CONTINUING EDUCATION FOR DECISION-MAKERS INCLUDING POLITICIANS, SENIOR GOVERNMENT OFFICIALS, AND CHIEF EXECUTIVES IN INDUSTRY

Bhaskar Nath
European Centre for Pollution Research, London, UK

Keywords: continuing; education; environment; certification; decision-makers; politicians; government; officials; chief; executive; industry

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Summary

Ever since the 1972 Stockholm "Conference on the Human Environment", our knowledge of anthropogenic pollution and how it has been degrading earth's natural environment and life support systems has been growing at an increasing pace. It follows therefore that, in order to be effective, decision-makers, politicians, senior government

officials, chief executives in industry and others responsible for making policy and for planning projects for and on behalf of society must keep abreast of rapid developments in the field by regularly updating and upgrading their knowledge and skills.

The methods of "Continuing education" employed for updating and upgrading are described in detail in this Article, including an innovative and effective mechanism for certification which adds value to the conventional methods of continuing education. Also discussed in detail are some of the pressing environmental issues and problems that need to be addressed by decision-makers, politicians, senior government officials, chief executives of business and industrial concerns and others whose policy decisions have potential to affect people's quality of life as well as earth's natural environment and life support systems.

1. Introduction

Curiosity, common in primates as a key element of their survival strategy, is a much enhanced characteristic of *Homo sapiens.* Ever since the dawn of civilization, man has been driven by his innate curiosity to know how the physical world around him works and why things work and behave the way they do. While the "how" has focused on understanding the physical and mechanical aspects of the world around us through scientific inquiry culminating in amazing developments in relativistic mechanics, quantum mechanics and molecular biology to name but a few, in the main inquiry into the "why" has been through metaphysical and philosophical pursuits. As a result, both new and updated human knowledge in all fields has evolved and accumulated through the ages, so profoundly in fact that today we have the ability to produce "made to order" plants, animals and even humans to desired specifications. Underlying all such developments is the ever-growing body of human knowledge as well as its momentum for change as new facts are discovered, new inventions made and old knowledge updated as a result of man's innate curiosity and incessant quest for knowledge.

As a result of increasingly rapid accumulation of knowledge in practically all fields of human endeavor, and as old knowledge is updated by new, it is becoming essential more than ever before for all professionals to keep pace with developments in their respective fields. So much so in fact that knowledge and skills of those who fail to do so are at serious risk of becoming dated, and this may erode the demand for their professional services in the job market. Conventional methods of what is called "continuing education" are employed to update and upgrade both knowledge and skills of professionals and others in line with on-going developments.

Rapid advances in knowledge assume particular poignancy for environmental professionals. It was the 1972 Stockholm "Conference on the Human Environment" that firmly placed the state of the global environment on the international political agenda. As may be judged from the veritable avalanche of publications and numerous conferences on the subject since then, a good deal has so far been learnt about how the global environment has been and is being degraded by human activities for socio-economic development. Indeed, nowadays hardly a day goes by without the media reporting on the impacts of one or more of these activities and their environmental implications for both present and future generations. For example, in a recent

conference eminent scientists gave dire warnings of the likely consequences of global warming that may be catastrophic (ICCT, 2005). And yet, the international community does not seem to be giving the Kyoto Protocol the urgency it deserves. In any case, according to many scientists the CO_2 reduction targets stipulated in the Protocol are already too little and too late. This lethargy probably reflects humankind's apparent psychological deficiency to respond urgently to an imperceptible *process*, however disastrous or catastrophic its potential consequences might be, unlike their instinctive ability to respond urgently to a disastrous *event* such as the 2004 Indian Ocean Tsunami, for example.

In pluralistic democratic societies Leaders of Society (see glossary) shoulder special responsibility for preserving the integrity of the natural environment because, acting for and on behalf of society and in serving society, it is they who make public policy and plan public projects with consequences for both people's quality of life and the natural environment. It follows therefore that they, more than anyone else, must keep pace with latest developments in environmental science, technology and management by constantly updating and upgrading their knowledge and skills through continuing education. Also, as sustainability is now the goal of all environmental policy and activities for socio-economic development, it goes without saying that their continuing education must sharply focus on how sustainable economic development ought to be achieved in ways that do not degrade or damage the natural environment to the detriment of future generations.

