having a brand new fountain pen in my young years because he was always making pens out of the

parts of discarded ones. At times his conservation ethic, tinged with frugality I guess, was counterproductive. He would buy us shoes a size bigger than needed to allow for rapid feet growth, not noticing that our heavy use of them did not allow the shoes to last that long. On one occasion he bought me white shoes for my first holy communion. For once they were of the right size. But because what I needed for daily use were black shoes, he would painstakingly hand-dye my white shoes every morning before I left for school. Unfortunately the result was that my white socks were likewise blackened.

My dad took us often to the seashore to enjoy the then unpolluted waters. He woke us up too early on certain mornings to make us enjoy the visual delight of a spectacular sunrise or the exciting chill of dawn.

My father was a medical doctor. As such he would have been expected to readily apply medical science’s discoveries to ‘manage’ health, and to repress all pain. This was not the case. Rather, he lived an environmental principle that “nature knows best!” (Commoner 1971). We hardly ever were given vitamin pills as he relied much more on nutritious food and exercise. Peanuts and prunes were our laxatives. Even when I had a high fever I remember him diligently monitoring my temperature, giving me lots of liquid and prescribing sponge baths but avoiding aspirin so that any symptoms would not be masked. He held back on antibiotics until he had absolutely diagnosed the illness.

My mom was also a medical doctor but one who had more faith in new medical discoveries; I remember hearing them argue while my life hung in the balance.

My dad utilised and enjoyed modern ways but did not embrace them indiscriminately, only when he believed they were superior to his tried and true old time practices. For instance he often used salt in place of toothpaste and until he died he had a perfect set of teeth.

‘Not all people can have a complete environmentalist for a dad’

I was not impressed by my dad’s ways then, but I believe these very ways have influenced my own appreciation of the problematic relationships between humans and their environments. I am certain that they were a major factor in shaping my world-view and my chosen options. I venture to suggest that most of the readers of this paper have stories to tell about their own choice to be involved in environmental education. I once made a rough poll of my friends in the environmental movement. Dominant among their memories were pleasurable nature experiences provided by a teacher.

Not all people can have a complete environmentalist for a dad but most go to school and have teachers. They have the opportunity to obtain the benefit of an education that is even more enlightened if it is environmental.

At this point in the global environmental debate, I see great opportunities for environmental education. There is an obviously heightened global awareness of environmental problems at local and regional levels and indeed at the level of the whole planet. The one unquestionable achievement of the 1992 Earth Summit was to educate a whole generation on the world-wide ecological crisis confronting humanity (Cairncross 1972). Millions now know of pollution, toxic waste, global warming, ozone depletion and forest destruction.

Terms such as ecology and biodiversity have been in currency for so long now that they have begun to enter the vocabularies of lay people. However, the issues associated with these and other pieces of environmental language are still being intensely researched and repeatedly discussed in countless conferences. There is one conclusion that inevitably surfaces after each conference; it is the need for more research and more education.

But what kind of education will answer the need? I’d like to cite one of my favourite ideas, one written by David Orr who says that it is generally believed that education is good and that the more education a person has, the better. But as he points out a great many of the problems facing us around the world today have been brought about not by illiterate peasants but by highly educated people with Ph.Ds or other degrees who have built nuclear bombs, built huge dams that have obliterated forests and their wondrous biodiversity, and conceived of persistent pesticides and of chlorofluorocarbons that threaten all life on earth. Orr further muses that he can almost hear the earth groan at every graduation time when hordes of degree-holders are let loose to assault the planet (Orr 1994).

The real problem is, then, not how much or how little education a person has but the kind of education received. What, therefore, are some of the elements of an education I believe people need if they are to care for their environments?

Education to help save the planet

Science—and its limitations

‘informed management includes being conscious of the limitations of science’

We do need more science, or more of it in environmental education. Each generation of human beings must manage their interactions with the world to the best level that their best knowledge allows. But informed management includes being conscious of the limitations of science. I doubt if human beings will ever know everything completely. Whether we like it or not that, in my view, is the prerogative of the Almighty; when we accept the limitations of our knowing with humility, we shall begin to manage wisely.

