FORMAL ENVIRONMENTAL EDUCATION AT THE GRADUATE LEVEL

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Keywords: Environmental; curricula; education; graduate; Masters; programmes; research.

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Summary

As future leaders of society, and certainly as stakeholders in the well-being of the natural environment which is unquestionably the unique resource base for wealth creation, it is important for all graduate students to know about Earth’s natural environment, about how human behaviour and activities have been relentlessly harming it, and about what ought to be done through higher education and research to arrest or if possible reverse the trend. Yet, even a cursory examination would reveal that, despite mounting scientific evidence of how anthropogenic pollution has been degrading the natural environment with potentially catastrophic consequences for future generations, at present formal environmental education at the graduate level falls short of what it ought to be, especially in non-environmental Masters degree programmes. It is also a matter of concern that while methods and strategies for pollution reduction and prevention are a priority, in the EU hierarchy of waste management options, for example, the so-called ‘end-of-pipe’ methods and strategies for dealing with pollution after it has been created continue to be emphasised in both environmental Masters Degree programmes and environmental research.

With a view to addressing these deficiencies, specific environmental subjects are proposed in this contribution as part of the formal curricula of graduate study programmes, and a number of research areas identified as priority. Some of the related
issues are also discussed.

1. Introduction

1.1. The background in brief

A disturbing question, which underscored deliberations at the World Summit on Sustainable Development (WSSD) (Hens and Nath, 2005) held in Johannesburg from 26 August to 4 September 2002, was this: why, in spite of all the money and effort expended during the ten-year period from Rio (1992) to Johannesburg (2002), the world of 2002 was environmentally less sustainable than in 1992? What went wrong? The response to this question was, and is, predictable. While the poor developing countries argued that their efforts to meet Agenda 21 objectives had been seriously thwarted by lack of financial and skilled manpower resources, in general the rich developed countries appeared to be reasonably content with the progress they had made notwithstanding the refusal of the USA to ratify the Kyoto Protocol.

However, this ‘progress’ warrants close scrutiny. We argue that it is suspect and misleading too. Because, whatever progress the developed countries have so far made towards meeting the Agenda 21 objectives has largely been achieved with systematic relocation of their ‘dirty’ manufacturing facilities to poor developing countries that have little or no bargaining power, where labour is cheap and abundant, and the regime for enforcing environmental standards and regulations is lax or can be manipulated with inducements. Largely as a result of relocation today, the manufacturing sector of the US or the UK economy, for example, accounts for only about 20% of their respective GDPs and is shrinking. If this trend continues—and it is more likely than not to given the gathering pace of globalisation—in about 20 years from now these macroeconomies are likely to be based almost entirely on the service sector. However, relocation of manufacturing facilities in this way cannot address the growing problem of global anthropogenic pollution—it merely changes the jurisdiction of the pollution, from the ‘rich’ world to the ‘poor’ world. And, as regional and national environmental pollution often becomes, or contributes to, global pollution affecting all, this state of affairs does not augur well for the long-term integrity of the global environment or for nature’s life support systems without which life on Earth cannot exist. As a result environmental contamination continues to be so relentless and so comprehensive that today it is hard to find a single aspect of the natural environment that has not been adversely affected by human activities. Typically, thanks to humankind’s headlong drive for economic development based on industrialisation, scientists predict that the mounting problems of global warming and climate change have potentially catastrophic consequences for life on Earth unless urgent action is taken to reduce anthropogenic CO₂ emissions (e.g. ISSC, 2005; McCarthy, 2005; Royal Society, 2005).

1.2. Why is it important for graduate students to know about the environment and current status of environmental education at the graduate level

Graduate students (see Glossary) represent the intellectual ‘cream’ of any society. In due course most of them become politicians, decision-makers, research scientists, leaders of business and industry, and so on. In these capacities they are expected to
discharge their professional responsibility in ways that protect the environment, promote sustainable development and improve people’s quality of life without irreversibly degrading the natural environment and/or profligately depleting Earth’s limited natural resources, so that the ability of future generations to meet their own needs is not compromised (WCED, 1987). Clearly, in order to be able to do so, they must have a good grounding in environmental protection and sustainable development. Furthermore, like everyone else in society, graduate students are also stakeholders in the natural environment and life-support systems that support and sustain life. It follows, therefore, that they also ought to know about the natural environment at large; in particular about how the natural environmental capital is being adversely affected, and scarce natural resources being depleted, by the life-styles and attitudes of the affluent between and within nations increasingly characterised by their apparently insatiable lust for open-ended consumption and profligacy (Nath, 2003; Nath and Kazashka-Hristozova, 2005). More importantly, it is their responsibility to ascertain through study and research what needs to be done to arrest and if possible reverse the current trend of environmental degradation. Unfortunately, at present education in such topics appears to be almost entirely absent in non-environmental graduate programmes, as an examination of the web pages of a randomly selected sample of such programmes would confirm.