Earth's natural environment and life support systems function as a delicately-balanced organic whole of a large number of interacting components. This means that no single component should be looked at independently of the others, or manipulated on the assumption that others will not be affected by so doing. The approach must therefore be multi-disciplinary and holistic, with due regard to their inter-dependence and mutual interactions. However, with our knowledge of the environment advancing rapidly on a broad front, the trend is for experts to specialize in a narrow area of environmental science, technology, management or law. As a result, pursuit of higher environmental knowledge is becoming highly specialized and compartmentalized too (in the disciplinary sense). Clearly, this is contrary to a multi-disciplinary and holistic approach. Specialization is perhaps inevitable, however, given that it is impossible for an individual to acquire in-depth knowledge that is rapidly advancing on a broad front or to keep pace with it. Even so, it is important for Leaders of Society to take a holistic view of nature's environmental and life-support systems with due regard especially to the known mutual interactions that occur among different environmental components and compartments, together with an understanding of how and the extent to which anthropogenic pollution undermines or disables them. Most importantly, they must have a clear understanding of the key modalities for achieving global sustainable development in ways that do not so degrade the natural environment as to compromise the ability of future generation to meet their own needs (WCED, 1987). And, of course, they must keep abreast of developments with particular regard to new knowledge, information and skills.

With regard to the above, the focus of this Article is on how to update and upgrade knowledge and skills of Leaders of Society effectively and continually. The following

are discussed to that end:

- Characteristics of human knowledge and its evolution;
- Continuing education for Leaders of Society;
- Suggestions for what continuing education for Leaders of Society ought to be about; and
- Need for certification and description of an innovative mechanism for it.

2. Human Knowledge and Some of its Salient Characteristics

Ever since the dawn of civilization, man has been curious to know about his place in the wider Cosmos, how the physical world around him works, and how to use the knowledge thus gained for social welfare, benefit and security. Arguably, evolution of human societies everywhere owes much to man's innate curiosity. Driven by it, so profound have the fruits of man's incessant quest been, and continue to be so at an ever increasing pace, that today we are apparently on the verge of discovering the secrets of life through genetic science and biotechnology, and well on the way to discovering how our universe has evolved following the Big Bang! Indeed, advances in all fields of human knowledge — Astronomy, Chemistry, Literature, Medicine, Music, Philosophy, Physics and so on — bear ample testimony to the human genius. And yet, mainly through his industrial activities for economic development, man has been so grossly degrading the natural environment that there is now a growing question mark against the integrity of earth's life support systems in the long-term. This juxtaposition of genius on one hand, and on the other man's conscious willingness to degrade and even destroy the natural environment and natural systems which make life on earth possible and provide the unique resource-base for economic development, is indeed curious if not amazing.

It would be instructive to consider some of the key characteristics of knowledge and its acquisition by humans. Certainly, both teachers and learners ought to be aware of them.

2.1. Evolution of Human Knowledge

An understanding of how human knowledge evolves and accumulates over time is facilitated by imagining a balloon which, at a given instant of time, contains the sum total of all new and updated human knowledge and experience accumulated up to that time (Nath and Talay, 1996). The balloon expands over time as human knowledge and experience accumulate. However, at a given time we humans have access to, and can utilize, only the knowledge and experience which the balloon contains at that time. At no time can we know or understand what is outside the balloon, because what lies outside it is beyond our knowledge and experience. We can only speculate on it on the basis of, or by extrapolating, the knowledge and experience contained in the balloon at the time in question. This is succinctly conveyed by the purport of the following story from ancient India (Nath and Talay, 1996):

> Once upon a time, there lived a frog in a deep, dark and slimy well. He was a happy frog, for he had plenty to eat and had no rival or predator. He used to wake up in the morning, swim and splash about in the water and feast

abundantly on the insects that fell into the well during the night.

But, one day his happy and peaceful life was shattered. For he found that a big spider had spun its web about one meter above him, so that all the insects that fell into the well for him to eat were now caught in the web. The spider ate them all with relish and became fatter and fatter, while the poor frog, that had practically nothing to eat, became weaker and weaker.

It became clear to him that either he must destroy the web and kill the spider or die of starvation. Although he tried his very best to jump and catch the spider, his jump was always a little too short. One day finally he resolved to kill the spider and, amazingly, despite his weakness caused by starvation, he was able to jump a little higher than before to catch it. He killed and ate the fat, juicy spider and destroyed its web.

In celebration the frog allowed himself a long rest, during which he thought to himself, "….well, I do not know of any other frog capable of jumping as high as I did. In fact, I do not believe it is possible for a frog of my kind to jump that high. So I must be a special frog, a very special frog. Because I am so special, let me speculate on the nature of the outside world. I am entitled to do so because I am so special. But I have a problem. It is that I only have knowledge and experience of this well and of nothing else, and I cannot go beyond what I know. Therefore, I declare that the world outside the well is also dark, moist and slimy.

