PROCEDURES FOR DEVELOPING AN ENVIRONMENTAL EDUCATION CURRICULUM
(Revised)
A Discussion Guide for UNESCO Training Seminars on Environmental Education

Prepared by:
Professor Harold R. Hungerford
Southern Illinois University
Carbondale, Illinois, U.S.A.

Dr. Robert Ben Peyton
Michigan State University
East Lansing
Michigan, U.S.A.

Editorial Assistance by:
Dr. William Bluhm and Dr. Trudi Volk
Southern Illinois University
Carbondale, Illinois, U.S.A.
PREFACE

The document entitled Strategies For Developing An Environmental Education Curriculum was originally prepared in 1980. It was prepared for serving as one of the working documents in a series of regional and subregional training workshops organized in the context of Unesco-UNEP International Environmental Education Programme (IEEP) from 1980 to 1985. In view of the rapid environmental education (EE) development at national, subregional, regional and international levels and the need for further training workshops and seminars for curriculum developers in EE, the above document was revised in 1986 by its authors, Prof. Harold R. Hungerford and Dr. Robert Ben Peyton under the title of Procedures For Developing An Environmental Education Curriculum. Once again, it is being revised in 1993 for continued use by Unesco-UNEP, taking into account and incorporating throughout the document recommendations and guidelines pointed out by Agenda 21 of the UNCED 1992.

Opinions expressed in this document do not necessarily coincide with any official views of Unesco. The designation employed and the presentation of materials herein do not imply the expression of any opinion whatsoever on the part of Unesco concerning legal status of any country or of its authorities, or concerning the delimitations of the frontiers of any country or territory.
# TABLE OF CONTENTS

Preface .......................................................... i
Table of Contents ........................................... ii
List of Tables ................................................ iii
List of Figures ................................................. iv
Acknowledgments ............................................... v
Foreword ........................................................ vi

## Chapter

I. Introduction .................................................. 1
II. Patterns in Environmental Education ..................... 3
III. EE Curriculum and Materials Development ............... 7
    Guidelines for Designing EE Curriculum Format .......... 7
    Criteria for Decision-Making in Environmental Curriculum Development ........................................ 13
    Goals for Curriculum Development in Environmental Education ......................................................... 16
    Benefits Derived from Using the Goals for Curriculum Development ................................................... 20
    Applying the Goals - An Instructional Model .......... 21
    Procedural Guidelines and Considerations for Curriculum Development ............................................... 26
    Teacher Preparation Guidelines .......................... 41
    Implementing EE Curricula ................................ 42
    Comprehensive EE Curriculum Evaluation ................. 47

IV. Summary/Conclusions ..................................... 51

Appendix: Sample Activities ............................... 53

Bibliography .................................................. 77
## Tables

I. Interdisciplinary VS Multidisciplinary (Infusion) Formats for EE: Advantages and Disadvantages 10

II. Matrix Showing Participation Roles of Committee Members in the Curriculum Development Process 29
Figures

Figure 1. Interdisciplinary Model Compared To The Multidisciplinary Model. 9

Figure 2. Developers' Validity Assessment: A Comparison Of The Goals For Curriculum Development In Environmental Education To The Tbilisi Conference Categories Of Objectives 19

Figure 3. Curriculum Development And The Instructional Process. 22

Figure 4. A Conceptual Model Illustrating The Integration Of Curriculum Scope Through Grade Levels And Across Subject Areas Within Grade Levels 33

Figure 5. Selected Objectives To Illustrate Scope Development At Four Curriculum Development Goal Levels. 34

Figure 6. How A Complex Concept Develops: An Example From Ecology 37

Figure 7. Curriculum Implementation Variables. 44

Figure 8. Curriculum Evaluation 48
ACKNOWLEDGEMENTS

The authors would like to express appreciation to UNESCO-UNEP for the opportunity to contribute our philosophy and experience towards the worldwide development of EE programs. We should also like to gratefully acknowledge the significant contributions made towards this effort by the late Dr. Audrey N. Tomera and Dr. Trudi L. Volk of Southern Illinois University. Their assistance in collecting reference materials and their critical comments on the content and organization of the manuscript has been extremely valuable. Thanks are also extended to Clifford E. Knapp, Morris Lamb, and Tom Marcinkowski for their valuable contributions to particular sections of this document. And, a special thanks to Joyce Harris for her patient and expert typing.

