

## **FORMAL ENVIRONMENTAL EDUCATION AT THE UNDERGRADUATE LEVEL**

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### **Summary**

Ever since the Industrial Revolution, which began in earnest in the 1860s, economic development through industrialization has been the dominant if not the exclusive paradigm of economic development. No doubt industrialization has brought immense benefits to practically every aspect of life, so much so that today it is impossible to think of modern living and life-styles without them. Unfortunately, like most things in life, a price has to be paid for it, and that price continues to be the mounting degradation of the natural environment with potentially catastrophic consequences for life on earth.

In all countries of the world undergraduate students at universities and equivalent institutions represent the elite of society, destined in due course to become political leaders, technocrats and leaders of business and industry. Therefore, it is argued that as future leaders of society they ought to understand how human behavior, activities and life-styles have been, and are being, adversely impacting on the natural environment and

what must be done to arrest or if possible reverse the trend. To this end a generic syllabus is proposed from which syllabuses of individual modules or subjects are to be tailor-made as deemed necessary and appropriate for inclusion in formal curricula. The objective is two-fold: First, to equip students reading civil, chemical and production engineering and related subjects with in-depth knowledge of planning, designing and operating facilities to deal with anthropogenic pollution already created. And second, to instill environmental awareness in *all* undergraduate students, with particular reference to the damage human behavior, activities and life-styles have been causing to nature's environmental capital without which life on earth cannot exist, aiming to bring about positive changes in their behavior and attitude to the natural environment. A number of other related issues are also discussed.

## 1. Introduction

These days hardly a day goes by without the scientific community and/or the media reporting on some environmental problem of mounting concern. Although currently the problem of global warming, which scientists believe has potential for catastrophic consequences for the very fabric of life on earth (e.g. Royal Society, 2005; ISSC, 2005), heads the list of such problems, there are other mounting problems, such as that of solid waste especially in developing countries (Kocasoy, 2000), that do not augur well for the integrity of earth's natural environmental capital.

In all countries of the world undergraduate students at universities and equivalent institutions represent the elite of society, destined in due course to become political leaders, technocrats and leaders of business and industry. Therefore, as future leaders of society there is a *prima facie* case for them to have a deep understanding of how human behavior, activities and life-styles have been adversely impacting on the natural environment and what must be done to arrest or if possible reverse the trend.

Like it or not, thanks in part to the gathering pace of globalization the world is becoming a uniform monoculture firmly based on, and shaped by, the quintessentially Western materialistic ethos of open-ended consumption of goods and services characterized by the bizarre manifestations of 'Retail therapy' and 'Conspicuous consumption'. Whereas a core requirement of sustainable development is that the affluent should "adopt life-styles within the planet's ecological means" (WCED, 1987, page 9), meaning reduce their consumption, the prevailing economic system functions well only when there is unfettered growth in production and consumption of goods and services. Increasingly the system is geared to supplying the 'wants' of the increasingly profligate, environment-degrading and quintessentially Western life-styles that are and have been vigorously promoted by the West as the 'ideal' to be emulated by all. By contrast, the authoritative definition of sustainable development, given in the Brundtland Commission Report, is in terms of 'needs', not 'wants' (WCED, 1987, page 8). Thus trying to achieve global sustainable development within the prevailing economic system is attempting an improbable juxtaposition of opposites, not unlike 'trying to fit a square peg in a round hole'. Arguably the environmental problems besetting humankind today are but symptoms of the apparently insatiable lust of the affluent within and between nations for open-ended consumption to satisfy their hedonism (Nath, 2003; also see Section 3 of *Need for Environmental Research*).

Many of the Western nations now claim to have cleaned up their cities, towns and countryside. However, this has largely been accomplished by relocating their (dirty) manufacturing industries in developing countries that have little or no bargaining power and where environmental laws and regulations are lax and/or enforcement regime weak. This amounts to the host countries mortgaging the future of their environment for short-term economic gain. Also, as pollution does not recognize political borders, in time pollution being caused in the developing countries will add to existing global environmental problems or create new ones affecting all. In spite of this, many of the Western nations continue to be the biggest polluters with grossly unsustainable lifestyles to match (Nath, 2003; Nath and Kazashka-Hristozova, 2005).

