ENVIRONMENTAL EDUCATION THROUGH BIOLOGY
by Professor Peter J. KELLY
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In June of 1972, the first UN Conference on the Human Environment was convened in Stockholm, Sweden. From it grew the United Nations Environment Programme (UNEP), and, in particular, the UNESCO/UNEP International Programme on Environmental Education. The Belgrade Charter, created by the International Environmental Education Workshop in Belgrade in October 1975, together with the Declaration and Recommendations of the Intergovernmental Conference on Environmental Education held in Tbilissi, USSR (1977), gave form and purpose to future initiatives, and since that time there has been an array of developments in environmental education throughout the world. Success has been variable. The environmental debate is now possibly less alarmist and less emotional than it was in the early seventies, but there remains a strong rational concern for the quality of the environment, as well as for the need for adequate education to provide the knowledge and cultivate the attitudes required to ensure it is achieved.

A decade after the Stockholm conference, the XXI General Assembly of the International Union of Biological Sciences (IUBS) held in Ottawa, Canada, in August 1982, provided a unique opportunity to review the current issues concerning environmental education. With the co-operation and support of UNESCO, a symposium was convened by the Commission for Biological Education of IUBS on "Environmental Education through Biology". Its basic aims were twofold.

i) To review key issues of environmental education and the role biology plays in them.

ii) To propose strategies and materials for environmental education, especially for developing countries.

The participants at the Symposium came from some thirty countries, and had a wide range of both biological and educational interests. The programme was in three parts. The first concerned general issues regarding environmental education, the second consisted of accounts of developments in environmental education in different parts of the world, whilst the final part focused on ideas for future developments. This report attempts to summarise the papers presented and the discussions that developed from them. It is completed by a number of recommendations arising from the Symposium.

ISSUES

Dr. Michael Atchia (Mauritius), in presenting the opening paper entitled "Environmental Education for the Developing World", argued that before one could decide on what environmental education was appropriate, it was necessary to define what is meant by the term "development". He suggested that for many people, development is seen "as being synonymous with the process of modernization... the transformation of man and environment for a better life, meaning, if we are to follow the economists of the seventies, or the UN and its agencies, a higher GNP... (or) for the... people in the third world, westernization".*

*Quotations are from the author's papers as presented at the Symposium.
Dr. Atchia considered this to be a totally inappropriate interpretation for developing countries, especially those of Africa, the region on which his paper was focused. He contended that development should be considered as a process of stabilisation. "A primitive society or a well-ordered modern society are both stable and hence developed; most of today's societies, either because of westernisation in the case of traditional third world countries or because of metropolitisation, divorce from nature, etc. in industrialised nations, are unstable, hence in need of development".

Dr. Atchia conceived environmental education as a part of the process of "homeostasis, by which a society adjusts its mode of life...to attain biological and energetic stability. In the present-day African context, it means educating people not to embark in the nineteen-eighties upon an industrial revolution nineteenth-century style; it means educating people to recognise features of quality within their own society, and enhancing these with elements from wherever appropriate".

Mr. E.B. Rugumayo (Uganda) took up a similar theme when he proposed in his paper entitled "Key Issues: Environmental Education in Developing Countries", that the definition of such issues "would have to take into account the three basic laws of ecology: interdependence of all forms of life; stability of ecosystems being dependent on their diversity; and, the finite limits of all resources". At the same time "how laws are observed by each country as it proceeds on its path of socio-economic development" would need to be taken into consideration. "Many Third World countries are experiencing serious economic problems. Arising out of this situation there is urgency on their part to try to industrialise fast, so as to get out of this economic vicious circle. In the course of this race, they tend to lose direction and violate the laws of ecology". Mr. Rugumayo considered that the maxim "conserve while consuming" should be adopted. "Before consumption is considered and effected, a conservation element must be incorporated into the programme of exploitation of a particular section of the resources". Through environmental education, a "conservation ethic should be gradually introduced and inculcated into the cultures of all these countries". He saw conservation manifested through careful use of both non-renewable and renewable resources through the banning of pollutants and the dumping of drugs and chemicals in Third World countries by unscrupulous multinational concerns, through the use of technologies appropriate to a country's circumstances and of local cultivars in diverse, not mono-cultural, agricultural systems, and through controlled population growth allied to relevant and natural primary health care.