With the 1994 revision, we acknowledge the excellent computer work of Mr. Eric Tong of Honolulu, Hawaii and the very special editorial assistance contributed by Drs. Trudi Volk and William Bluhm. Once again, Dr. Tom Marcinkowski has contributed generously with his time, wisdom, and expertise in the field.

Harold R. Hungerford
R. Ben Peyton
1994
... One billion people in developing countries live in poverty and hunger. Forty thousand children die daily from causes related to this deprivation. . . . expanding populations and inappropriate development are destroying the fragile base of soils, water, forests and fisheries on which the future depends. The deserts are advancing, while the tropical forests, with their immense wealth of life forms, are in retreat. One and one-half acres of these forests disappear every second; scores of species are committed to extinction every day. Each of these problems is deepened by the addition of almost a billion people to the world's population every decade.

Partnership for Sustainable Development
Environmental and Energy Study Institute
James Gustave Speth, Chairman and
President of World Resources Institute, 1991

Procedures for Developing an Environmental Education Curriculum was first published in 1980 under the auspices of Unesco-UNEP and revised in 1986. The purpose of the document both times was to present some rather detailed guidelines for the development of environmental education (EE) curricula. These guidelines were fashioned in a very generic sense with the hope that they could be applied in a wide variety of educational settings and across numerous grade levels.

Since 1980 many, many events have taken place with respect to the environment, globally and regionally as well. Some of these events have been positive ones but many have been negative.

In today's global political climate, there is increasing interest in a phenomenon called "sustainable development". For those uninitiated with this concept, one definition follows:

Sustainable Development: a process of change in which the use of resources, the direction of investments, the orientation of technological development, and institutional change all enhance the potential to meet human needs for today and tomorrow.

The Global Tomorrow Coalition, 1989
The World Commission on Environment and Development (1987 in a publication entitled, *Our Common Future*) spoke of requirements for sustainable development:

Sustainable development involves more than growth. It requires a change in the content of growth, to make it less material- and energy-intensive and more equitable in its impact. These changes are required in all countries as part of a package of measures to maintain the stock of ecological capital, to improve the distribution of income, and to reduce the degree of vulnerability to economic crises.

Given a definition for and requirements associated with sustainable development, we begin a search for goals and objectives associated with it. Some of the major objectives [priorities] associated with sustainable development and listed by The Global Tomorrow Coalition (1989) include the following:

- Reviving economic growth, especially in developing countries.
- Making economic growth less energy-intensive.
- Meeting the essential needs of an expanding population in the developing world.
- Ensuring a sustainable and stabilized population level.
- Conserving and enhancing the resource base.
- Reorienting technology and managing risks.
- Merging environmental and economic concerns in decision-making.

One is quick to find, however, that not all sources list the same goals or priorities with respect to sustainable development. This itself brings substantial confusion and frustration to the concept of sustainable development but, for the moment, let us add other "priorities" - ones which are in addition to the above and listed by the Environmental and Energy Study Institute (1991):

- Sustainable production of energy . . . while neither polluting urban areas nor increasing global warming.
- Sustainable management of forests, with the goal of conserving remaining natural forest areas and their diversity of species.
- Effective pollution control, with the goal of providing clean air and protecting public health.
- Sustainable agriculture and fisheries, with the goal of meeting food and other agricultural needs without destroying the natural resource base.