Against this backdrop, precisely what is it that undergraduate students ought to know about the environment? Do they really need to know about such matters, given that today most if not all organizations employ environmental managers and/or have access to experts to deal with their environmental issues and problems?

Taking the second question first, the answer is ‘yes’ mainly because we are all stakeholders in the natural environment and so collectively and individually responsible for preserving its integrity. It is hard to see how that responsibility could be discharged without knowing how human behavior, activities and life-styles have been adversely impacting on it. More precisely, *all* undergraduate students ought to know about ‘before-the-pipe’ (see glossary) strategies for reducing or eliminating anthropogenic pollution. As for the first question, it is clearly important for undergraduate students reading civil, chemical and production engineering and related subjects to acquire in-depth knowledge of planning, designing and operating ‘end-of-the-pipe’ (see glossary) systems to deal with anthropogenic pollution already created. In addition, it is argued that education in ethics and morality should also be included in formal curricula. A generic syllabus is proposed from which to develop the syllabuses of individual modules (or subjects) as deemed necessary and appropriate these issues together with a number of other related issues are discussed in this chapter.

## **2. Some of the Related Issues**

### **2.1. Evolution of Higher Education**

The primary mission of the ancient centers of learning, such as the *Shangyang Academy* in China during the *Yu* period (2257 to 2208 BC), *Plato’s Academy* (c. 387 BC) in Athens, and *Nalanda* in India during the Gupta period (c. 320 to 500 AD), had been to seek knowledge of the world around us, how to relate to it, contemplate man’s place within it, and to “celebrate knowledge” focusing on natural philosophy. In the main this tradition continued in the medieval universities too, for example at *Al-Azhar* (Cairo, 971 AD), *Magnaaura* (Constantinople, 849 AD), *Bologna* (Italy, 1088 AD) and *Paris* (France, c. 1100 AD).

However, especially since the mid-nineteenth century when the industrial revolution began in earnest, European universities and institutions of higher education as well as those in their then colonies began increasingly to serve the needs of the macroeconomic machinery for wealth creation through teaching, research, innovation and enterprise.

Consequently, it is no exaggeration to say that today, in the Anglo-Saxon world in particular, the growing role of modern universities is to offer higher education as dictated by the market forces of supply and demand. And therefore, of necessity, and for many as a survival strategy, the institutions of higher education are having to continually develop and offer degree programs that command high demand in the market place. This trend is having two main impacts, neither conducive to what higher education was originally supposed to be about. First, increasingly it has been making higher education a market good governed by the laws of supply and demand — often the best being accessible only to those able to afford it. And second, due to progressive reduction in state funding for higher education (in the United Kingdom for example), increasingly universities and other institutions of higher education are having to rely on industrial and commercial sponsors for financial support, especially for research. And, under such arrangements it is not uncommon for research programs to serve sponsors' specific agenda.

Depending on demand, today the growing trend among prospective students is to opt for those subjects that have potential for high financial and material rewards on graduation. In the main the original purpose of higher education — to produce enlightened human beings through the acquisition of knowledge for its own sake — has now been jettisoned. Rather, the purpose of higher education today is two-fold: to produce consumers with open-ended demand for goods and services to ensure efficient functioning of the prevailing economic machinery; and to produce graduates equipped with scientific and technical knowledge and skills to service that machinery.

## **2.2. Education in Ethics and Morality**

It is disturbing that while science and technology are now advancing at a breathtaking pace transforming both societies and life-styles, developments in and understanding of the ethical and moral values to underpin and so justify such advances are lagging farther behind. Seldom, if ever, ethics and morality are included in the formal curricula of higher scientific or technological education. If this trend persists, future generations would be at risk of inheriting a world of science without civilization, materially prosperous societies consumed by insatiable greed and bereft of humanity, and the Earth denuded of its endowment of life-sustaining benediction.