Mr. Rugumayo stated that surveys of various Third World countries' environmental problems indicated that environmental education should fall under six headings: conservation, food, family planning, water-related and pest-vectored diseases, pollution and energy. Biological topics would be included under each heading, but essentially an inter-disciplinary approach is required. It has been found in Third World countries, he said, that a national programme for environmental education must be launched if ideas and plans are to have the desired effect. National science research councils working in collaboration with relevant governmental and educational institutions were appropriate bodies to establish environmental education programmes. He
advocated a five-part strategy in which research on environmental problems and developments in environmental education were linked closely.

1. **Reviewing existing experience, data and literature.** The tendency for experts to ignore this step and begin from their own, not necessarily relevant, premises can be costly in time and money.

2. **Drawing up an inventory and ranking of major environmental problems.** At this stage, the key issues which are particularly relevant to biology would be defined and researched by a team of biologists and educators.

3. **Designing case studies of environmental education programmes.** The topics of these would be taken from the inventory of environmental problems.

4. **Analysing cost-effectiveness.** It is important to show the public that they are getting their money's worth.

5. **Evaluating and monitoring.** Parallel ongoing evaluation of environmental education programmes and monitoring of the environment should be conducted to ensure the continuing effectiveness and relevance of the programmes.

Mr. Rugumayo stressed finally the importance of training personnel to work in areas of environmental education at both the technician and graduate levels, and of both educating and utilising the community at large in environmental education. Ideally, he argued, the community should spear-head the campaign for a better environment.

**DISCUSSION**

In the discussion that followed these papers, stress was put on the particular difficulties of developing countries. It was pointed out that frequently they had few economic alternatives and thus, without external support, the possibility of environmental planning was limited. Development, some argued, could not be defined in a general sense because each country's history and its current social, political and economic circumstances. The starting point for planning should be the reality of that situation. Whilst some contributors emphasised a moral dimension in environmental issues, others complained that environmentalism put too much stress on self-denial. These latter argued that environmental planning and education should be focused more on economical and political realities, and appeals to altruism should be based on these rather than abstract moral notions.

A number of speakers elaborated on Dr. Atchia's concept of development as a process of stabilisation. They contended that a dynamic and holistic interpretation was necessary in order to encompass inevitable ecological and social changes and the interactions between the natural ecosystem and the human social system. In this sense, development was conceived as being
homoeostatic. Cultivating an understanding of this concept was considered to be central to environmental education.

Recognition of the importance of population management was seen as equally important by some participants. In order to conserve natural resources adequately, they had to be in positive balance with their exploitation by the human population. The essential index was the per capita use of energy and materials, not necessarily the number of people. A small population having a high level of use can be harmful to the environment as a larger population with less use. Use will depend on cultural, economic and technological factors as well as population size. This complexity of the relation between population and use of resources was particularly highlighted by those who argued that the nature of environmental issues in different parts of the world varied and thus, the content of environmental education should, in part at least, be specific to individual countries or regions. In their view, whether or not population management should feature as a prime element in an environmental education programme, depended on local circumstances.

Another concept seen as a key one in environmental education was that of resource management. Again, an integrated approach incorporating consideration of both society and ecology was advocated. The importance of a long-term preventive view rather than a short-term approach was stressed.

Mention was made of newer perspectives on environmental issues which had evolved particularly in Western countries. These involved the concept that the environment had moral and legal rights. A considerable amount of legislation on environmental issues had been developed, and an understanding of this was important to the ordinary citizen as well as the experts.

There was debate over the methods of environmental education. To what extent should it be didactic, concerned with propagating particular national plans in order to ensure their success? To what extent should it present the pros and cons of environmental issues, leaving students, the public, and decision-makers to make up their own minds? Ideally, and for the long-term, the latter idea had greatest support; although the strength of the first proposal was seen when it was set against a country with grave environmental difficulties and had little to afford for indecision. Possibly environmental education programmes should have an element of each form of presentation in them. The balance between the elements would depend on particular national circumstances.