Regardless of the perspective held by this agency or that agency or this nation or that nation, sustainable development can be observed to touch and be impacted by most if not all of the major environmental issues facing human beings on the face of the earth.

At the same time, in education, one is beset with numerous statements about and pleas for the development of an environmentally literate global citizenry. In almost all
instances, there is a sense that literacy brings with it at least a willingness to engage environmental issues in an attempt to help resolve them at some level.

Where is this discussion taking us and what is the point of it?

The point of all of this focuses squarely on the fact that, not only have there been changes in philosophical thoughts about the global environment since 1980, there have also been major changes in what is known about "environmental behavior" or, in other words, what drives a citizen to try to remediate or help resolve issues that impact him or her.

We now know, with great certainty, that, if educators want to develop learners who are both capable of and willing to respond to environmental issues in their communities and nations in ethically responsible ways, two things must happen: (1) The students must feel an ownership of the issue in question, and (2) the students must feel empowered to somehow effect change with respect to that issue. Once again, stated briefly and a bit differently:

If we want to develop large numbers of learners who are skilled and dedicated environmental citizens, the learners must feel a sense of ownership toward issues needing resolution and a sense of empowerment with respect to helping with that resolution.

Thus, this document is dedicated to the development of such an individual. The document recommends the development of curricula which are specifically designed to change learner behavior - to provide for the critical variables of ownership and empowerment. The research is very clear and straightforward on the matter. There seems to be little wiggle room for educators who wish to keep to traditional ways and stand in front the class and lecture to bored and uncaring learners about what needs to be done with the environment. Many are those who will argue the point, but these same individuals care more about their own points of view than facing up to a global crisis the intensity of which has never been seen before!

For purposes of this document, then, the major goal of environmental education is accepted by the writers as follows:

The Goal of Environmental Education:

... to aid citizens in becoming environmentally knowledgeable and, above all, skilled and dedicated human beings who are willing to work, individually and collectively, toward achieving and/or maintaining a dynamic equilibrium between development and the quality of life and quality of the environment.
This definition suggests two important implications. First, the goal implies that EE must develop skilled problem solvers. Thus, EE should itself, use a problem solving (inquiry-based) approach. Secondly, it is important to note that EE must be concerned with development and, importantly, a quality of human life and a quality environment - closely akin to the overriding concept of "sustainable development".

With these thoughts in mind, a number of very disciplined goal statements are presented here to be used as guidelines by curriculum developers. These goal statements, sometimes called "Goals for Curriculum Development in Environmental Education" (and focused on an investigation approach to EE) move hierarchically from science foundations to issue awareness through issue investigation and evaluation to citizenship action.

A review of the goal level statements presented in Chapter III, and the sample lessons provided in Appendix A should indicate the problem solving nature of a sound EE curriculum. Goal levels III and IV (also found in Chapter III) clearly mandate that EE curricula provide students with experiences in environmental problem solving skills such as problem identification, values clarification, issue investigation and evaluation, and the identification, evaluation and implementation of environmental actions (issue resolution). The sample lessons included in Appendix A illustrate how such experiences may be designed.

It is not sufficient to tell students about ecology, or to present them with an awareness that environmental issues exist. Students must experience an EE curriculum which allows them to discover how they interact with the environment themselves. They should assess their own impact on the environment. Learners must be allowed to develop investigative, evaluative and action skills by using these processes as well as learning about them. In this way they will be intelligent consumers and processors of issue-related information throughout their lives. Only in this way will citizens the world over be able to make sound and responsible decisions concerning environmental issues!

The consequences of failure to achieve the goals set forth in this document are clearly forecast. One has merely to review the tragic loss of ecosystems as well as plant and animal species, global population pressures, air and water pollution, the disappointment with many major technological resource-use projects throughout the world, the depletion of ocean fisheries, oil polluted beaches and coastlines, land-use management crises, and acute energy issues in order to see just how critical environmental issues are worldwide. Indeed, the list of problems and issues seems endless and the message clear. If sustainable development is to become the movement that saves the planet, all of these issues and others must be attended to.
Human beings simply must care for the health of the global environment. Educators must prepare them to do this! It is that simple!