Of particular concern is the absence of such topics in graduate programmes in Law, Economics and Business Management, because in most countries these are the backgrounds of by far the majority of politicians and decision-makers. Typically, topics in environmental protection or sustainable development appear to be absent in MBA programmes. For example, students in the 21-month MBA programme at the London Business School of the University of London, which is ranked in the top ten business schools in the world by the Financial Times, are required to take 16 core courses followed by 12 elective courses to be chosen from around 70 on offer. Yet, not a single one of these courses appears to be remotely concerned with environmental protection or sustainable development. Another example is provided by the MBA programme of the prestigious Vlerick Leuven Gent Management School in Belgium. Once again no subject on offer is remotely concerned with these topics. Generally, this deficiency is to be found in graduate programmes in Law and Economics, too, but not in Environmental Law or Environmental Economics programmes which appear to address the issues of environmental protection and sustainable development, albeit almost exclusively from the ‘end-of-the-pipe’ standpoint.

This state of affairs is a little strange, because in due course many if not most of the MBA graduates would be responsible for managing and leading business and industrial concerns, and that these concerns have been, and are, responsible for increasing contamination of air, water and soil as well as for generating increasing quantities of industrial waste to be safely disposed of. Directly and indirectly such enterprises are also responsible for generating ever-increasing quantities of post-consumption waste to be safely disposed of. Of course, one could argue that a major business or production facility will have its own Environmental Manager whose job is to ensure that the organisation complies with relevant environmental regulations in force. But then, major corporate policy is made by the Executive Directors of an enterprise, not by its Environmental Manager, and policy is nearly always concerned with improving the
enterprise’s ‘bottom line’ and seldom with achieving or promoting sustainable development. Indeed, experience shows that although there are exceptions, corporate policy generally tends to comply as minimally with environmental standards and regulations in force as they can get away with. (In any case, environmental standards, such as they are, cannot deliver environmental sustainability or sustainable development; see section 3.2.3). The neglect of these subjects, especially in MBA programmes, as appears to be the case, is indicative of the very low priority (or perhaps disdain) which the business and industrial communities appear to attach to environmental protection and sustainable development. It is hard to see how future leaders of business and industry could make corporate policy conducive to environmental sustainability or sustainable development without having at least a working knowledge of the pertinent environmental issues and problems and how they ought to be addressed.

Currently teaching of environmental subjects at the Masters level tends to emphasise ‘end-of-the-pipe’ methods and strategies in the problem-solving mode to deal with anthropogenic pollution already created. This is a major deficiency because, where appropriate and feasible, emphasis really needs to be on ‘before-the-pipe’ methods and strategies too. This is because waste reduction and waste prevention are a priority, for example in the EU hierarchy of waste management options (e.g. Powrie and Robinson, 2000). Ideally, there would be no need to treat waste (or to deal with the impacts of anthropogenic contaminants) if it is not created in the first place.

2. Sustainable development and related issues

2.1. Sustainable development and environmental sustainability

In the Brundtland Commission Report, *Our Common Future*, the authoritative definition of sustainable development is given as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (WCED, 1987, page 8).

Demonstrably, nature’s bountiful benediction of resources (e.g. minerals, fossil fuels, air, water, soil fertility, biodiversity, etc.) provides the unique resource base for wealth creation through economic development. However, as that resource base is not inexhaustible and can be degraded, it follows that there must exist some as yet unknown limit beyond which environmental degradation and exploitation of natural resources to supply the open-ended and increasingly profligate demands of the present generation for goods and services will compromise the ability of future generations to meet their own needs. Thus, prudent use and husbandry of natural resources in ways that do not degrade the natural environment, or seriously deplete the natural resource base commensurate with nature’s cyclic renewal and capacity for regeneration, is implicit in the above definition. Clearly therefore, sustainable development is firmly and inextricably linked to sustainability of the natural environment (generically referring to nature’s resource base including life support systems) in the sense that sustainable development is economic development that exclusively relies upon and is firmly and inextricably rooted in the integrity and sustainability of the natural environment. In other words sustainable development, which is after all a particular type of economic development, can only derive from a healthy and sustainable natural environment and nature’s vital life support
systems. This is tangentially reflected in Article 2 of the Treaty of the European Union (TEU) (1992), “...environmental policy objective to include the goals of sustainable and non-inflationary [economic] growth respecting the environment” (Lee, 1994). Clearly, if nature’s resource base is irredeemably depleted or irreversibly degraded, the means of wealth creation for social welfare will be seriously jeopardised and the notions of inter-generational and intra-generational equity will be little more than hollow. Unfortunately, experience shows that in the environmental community there are many who do not understand the true meaning of sustainable development, which is in the above sense, and sustained and non-inflationary economic growth per se is sometimes confused by many with sustainable development without any reference to environmental sustainability. There is also confusion between sustainable development and quality of life.