In what essential respects does the human situation differ from that of the frog, considering especially our limitations referred to in Section 2.3? Annals of history show that like the frog, we humans bestow upon ourselves attributes and grant ourselves "licenses", often on the basis of our manipulative, intellectual or mechanical skills, power or even brute force to carry out unspeakable activities in self interest. For example, we exploit and subject innocent ("food") animals to unspeakable suffering because, according to Descartes — and historically his judgment on the matter was given great credence — they are "automata" and therefore not intelligent by definition and believed to be not even capable of feeling pain. The arbitrary and questionable criterion chosen here by man to justify his "license" to do what he wants to do (to kill innocent sentient creatures in this case and to eat their flesh) is level of intelligence, while that used by the frog for his "license" to speculate on the nature of the outside world was his ability to jump higher than other frogs of his kind. Indeed, man has often used the notion of superiority, which comes with self-awarded attributes and "licenses", to exploit nature and her bountiful benediction of resources, other creatures as well as fellow human beings mercilessly and still continues to do so. At least the frog had the humility to acknowledge his limitations. We humans seldom do. Such is the nature of aggression and arrogance characteristic of man.

2.2. The "World View" of Aristotle and its Enduring Environmental Legacy

The philosophical "world view" of Aristotle (384 – 322 BC), how it has largely shaped Occidental attitude to nature and the natural environment over the last two millennia, and the adverse environmental consequences thereof merits particular attention.

According to this view of the world, man is paramount in creation and all non-human things within it, animate and inanimate, have no intrinsic value. They are of value if and only if they serve some purpose useful or beneficial to man (Allan, 1970). Thus, for example, a rare plant in the Tropical forest is valuable, and therefore presumably worthy of respect and/or preservation, only if some drug could be made from it to cure a human ailment. This dominant and profoundly anthropocentric world view of the time is reflected in the Judaeo-Christian tradition too (e.g. Genesis 2.28, The Holy Bible).

> "In Western terms, one of the underlying factors which may have contributed (by being taken literally) to the desire to dominate nature, rather than live in harmony with it on a sustainable basis, is to be found in the Book of Genesis where it records that "God said unto man, be fruitful and multiply, and replenish the Earth and subdue it; and have domination over the fish of the sea and over the fowl of the air and over every living thing that moveth upon the Earth." To me that Old Testament story has provided Western man, accompanied by his Judaeo-Christian heritage, with an overbearing and domineering attitude to God's creation".
>
> HRH The Prince of Wales (Porritt, 1991)

Later, in the Seventeenth Century, this world view was set in the secular context by thinkers like Francis Bacon (1561–1626), René Descartes (1596 –1650) and others whose work substantially contributed to building the foundation of modern economics, science and technology. The origins of this quintessentially Occidental attitude of exploiting all animate and inanimate non-human things (and humans too, as objective European colonial history would confirm) can be traced back to the Aristotelian world view, and arguably it continues to be responsible for the growing environmental predicament confronting the humankind today (Nath, 2003).

According to the knowledge contained in the balloon at the time of Aristotle, the Earth was stationary and the center of the universe, and all other known heavenly bodies revolved around it along circular orbits. In 150 AD Ptolemy elaborated and synthesized these ideas, promoted by Aristotle himself, into a complete model of the universe known as the "geocentric model". This model was adopted by the Christian Church and became the dominant cosmology until the Sixteenth Century (it is to be noted that about four thousand years before Aristotle the Sumerians also believed the Earth to be the center of the universe).

However, we know from advances in astronomy since Aristotle that the geocentric model was completely wrong. We also know that the Earth is not and has never been the center of the universe, neither is it stationary. It is actually a small planet of an insignificant star called the Sun situated at the edge of a minor galaxy called the Milky Way; and that in the universe there are billions of larger galaxies and billions upon billions of stars larger than the Sun, each with its own planetary system. Indeed, the unimaginable vastness of the universe can be gleaned from the fact that light, traveling from some distant stars and galaxies at the tremendous speed of 300,000 km/second, has not reached us yet. In fact, the Earth is so insignificantly small in the unimaginable vastness of the Cosmos that if one day it was to be annihilated by a man-made or natural catastrophe — and heavens forbid it — it will not register as a cosmic event of any

significance whatsoever.

Had the balloon at the time of Aristotle contained today's knowledge about the Cosmos and our place in it, and if he had known about it, it is very unlikely that he would have advanced and promoted his "world view" which is preposterous on hindsight and which has largely shaped Occidental attitude of exploitation to nature and all non-human animate and inanimate things within it (Nath, 2003). Instead, modern economics, science and technology will probably have evolved under the rival eco-centric "world view" of Plato (427 – 347 BC), according to which all things in creation, animate and inanimate including humans, have their intrinsic values even though we humans cannot know what those values might be because of our intellectual deficiency. Indeed, in the *Timaeus*, in which Plato addresses a number of scientific questions of his time and their philosophical implications, he forcefully states that "this world in very truth [is] a living creature with a soul and reason". It is interesting to note that this ancient view of the Earth is in line with the recent *Gaia Hypothesis* which states that the Earth is *alive* and proposes that "Planet Earth functions as a single organism that maintains conditions necessary for its survival" (Lovelock, 1979).