CASE STUDIES

The papers by Dr. Atchia and Mr. Rugumayo, whilst being concerned with general issues, focused on African countries. Other papers presented provided case studies of environmental education activities in Japan, Ireland, Malaysia, some of the Arab nations (the Gulf States, Jordan, Egypt), and the international "Ecology in Practice" project of the Man and Biosphere (MAB) Programme.
Dr. Kozo Imahori traced the history of environmental education in Japan most graphically. Environmental problems in that country arose during and after the Second World War. The destruction of the war was followed by developments aimed at economic recovery with little regard for environmental safeguards. From 1947 to 1960, the practice of nature conservation gradually evolved as a counter-balance to these developments. In 1951, the first step in environmental education occurred with the introduction of a course on "the protection of nature and the development of natural resources" into upper secondary schools. 1960 to 1973 is described as the Kogai period. Kogai is the term referring to local harmful or unpleasant effects on daily life. It includes aspects of pollution, but not broader aspects of environmental issues such as population, energy balance, and ecosystem management. Phrases such as aircraft-kogai, refuse dump-kogai, atomic power plant-kogai, lend a sense to the word's meaning. It gained considerable publicity, and led to the introduction of "anti-kogai" teaching in social studies courses, but this was quite different from environmental education as it is usually conceived.

Under the stimulus of the first UN Conference on the Human Environment and the 1975 Belgrade Charter, environmental education in its fuller sense has developed considerably in Japan since 1973. International symposia, research and development programmes and the introduction of new courses in schools and colleges have all played their part. At first environmental education was included as part of social studies, but in later years it had also been taken up as an interest by science educators and biologists, and incorporated to some extent into science courses. Nevertheless, in the schools, environmental education still remains mainly in the sphere of social studies.

There is a growing view that environmental education should be taught as an inter-disciplinary subject. This idea has been taken up in Japanese colleges and universities where biologists are frequently the key teachers in such courses.

Dr. D.W. Jeffrey reviewed developments in environmental education in Ireland, and provided an account of the work of the Environmental Sciences Unit, of which he is director. He emphasised the relevance of advanced studies in environmental science. They have value in their own right, but can also influence, through publications and other means, what happens in other parts of an education system. Dr. Jeffrey also stressed the importance of environmental education through informal channels, which was a further aspect of his work.

Dr. M.S. Subbarini (Kuwait) outlined developments in the Gulf States. It was interesting to learn again of the seminal influence of the UN Stockholm Conference in 1972. This led to regional developments through the Arab League Educational, Cultural and Scientific Organisation (ALECSO). Biologists were particularly prominent in these developments and thus "environmental education in school syllabuses of the Arab Gulf States is basically presented through biology courses. Pollution, natural resources, food problems, environmental balance, and desertification are the main issues encountered in school biology." Specific courses in environmental studies have been introduced in higher education and, again, these are mainly taught
by biologists. There have been attempts to develop environmental education as an inter-disciplinary activity in schools, but so far these have not come to fruition. Disruptions in the work of ALECSO have partly been responsible for this.

Dr. Subbarini stressed the value of environmental education in non-formal contexts. In the Gulf States this was better developed then that in schools and universities. A number of governmental and non-governmental organisations have been established specifically concerned with environmental education, whilst well-established scientific and other bodies have developed their own activities in this field. The mass media also plays its part in, for example, helping to celebrate environmental events, such as June 5, designated as "World Environment Day".

Regional organisations play their part, and the proposed activities of the recently established Regional Organisation for the Protection of the Marine Environment (ROPME) indicate their variety viz., distribution of a newsletter on the marine environment, conducting workshops on environmental awareness, production of documentary films and T.V. programmes, and the publication of booklets, posters, calendars, audio-visual materials and press hand-outs on environmental matters.

Environmental education aimed at overcoming specific environmental problems was the theme drawn by Professor A. Badran and Dr. E. Baydoun (Jordan), in their case study of pollution in the Gulf of Aqaba. They pointed to the importance of cooperation between institutions and of research, legislation and education, being seen as each having a part to play in overcoming environmental problems.