Which should then come first, environmental sustainability or sustainable development? To answer this question, think of Earth’s natural environmental capital as a ‘cow’, and its ‘milk’ as the benefit and welfare derived from that capital through economic development. Clearly, if the cow is not well looked after, or abused and milked beyond its capacity, it will become sick and may even die, and there will be little or no milk as a result. We argue, therefore, that global environmental sustainability must take precedence over global sustainable development which is after all a particular paradigm of economic development.

2.2. Heuristic for an operational definition of sustainable development

The definition of sustainable development given in the Brundtland Commission Report, *Our Common Future* (WCED, 1987), is political, as is the Report itself. And it is proving to be a huge challenge to translate it into an operational definition for practical implementation. At present there is no unique operational definition of sustainable development. Neither is there a single, compound indicator like GDP (Gross Domestic Product) in macroeconomics for comparing relative progress made by different countries or regions towards environmental sustainability or sustainable development, or for monitoring progress towards them made by a given country or region over time. The lack of a unique operational definition of sustainable development has spawned a veritable ‘industry’ devoted to developing such a definition with the result that today there are more than 200 different definitions of sustainable development. Most of these are of the ‘do-it-yourself’ kind designed to suit or promote specific developmental goals or circumstances, although the serious ones are basically repackaging of the Brundtland Commission definition and convey more or less the same meaning. This lack has been impeding progress towards global sustainable development and environmental sustainability. Certainly, from the educational point of view a unique operational definition is essential because without it students become confused and tend to lose interest, as experience shows.

Sober contemplation would reveal that the apparently insatiable lust of the affluent between and within nations for open-ended consumption of goods and services is mostly to blame for the environmental predicament confronting humankind today. It is acknowledged in *Our Common Future* which advocates, “Sustainable development requires that those who are more affluent adopt life-styles within the planet’s ecological
means in their use of energy for example” (WCED, 1987; page 9).

“The world manufactures seven times more goods today than it did as recently as 1950. Given population growth rates, a five- to ten-fold increase in current manufacturing output will be needed just to raise developing-world consumption of manufactured goods to industrialised world levels by the time the population growth rates level-off next century” (WCED, 1987, page 15).

‘Today’ above refers to 1984. Today (2006) that factor is more than seven, probably ten or eleven. It is now acknowledged that unfettered growth in production and consumption of goods and services, which the prevailing laissez-faire economic system demands for its smooth functioning, is the main obstacle to the achievement of even a modest degree of global sustainable development or environmental sustainability (e.g. Martinez-Alier, 1993 and 1997; Nath, 2003). We also note that while the authoritative definition of sustainable development is in terms of ‘needs’ (WCED, 1987, page 8), the prevailing economic system is increasingly geared to supplying the ‘wants’ of the affluent, not to mention their ever more fanciful pursuits for instant sense-gratification. Arguably, insatiable lust of the affluent for open-ended consumption of goods and services is the ‘deep malaise’ whose symptoms are the environmental problems confronting us (Nath, 2003). The following excerpt from the Living Planet Report 2000 (WWF, 2000) concentrates the mind well:

“Man has wiped out a third of the natural world in the last thirty years and soon will have to start looking for a new planet to live on……The scale of devastation is so great that man will have used up all the Earth’s natural resources by 2075…..If every human alive today continues to consume resources and produce carbon dioxide at the same rate as the average Briton, we will need to colonise at least two Earths to survive…..Our current consumption is eroding the very fabric of our planet and will ultimately threaten our long-term survival”.