The following explain why education in ethics and morality is important (Nath, 2003):

- Philosophy is unquestionably the foundation of all knowledge. As Albert Einstein famously observed, “Knowledge without philosophy is just mechanics”. Surely, the aim of scientific and technical education (or any education for that matter) cannot be, and must not be to produce scientists or technologists who think and act like ‘automata’ and/or have little or no idea of the ethical or moral underpinning of their actions with particular regard to the natural environment.
- Unlike animals of lower species, humans have an innate need to rationalize all their actions and even their thoughts. And it is this need that sets them apart from other earthly creatures. Philosophy and moral philosophy in particular, provides this rationale, and by doing so it gives us our humanity.

Especially since the industrial revolution, open-ended consumption of goods and services by the affluent both between and within nations demanded by their profligate, hedonistic, narcissistic and ultimately unsustainable aspirations and life-styles has been responsible, more than any other factor, for the mounting degradation of earth's natural environmental capital and life-support systems. The origins of the quintessentially Occidental attitude responsible for such life-styles can be traced back to, among others, Homer (Rieu, 1991), Aristotle (Allan, 1970) and the Judaeo-Christian tradition itself.

“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 dominion 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)

Taking the three together, in a nutshell this attitude, and the purpose of life it alludes to, may be stated as: “Enjoy life to the full and live for the moment by exploiting nature and all things within it because they have no intrinsic value and they exist only for your pleasure and benefit”. While Homer's ‘live for the moment’ implies instant sense-gratification through the achievement of immediate rewards, he nevertheless acknowledges the need to revere the gods of Olympus (who took sides in the Trojan War) in order not to offend them — just in case. Aristotle's ‘world view’, unlike that of Plato, proclaims that nature and all things within it have no intrinsic value; that they exist for the pleasure and benefit of man (Allan, 1970), and that man is paramount in creation (reflecting the geocentric cosmology of his time). Arguably, this profoundly anthropocentric and environment-degrading attitude coupled with industrialization, its vigorous promotion worldwide by the West as the must-have imprimatur of progress, civilization and modernity, and the dysfunctional environmental values on which it is based, have together created the intractable environmental predicament in which we now find ourselves and which is increasingly threatening the very fabric of life on earth.

If Aristotle had known that in cosmic terms the Earth is but a small, insignificant planet of an insignificant star called the Sun situated at the edge of an unremarkable galaxy called the Milky Way — one among billions of much larger galaxies in the universe — it is doubtful if he will have postulated his profoundly anthropocentric, not to say preposterous, ‘world view’ which has shaped the grossly exploitative Occidental attitude to nature and the environment. By contrast, many of the ancient cultures (mainly of the East) taught man to live contented lives in harmony with nature, venerating the Earth as the provider of life-sustaining benediction. For example, in the ancient *Vedic* philosophy of India, which still constitutes the bed-rock of that country's culture, the Earth was revered as Mother Earth (*Dharitri Mata* in Sanskrit), and in Greek mythology too as primeval goddess *Gaia* (also called *Gaea*) who appeared when the universe was created.

“Everything animate or inanimate that is within the universe is controlled and owned by the Lord. One should therefore accept only those things necessary for oneself, which are set aside as his quota, and one should not accept other things, knowing well to whom they belong”.

Mantra One, *Sri Ishopanisad*

The crux of the matter is this. According to behavioral psychologists — and it follows from common sense too — how we treat something (or someone) is largely determined by our attitude to it, and our attitude in turn is shaped by the moral and ethical values we hold (Gross, 1991). The Occidental attitude to nature and the natural environment has been one of gross exploitation and, thanks to economic, social and political pressure it is now being emulated worldwide as never before. Typically, today most young people in China aspire to North American life-style and standard of living. That country, closely followed by India, is now making breath-taking economic progress towards that goal and to becoming a super power in due course. Certainly, economic prosperity would lift millions of citizens of these countries from poverty, and this is much to be welcomed.