At this point in the development of our environmental knowledge many are the examples that illustrate how imperfect scientific knowledge has been—and is. Chlorofluorocarbons were invented in the 1920s and have defined much of the Western lifestyle in the last 30 to 40 years (Dwyer & Leeming 1995). What a shock it was to discover that the lack of reactivity of these wonder substances allowed them to migrate undisturbed to the stratosphere there to succumb to powerful and plentiful ultra-violet rays thus releasing halogen atoms which attack the ozone layer protecting the earth from those same ultra-violet rays (Gore, 1992).

‘Scientific knowledge is not only incomplete; it can be reversed by new discoveries’

Atomic fission was billed as the source of energy that would sustain humankind’s increasingly voracious appetite for electrical energy. But now we know the inherent dangers involved. One of the biggest problems is the matter of storage and disposal of nuclear wastes. It is estimated that it would take over 100 years and anywhere between US\$29–175 billion to clean up the nuclear waste that needs to be stored, or disposed of more safely (Ehrlich & Birks 1990).

Scientific knowledge is not only incomplete; it can be reversed by new discoveries. Scott Peck (1990) in writing about the limitations of science as a side issue in his book *People of the Lie* tells how their paediatrician instructed him and his wife to start feeding their month-old baby solid foods almost immediately because such supplementation was needed for breast-fed babies. A year later, after the birth of their second baby, the same paediatrician directed them to delay feeding her solid food as long as possible so as not to deprive her of the extraordinary nutrition in breast milk! Peck also tells that, when he was in medical school, he was taught that the essential treatment for diverticulitis was a low-roughage diet but that students are now taught that the essential treatment is a high-roughage diet.

‘Carrying capacity is a concept that indigenous peoples may not consciously appreciate but it is one they live by’

Scientific investigation ‘opening up’ nature and the scientific knowledge emerging from that activity have spawned a belief in people’s mastery over nature. This belief has led to humans viewing and treating nature in simplistic and mechanistic ways.

At the end of World War I mechanisation and the availability of cheap oil brought about modern agriculture in the USA where farms could be treated like factories. Input of seed, fertiliser and water to hectare after hectare of field, shots of pesticides, herbicides and fungicides; output of fruit, vegetable or grain. The aim of agriculture was to search for greater and greater efficiency. So much fertiliser and pesticide was sprayed from aeroplanes that the endeavour was cost-effective. No matter that there were different degrees of health and sickness among the plants. No matter that some of the chemicals did not reach the targetted plant parts or pests. No matter that the chemicals did not discriminate between harmful and beneficial organisms. This became the way to obtain gorgeous-looking produce every time, satisfying customers who came to expect, and continue to expect, assembly-line uniform perfection.

Contrast this with the principles of ecological farming explained to me by an organic farmer. These require continuing observation of plants’ responses to differing environmental conditions, careful selection of companion complementary plants, and manual production and monitoring of compost heaps.

Indigenous peoples in many countries, by the very fact that they lived close to nature, understood very well the intricacies of nature—and still do where those kinds of close associations are allowed. Carrying capacity is a concept that indigenous peoples may not consciously appreciate but it is one they live by, knowing the limits of an area in terms of volume and rate of resource extraction and alteration. And how they respected these limits, knowing the backlash that disrespect would bring about. Aboriginal peoples of Australia, the Philippines or Canada followed and follow the same principles; many of their strategies to cope with the complexities of nature are similar (Ramphal 1992).

Modern ways reject any inconvenience brought on by the complexities of nature. They seek to control nature by simplifying it. In contrast to these modern tendencies, ecological living respects the dynamic interaction and fluxes in nature and the need for sensitivity to nature’s signals. Ecological living requires personal attention and involved nurturing of the life-giving matter and forces of the earth.

Sadly, the culture of convenience that technology has engendered has extended to many facets of our lives so that

everyone has come to assume that garbage will be taken care of in the dumpsite no matter how much of it there is. This attitude does not foster individual responsibility for what happens to discarded matter.

Environmental educators need to assist their students to appreciate the nature and limitations of technology and to pursue a culture of nurturing the Earth rather than mechanistic and ill-informed manipulation of it. From this will spring a care for the earth, for each other and for all the earth’s inhabitants.