Dr. M.S. Selim (Egypt) stressed again the key role of ALECSO in environmental education in the Arab States, and quoted the definition adopted for its programmes. "Environmental education is the educational process of developing values and attitudes, skills, and concepts necessary for the individual to understand and appreciate the inter-relationships of man, his culture and the bio-physical aspects of his environment. It is also the process of clarifying the importance of natural resources and the vitality of their wise use."

In describing the evolution of environmental education in Egypt, Dr. Selim pointed again to three stages. In the 1940s there were experiments in field studies in some schools. It was "a step forward towards realising the importance of the environment as a laboratory for school activities." In the 1950s, this merged into activities concerned with conservation education and objectives aimed especially at science education in the schools, and formulated on the following basis.

1. Develop an understanding of natural resources in Egypt, and their conservation.
2. Sensitize the individual to the evidence of waste.
3. Present the fact that all human activities and institutions have their
basis in, and are dependent on, natural resources.

4. Teach the interrelations and interdependences between human beings, other living organisms, and the earth that supports them all.

5. Correct the belief that resources are inexhaustible.

6. Dispel the notion that science and technology can provide substitutes for all natural resources.

7. Present the disturbing history of natural resources' depletion, and its inevitable consequences of social decline.

It was during the late sixties, under the influence of biology projects in other countries which emphasised ecology and the work of ALECSO that environmental education finally became established in Egypt. Whilst environmental education is not taught as a subject in schools, the aim is to integrate environmental issues within subjects such as biology, chemistry, and social studies. A revision of textbooks has been undertaken to foster this. At the tertiary level, programmes in environmental sciences have been established and, for example, colleges of agriculture and engineering have introduced environmental studies in their programmes.

Whilst progress has been made, Dr. Selim pointed to his own research, which indicated generally that students often felt that their curriculum did not encourage positive attitudes towards the environment and its problems, and that authors of textbooks were not environmentally-oriented. More heartening results came from studies of biology courses in schools. Significant increases in environmental knowledge and attitudes have been demonstrated in secondary schools. An interesting finding was that results obtained with "traditional" courses on pollution were comparable to those using more enquiry-based "BSCS-type" courses.

Dr. Cheong Siew Yoong (Malaysia) echoed many of the points brought out by Dr. Selim. Regional organisations had been influential in developing environmental education in Malaysia and other Asian countries, and biologists were key figures in curriculum development. She also pointed to the importance of teacher education. In particular, Dr. Cheong stressed the need for cheap and relevant curriculum materials which could be easily used by teachers, enabling them to incorporate environmental topics in their teaching confidently and with relatively little training.

Dr. Malcolm Hadley (UNESCO) illustrated the value of research in environmental education when he described the development of a poster exhibit entitled "Ecology in Practice" as part of the Man and the Biosphere (MAB) Programme.

MAB is an international programme of research designed to produce
information for improving land use. The results of MAB research need to be communicated to a wide audience amongst scientists, decision-makers, educators, environmental groups, and the general public. Several forms of communication have been utilised. The "Ecology in Practice" exhibit consists of a series of high-quality wall charts aimed at conveying the major principles and findings of research concerned with land use. It is intended to be used at meetings, conferences, public exhibitions, and it is argued that this has greater potential for reaching a wide audience than other forms of publication.

Dr. Hadley reviewed the development of the exhibit which involved careful evaluation studies. He outlined the problem of deciding how much information should be included. The nature of the dilemma designers have is summarised in the following table, showing the implications of including less or more text.

<table>
<thead>
<tr>
<th>less text</th>
<th>more text</th>
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<tr>
<td>little information</td>
<td>information content higher</td>
</tr>
<tr>
<td>tending to resemble advertisements</td>
<td>tendency to scientific display</td>
</tr>
<tr>
<td>rapid and direct impact</td>
<td>more time and effort required to digest information</td>
</tr>
<tr>
<td>scientists see it as too simple</td>
<td>greater chance of capturing scientists' interest</td>
</tr>
<tr>
<td>use for decision-makers and general public</td>
<td>less appropriate</td>
</tr>
<tr>
<td>not particularly useful for teaching</td>
<td>more useful than teaching</td>
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Each "Ecology in Practice" poster is designed to include information at different levels, each aimed at different audiences. The difficult levels relate to the user's likely scientific knowledge, and the time for reviewing the exhibit. This multi-level approach was reinforced by using diverse visual elements, e.g., artists' drawings, graphics, maps, and photographs to capture the interest of the various audiences that are likely to be attracted to different styles and forms of expression. An interesting aspect of research on the use of the exhibit was the demonstration that, in general terms, over a period of 30 minutes a decision-maker would absorb about 50% of the information, an informed member of the general public about 1/3 of it, and a specialist just over 2/3.