However, considering that with only 4 percent of the world’s population the USA consumes about 25 percent of the world’s resources and produces an estimated 26 percent of the world’s pollution, and that such a country cannot be said to be sustainable by any stretch of the imagination (Nath, 2003; Nath and Kazashka-Hristozova, 2005), China’s ambition, not to mention India’s, does not augur well for global environmental sustainability or intergenerational and intra-generational equity in the long term. If current trend continues, within the next 10 years or so China is expected to overtake the USA as the world’s biggest emitter of CO<sub>2</sub>. To put the issue in perspective, if by some magic every person in the world today was afforded North American standard of living, global oil consumption would be 4.6 times greater than at present with global pollution to match (Nath and Kazashka-Hristozova, 2005).

How could we possibly change the current attitude of gross exploitation of the natural environment and limited resources to one of *genuine* concern, care and respect? It is hard to see how command-and-control strategies or science and technology could be helpful in this matter. What is needed for changing attitude is education in moral and ethical philosophy which, as it would appear, has been eliminated from the formal curricula of scientific and technological education.

### **2.3. Perceived Role of Science and Technology in Delivering Environmental Sustainability**

There seems to be a firmly held belief in the international scientific community that environmental problems can be solved and sustainable development and global environmental sustainability achieved with the application of science and technology alone. Indeed, this orthodoxy appears to be so deeply embedded in the collective psyche of the scientific establishment that one may be forgiven for mistaking it for something of a religious conviction.

The same orthodoxy also pervades the formal curricula of environmental education of

students reading the natural sciences and engineering, as well as research. Consider the following among many that could be cited:

- (a) Paragraphs 81-136 of the Johannesburg Plan of Implementation (JoPI), which is probably the most important document to emerge from the World Summit on Sustainable Development held in Johannesburg in 2002 (Hens and Nath, 2005), elaborate on the means of implementing Agenda 21. Many of these paragraphs are concerned with education, training and capacity-building, but they are *only in the particular context of science and technology*. For example, “...to provide technical assistance to developing countries...” (para. 97(a)), “transfer and diffusion of environmentally sound technologies to developing countries and economies in transition” (para. 106(e)), “Build greater capacity in science and technology for sustainable development” (para. 108), etc.
- (b) The ICSU (International Council for Science) initiative on “Science education for capacity building for sustainable development” is exclusively in terms of science and technology (ICSU, 2002; Nath, 2003).
- (c) In the “Framework 6” program of the European Union, sustainable development, global change and ecosystems are a thematic priority for research. And research in these areas is specified in terms of “strengthening the scientific and technological capacities needed for Europe to be able to implement a sustainable development model in the short and in the long term, integrating its social, economic and environmental dimensions contributing to international efforts mitigating adverse trends in global change” (www.europa.eu.int ).

This exclusive reliance on science and technology, presumably born of arrogance and/or ‘Acute Professional Deformity Syndrome’ of the ‘Hammer Man’ (see glossary), is hard to understand. Because, if science and technology alone could deliver global sustainable development, re-orient moral values and alter attitudes for achieving it, then how is it that the rich developed nations that are abundantly endowed with latest science, technology and financial and skilled manpower resources continue to be the biggest polluters and consumers with grossly unsustainable life-styles to match (Nath, 2003; Nath and Kazashka-Hristozova, 2005)? We argue that meaningful progress towards sustainable development is contingent upon a fundamental change in societies’ attitude to nature and the environment — from one of gross exploitation as at present to that of *genuine* respect, care and concern (Nath, 2003). It is only with such enlightenment that the affluent would be willing to adopt less consumptive life-styles commensurate with earth’s ecological capacity (WCED, 1987).

Science or technology, however advanced, cannot help in this matter. What is needed to bring about this change of attitude is education in moral and ethical philosophy (Nath, 2003). Yet, no reference to ‘morals’ or ‘ethics’ could be found in (a), (b) or (c), or in scientific or technological curricula. This reinforces the case for instilling genuinely environment-respecting moral values in undergraduate students through formal education.

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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.