Limits to growth

There is no question that technology has made life more comfortable for our species. However, Earth systems supporting all life are now threatened by this very technology and the ‘developments’ that technology has spawned—world population increase, growth economics and materialism.

Modern western society, with its insatiable hunger for materials and energy has strained the Earth’s limits. Human social and economic systems rely on the Earth’s stock of mineral deposits, the well-paced turnover of renewable flora and fauna and the ‘sinks’ needed to absorb society’s wastes. However, growth in human numbers and per capita growth in demand for goods have depleted resources and have caused levels of pollution obstructing the continuous re-creation of biological resources, and have severely damaged the capacity of the Earth to absorb waste and renew itself (Goodland 1992). How can environmental educators help their students construct an informed view of this major force in society?

Making decisions—for better or worse

In many discussions about the world’s environmental situation science and technology are often pointed to as the main culprits. Environmental educators need to emphasise that science and technology are but tools. It is people who use them. It is our needs, wants, dreams and ambitions that drive us to use resources. It is people who make decisions about driving instead of biking or walking; it is people who decide to car-pool and to tune up their cars properly, to purchase gas guzzlers or cars with more efficient engines. A major responsibility of environmental educators is to emphasise that each individual’s actions impinge on the capacity of the planet to care for all its inhabitants.

The precepts of organic farming are known; case studies from all over the world, from Bangladesh and Cuba to Senegal and Iowa show the feasibility of sustainable agriculture using these precepts. In fact, sustainable agriculture produces more food for more people. Why is its practice not more widespread? Studies in this area emphasise that shifting from conventional, ‘chemical-dependent’ approaches needs not just new technology but human will to use it and the socio-political structures that will support its use (Thurpy 1996).

Today all nations are in pursuit of ecologically sustainable development. Citizens need opportunities to be involved in

choosing between alternative paths towards progress in attaining such development. Central to environmental educators' work must be their attempts to help their students develop skills in making informed decisions for ecological and nurturing development.

Paul Goodman, quoted by Neil Postman, has called technology a branch of moral philosophy, not of science (Postman 1993). Students of environmental education need assistance to appreciate that the present directions of technological and industrial evolution are not inevitable. They are not beyond our control. There are many points at which we can say "No!". There are processes and products discovered and invented through science and technology, and applied by economic and socio-political systems, which we can reject and should reject, knowing their impact on our planet. There are times when 'progress' for this generation would mean misery for future generations; such projects need not be allowed to push through.

Here I would like to cite a recent event in the Philippines when Filipinos said "No!". There are many things wrong in my country in terms of the ways we continue to treat our environments but this decision has done us proud. A major development project intended for launching in Bolinao, Pangasinan was blocked. The project which involved, among other things, a cement plant and the upstream and down-stream activities associated with it was being pushed by some influential people and was purported to be one that would catalyse economic development. However, it would have degraded a valuable marine reserve and affected the livelihood of many fisher folk. Progress in terms of more money for some was blocked; sustainable living won out.

What does this say to environmental educators?

Daily, as we and our students go about our lives, we make many big and small decisions. Consciously and unconsciously, we sift through the monetary, emotional and aesthetic costs and benefits of alternatives. The choices we make as individuals, societies and nations are influenced by what we know and value (Galang 1995). The world of the 21st century will bring new and unforeseen challenges. New technologies, new social and economic systems, global interdependence and interconnections. How will we respond—and how, as environmental educators will we have helped our students to equip themselves to make wise decisions and effect wise actions?

The task for educators is to assist students to prepare themselves for the new millennium, for the vast array of knowledge continuously being generated and the innumerable options available to them. We are asked to guide them as they develop the attitudes, values and perspectives they will need if they are to choose wisely. We need to provide them with inspiring encounters with nature so that when they do choose among alternatives they will decide in favour of nature and in favour of coming generations so that they too will be inspired and act accordingly (Nash 1991).

As fathers, mothers and teachers, let us all be environmental educators. Our children will thank us for it, as I thank my father for his legacy. ☺

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