It is clear from the above that the core requirement of sustainable development is diametrically opposed to the fundamental condition for the smooth running of the prevailing laissez-faire economic system. Therefore, achievement of global environmental sustainability (or global sustainable development) within the framework of the prevailing economic system is not unlike trying to fit a square peg in a round hole. Yet, efforts must be made to reconcile this improbable juxtaposition of opposites by reducing consumption, especially by the affluent, and by making necessary changes to the economic system. We do not pretend that the exercise is going to be easy. Certainly not, for human desire for open-ended consumption strongly resonates with our innate aspiration for ever rising standards of living which in most cases translates into acquisition of ever greater wealth and material possessions. Neither is it new; even the ancient Greeks knew about the utility of open-ended consumption (for example, in The Wealth by Aristophanes (c.450 – c.385 BC)). We also note that according to Darwin, a species cannot survive (and perhaps does not deserve to) if it cannot adapt to changes to its environment and/or circumstances. Therefore, if the international community is at all serious about achieving even a modest degree of global environmental sustainability (and therefore global sustainable development), global consumption of goods and services must be reduced; there must be more equitable distribution of wealth and
resources between and within nations; sustainability should be defined in terms of reduced consumption; and a simple, universal indicator like GDP in macroeconomics developed in terms of reduction in consumption.

3. Proposal for the environmental curricular content for graduate students

3.1. Masters degree programmes

Global environmental sustainability (and global sustainable development) is not so much ‘a problem out there’ to be ‘solved’ for its achievement. Rather, it has to do with our mind and mindset—it is a function of our attitude and behaviour to nature and the natural environment and of how we relate to them. Indeed, how we treat nature and the natural environment (and anyone or anything for that matter) is largely determined by our attitude to them, and our attitude in turn is shaped by the moral and ethical values we hold (Nath, 2003). Therefore, at all levels the objective of environmental education ought to be to engender a change in learners’ attitude to nature and the natural environment, from one of gross exploitation as at present to that of genuine care, concern and respect. It is hard to see how science and technology however advanced, or command-and-control public policy however rigorously enforced, could bring about such a change. What is needed is education in moral and ethical philosophy, because it is morality and ethics that shapes our attitude, behaviour and how we perceive the world around us. With this in mind and acknowledging that ‘end-of-the-pipe’ and ‘before-the-pipe’ methods and strategies ought to be equally emphasised where appropriate and feasible, Table 1 gives a proposal for the generic curricular content for the Masters level. It is based on the generic outline syllabus given in Box 2 of Curricula Development for Undergraduate University Students. But clearly, treatment of the subjects should be at a higher level and greater depth than for undergraduate students.

<table>
<thead>
<tr>
<th>Discipline</th>
<th>Proposed subjects to be taught (one subject to be developed from each item of Box 2, Topic 4.16.2.1, indicated below)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engineering</td>
<td>(B), (C), (D)</td>
</tr>
<tr>
<td>Civil, mechanical, chemical, production, and electronic and electrical engineering</td>
<td></td>
</tr>
<tr>
<td>The exact sciences</td>
<td>(B), (D)</td>
</tr>
<tr>
<td>Mathematics, physics, chemistry, biology, astronomy</td>
<td></td>
</tr>
<tr>
<td>The social sciences</td>
<td>(B), (D)</td>
</tr>
<tr>
<td>Law (excluding environmental law), economics (excluding environmental economics), business and management studies, politics, geography</td>
<td></td>
</tr>
<tr>
<td>Environmental law and environmental economics</td>
<td>(B)</td>
</tr>
</tbody>
</table>

Table 1. Proposed subjects for the environmental education of graduate students
In addition, group discussion and brain-storming should be organised on topical environmental issues and problems. Experience shows that when properly organised, these events bring considerable benefits in terms of appreciation of the environmental problems confronting societies today, what could be and should be done to address them, and the likely consequences of doing nothing.

Using basic mathematics, a simplistic mathematical model is given in the Appendix to explain how, exacerbated by ‘positive feedback’, Earth’s self-regenerative capacity (SRC) is eroded by anthropogenic pollution. If deemed appropriate, Masters degree students should be encouraged to study the model and to improve it as a part of their coursework. This can bring significant academic benefits, as experience shows.

3.2. Topics for research

Scientists engaged in research in a certain disciplines tend, sometimes by the very nature of their work, to specialise in a relatively narrow area of that discipline. In most cases this leads to a kind of ‘tunnel vision’ which emphasises narrow, individual areas of special interest and denies a proper perspective on the totality of the problem of which such individual areas are but components, usually small or very small. This does not accord with the real world of the environment which functions as a delicately balanced ‘organic whole’ comprising a multitude of interacting and inter-dependent elements, not one of which can be or should be manipulated or studied by ignoring its effects on the others. In other words environmental research should be holistic, which it is largely not at present.

With regard to the above and Some Pressing Global Environmental Problems of Our Time and Strategies for Mitigating Their Impacts, holistic (as far as feasible) research is suggested in the following topics as the priority, aiming to enhance the prospects of global environmental sustainability and true global sustainable development.

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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 a Ph.D. degree from the University of Wales, UK, in 1964. In 1983 he was awarded a 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, Bhaskar Nath is currently: 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 organisations. His 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.