Harold R. Hungerford and R. Ben Peyton. 1994

A man said to the universe:
"Sir, I exist."
"However", replied the universe,
"The fact has not created in me
A sense of obligation."

Stephen Crane, 1977
CHAPTER I

INTRODUCTION

National reports . . . testify to the significant advances made by a number of countries towards implementing environmental education programmes both inside and outside the school system. Important as these efforts and achievements may be . . . there are still gaps and shortcomings. Less seems to have been achieved at the secondary level than at the primary level in schools both quantitatively and in terms of innovation. Little has been done for training out-of-school educators or in-service teachers in environmental matters. There are still far too few trained for the teaching of ecology or capable of effective participation in a multidisciplinary approach. Last, but most important, there still appears to be a considerable need for developing or refining overall environmental education strategies in all forms and at all levels of education.

The Tbilisi Declaration, 
Connect, vol. III, no. 1, 
January 1978.

This document is sponsored by the Unesco-UNEP International Environmental Education Programme in response to needs identified by the Intergovernmental Conference on Environmental Education, "Tbilisi, 1977, and the United Nations Conference on Environment and Development, Rio de Janeiro, 1992. It has been prepared primarily to serve as a basis for curriculum development in environmental education (EE). It does not propose a specific curriculum for EE but, instead, establishes a set of guidelines which are valid for curriculum decision-making in any school, community, region, or nation. Specifically, this document . . .

(1) . . . analyses the present status of environmental education.
(2) . . . synthesizes a statement as to the character of current curricula and materials development efforts.
(3) . . . presents strategies and guidelines for curriculum and materials development in environmental education at primary, secondary and tertiary (teacher education) levels.
The format for curriculum development used in this document is directed toward the institutional level (i.e., the university or public school system), but it is intended to apply generically to curriculum development at any level (local, regional, or national). The application of specific strategies may vary considerably with the nature and the scope of a particular project. However, the guidelines for EE curriculum decision making presented here should be largely adhered to by any development team if the completed curriculum is to achieve internationally-accepted goals for environmental education.

Chapter III of this document is particularly important for any EE curriculum development effort. Specifically, Chapter III represents a synthesis of curriculum development tasks, each of which contributes to the overall project. Critical Chapter III components include available curriculum patterns for use in EE, criteria for decision-making in curriculum development, instructional models which demonstrate how specific instructional designs attempt to meet appropriate goals in a multidisciplinary (infused) curriculum, procedural guidelines to be followed in curriculum development efforts, curriculum implementation, curriculum evaluation, and guidelines for teacher preparation in EE.

A flow chart of the entire curriculum/implementation/evaluation process is presented in Chapter IV. The curriculum developer may wish to use this flow chart as a reference while studying or applying principles and guidelines presented in Chapter III. Such a strategy would provide a framework within which a sound developmental syntax could be maintained.

To be effective, environment and development education should deal with the dynamics of both the physical biological and socio-economic environment and human development, should be integrated in all disciplines, and should employ formal and non-formal methods and effective means of communication.

*Agenda 21, Chapter 36*
Environmental education (EE) as an entity unto itself is of fairly recent origin. Its roots, however, extend back in time to that moment when man first envisioned an interrelationship between himself and the biosphere which resulted in an evaluation of his role in the maintenance or deterioration of the environment. Exactly when this took place and the context of this interaction are, of course, uncertainties. However, the historic concerns for the interactions of man with the environment are many and various. They appear in the folklore of numerous tribes or races. They appear as biblical references and in other early writings. And, as man began to expand and record his history, references to interrelationships with the environment became more numerous.