2.3. Perceptive Nature of Knowledge and Human Limitations

We humans acquire knowledge about the physical world by interacting with it with our five senses. And what our sense impressions convey to us are merely our *perceptions* of the physical world, as determined by the situation of the observer, and not *reality* (Nath and Talay, 1996). Indeed, in this mortal coil and with our inadequate brain machinery, which manifests in a number of human limitations that are spatial, temporal and others, we are simply not equipped to observe reality (Nath and Talay, 1996; also see Sections 2.1 to 2.4 of *Instilling Environmental Awareness in Undergraduate University Students*). Is the world, as we perceive it, then a drama, an illusion, or perhaps *maya* (nearest English translation of this Sanskrit word is also illusion) as characterized in the scriptural texts of ancient India?

> All the world's a stage,
> And all the men and women merely players;
> They have their exits and entrances,
> And one man in his time plays many parts,
> His acts being seven ages.
>
> *As you Like It* (act 2, scene 7) by William Shakespeare

Yet, while we celebrate our achievements in all our endeavors with justification, seldom do we acknowledge our limitations. The danger is that, this can create an unbalanced view of ourselves in our minds to make us arrogant about our abilities, especially with regard to science and technology, or even confer upon us, perhaps unknowingly, some attribute of omnipotence which as mere mortals we certainly do not possess or have any claim to.

In the environmental context, a crucial limitation of human beings is their inability to predict the future in sufficient detail. History of science and technology is littered with

examples of scientific and technological developments that by all accounts held much promise for human welfare and benefit at the time of their discovery. Unfortunately, in many cases their medium- or long-term impacts turned out to be harmful or dangerous to Earth's fragile environmental systems and/or to human and animal health. All such impacts have occurred because of man's inability to predict future consequences of present action with sufficient degree of certainty. The topical issue of Global Warming, whose adverse consequences for Earth's natural environment could be wide-ranging and even catastrophic, provides a typical example. From the beginning of the Industrial Revolution in Britain in the late Eighteenth Century when the burning of fossil fuels to generate energy took off as never before, to only 30 or so years ago no one knew or could predict that the use of such fuels to drive the insatiably ravenous engine of industrialization for socio-economic development could one day lead to something potentially catastrophic called Global Warming.

Werner Heisenberg's Uncertainty Principle in Quantum Physics (Heisenberg, 1970) can be invoked to shed some light on this innate human deficiency. In its rigorous mathematical formulation, the Uncertainty Principle states that as a cardinal rule of Quantum Mechanics, "in principle it is impossible to measure precisely certain pairs of properties [e.g. position and velocity or position and momentum] simultaneously". That is, if we know the position of an electron precisely, in principle we cannot know its velocity or momentum with certainty, and *vice versa* (we speak of electrons, protons and atoms because the subatomic level is the domain of Quantum Physics). In the philosophical context the above statement translates into "we cannot know, as a matter of principle, the present in all its details" (Gribbin, 1994). If we cannot know the present in all its details, and given that today (present) was yesterday's future, how could we possibly predict with certainty what future might hold? What is called the "Precautionary Principle" in Environmental Management and Environmental Law seeks to prevent making potentially environment-damaging decisions resulting from man's innate inability to predict future consequences of present action with sufficient certainty.

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Biographical Sketch

Professor Bhaskar Nath received his Bachelor's degree in Civil Engineering from the Indian Institute of Technology, Kharagpur, India, in 1960, followed by the Ph.D. degree from the University of Wales, UK, in 1964. In 1983 he was awarded the D.Sc. degree by the University of London for his outstanding original research (according to citation) in numerical mathematics. In 2001 he was awarded the *Doctor Honoris Causa* (Dr.H.C.) by the University of Chemical Technology and Metallurgy, Sofia, Bulgaria, for his contribution to environmental education.

After having taught at the University of London for more than 27 years, currently Professor Nath is Director of the European Centre for Pollution Research, London; Executive Director of International Centre for Technical Research, London; Editor of *Environment, Development and Sustainability* published by Springer; visiting professor to several European universities, and consultant to a number of international companies and organizations. Professor Nath's research interests include Numerical Mathematics, Elasto-Hydrodynamics, Philosophy, Environmental Economics, Sustainable Development, and Environmental Education. He has more than 100 scientific publications in these and related areas including 13 books.