Dr. Hadley emphasised that such a poster exhibit could be used as a core of a much more encompassing presentation, including for example, additional posters, audio-visual aids, lectures, and discussion sessions. In this way particularly, the global perspective portrayed in the MAB posters could be
related to the local issues of the location in which they are exhibited. He outlined the extensive impact of the exhibit in a number of countries and advocated further developments and research on such methods of mass communication.

FUTURE DEVELOPMENTS

The Case Study papers provided the stimulus for the participants to discuss the needs of environmental education, and possible forms of future development. Ideas that came out of the discussion can be listed under three headings: Planning and Management, Content and Method, and, Communication and Materials. Time did not allow for these to be elaborated. However, it is hoped that they will offer a guide to future endeavours.

Planning and Management

(I) New programmes should be based on a review of what has been achieved so far. There are numerous examples of successful programmes, certainly no lack of objectives, and a wide variety of resources which can be either adapted or utilised directly.

(II) Programmes should be developed by teams including biologists and other scientists, social and economic experts and educators.

(III) The cultural, social, and economic context of a country or region, as well as its ecology, should be taken into account when planning programmes. This would involve strategies of community analysis such as those identified by the IUBS-CBE project on "Strategies for Community-Based Biological Education".

(IV) There is a need for closer co-operation between agencies concerned with environmental education, particularly at the international level. There is evidence of undue duplication of effort and confusion from a variety of approaches.

(V) Environmental education should be planned with a variety of audiences in view. More concern should be given to non-formal education.

(VI) The main difficulties of programmes in environmental education lie in their implementation. This requires appropriate training programmes and adequate communication and support. Non-governmental organisations can play a major part in this.

(VII) Regional organisations can help stimulate and guide environmental education programmes, especially if they correspond to ecological regions.
(VIII) The development of a programme should be accompanied by careful research and evaluation.

(IX) Planning should involve long-term objectives and adaptable procedures.

Content and Methods

(I) Environmental education should be based on a clear exposition of key concepts and objectives. This should include:
   a) the major ecological principles;
   b) the central themes of Population and Resource Management, Homoeostatic Development and the Conservation Ethic;
   c) an integration of social and ecological concepts arising from the interaction of human social systems with natural systems;
   d) a multidisciplinary approach;
   e) global environmental problems interpreted in relation to local situations.

(II) Whilst the transmission of knowledge is an important aspect of environmental education, the development of attitudes, the skills of analysis and synthesis, and the abilities of problem-solving and decision-making are equally, if not more, important. Environmental education programmes should include methods for encouraging these attributes.

(III) Environmental education should involve a significant element of practical study.

Communication and Materials

(I) There is a need for biologists and educators to work more closely in the field of environmental education, particularly to provide regular reviews of scientific findings relevant to environmental issues, the interpretation of them for educational use and their dissemination to those concerned with environmental education programmes at the local, national, and international levels.

(II) A closer liaison between biologists, physical scientists, and social scientists is required to assist educators in the development of environmental education programmes.

(III) There should be greater liaison and communication between people concerned with environmental education in different contexts.

(IV) The central themes of environmental education outlined previously are not widely or clearly understood by educators. There is a need for publications in which they are explained simply and concisely, and which provide guidance for teaching them.
There is a lack of understanding of attitude formation and the development of problem-solving skills among many concerned with environmental education. Concise publications and workshops dealing with these topics would be of value.

Accounts of successful practice, provided it has been reliably evaluated, should be made more widely available. Accounts of what should be avoided are sometimes of equal value.

International workshops, particularly of practitioners of environmental education, can be of value in these respects.

There is a need for publications providing guidelines for the implementation of environmental education.

A major need in many countries is for cheap, simple, and adaptable packages of teaching and learning materials (including practical work), which can be used by teachers and others (including parents) with little training.
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