More recently - with respect to man's history - the roots of EE can be traced back to the conservation movement(s) although in many dimensions and for many reasons the conservationist of yesterday and the environmentalist of today yield different images. Although differences exist between conservationism and environmentalism, the conservation movement(s) throughout the world go back centuries in time. Various movements across various cultures came and went as societies evolved in their perspectives concerning the environment and the use of available natural resources.

In North America, the beginnings of the conservation movement have been traced back to 1626 when an ordinance was passed in Plymouth Colony controlling the cutting and sale of timber on Colony lands (Nash, 1968). From this point onward, a number of serious attempts were made to develop a philosophy of what constituted an acceptable man-environment relationship. Numerous points of view arose, among them the divergent perspectives allied with unlimited use of resources and man's responsibility to maintain the integrity of natural ecological systems.

In the schools, the roots of environmental education can be traced back to the didactic literature printed for use in schools dominated by religious groups. Texts moralized the virtues of certain kinds of human behavior toward the environment as well as providing an attitudinal set toward both living and nonliving resources.

The didactic literature period was followed by what has come to be called the Nature Study movement, a conservation oriented science education which was character-
ized by nature observations and a respect for natural systems. This movement lasted in
the USA until about 1930.

Formal conservation education had its beginnings after the turn of the Twentieth
Century but didn't gain momentum in the USA until the 1930's. Conservation education
lost its momentum late in the 1940's and there was little activity in any similar dimension
(with the exception of outdoor education programs) until the 70's. Due to a myriad of
issues and problems relating to natural ecosystems and man's communities, environmen-
tal education - as a distinct entity - arrived on the scene. It was at this time that the world
community began to focus on a concerted effort to bring EE into world-prominence
through the auspices of the United Nations.

In 1975 a questionnaire entitled, "Assessment of Resources for Environmental
Education: Needs and Priorities for Member States" was distributed by the environmental
education section of UNESCO to 136 Member States. The aim of this research was to
furnish specialists and decision-makers in EE with a valid and viable base of information
on which future action could be based, taking into consideration the principle insuffi-
cienes affecting such an education at the world and regional levels (UNESCO, 1977).

A major component of the UNESCO questionnaire dealt with trends in environ-
mental education programs. A number of extremely significant findings were generalized
from this study. Among these were:

(1) World educational programs are insufficient in number or in scope to
make environmental education a national preoccupation. This insuffi-
ciency was particularly evident in developing nations.

(2) There exists a persistent lack of truly interdisciplinary approaches for
EE programs. Educational programs based on real problems and a
functional logic aimed at their solution, have not been developed, in a
general manner, in any of the countries studied.

(3) A definite lack of concrete problem solving approaches exists. This
condition tends to isolate the EE program from the surrounding com-

(4) There exists a tendency (in EE programs) to reduce the environment to
its natural aspects. This tends to preclude the consideration of social
perspectives and makes the comprehension of complex phenomena
and problems a difficult task.

By and large, these findings were further documented in other research studies.
Many of the same problems and issues were identified and reported for the United States
by Childress and Wert (1976). Contributing to the persistent presence of problems, at a
time of emerging interest in EE, was the sometimes silent and sometimes vocal debate
surrounding the philosophical dimensions of EE per se. These various perspectives of what constituted EE led to a multitude of programs revolving around traditional conservation education, nature interpretation, outdoor education, outdoor recreation, and others. There appeared to be little agreement as to the substantive structure of EE and this lack of consensus was further promoted by individuals who were attempting to maintain quasi-environmental programs for a variety of reasons.

During this period of indecision and confusion in EE, UNESCO in cooperation with the United Nations Environmental Programme (UNEP) established the UNESCO-UNEP International Environmental Education Programme (IEEP) which organized a number of regional conferences and seminars, each contributing to a philosophy and a body of knowledge concerning world needs and a perspective of EE. These meetings led, eventually, to the world’s first Intergovernmental Conference on Environmental Education, organized by UNESCO in cooperation with UNEP. The Conference was convened in Tbilisi, Georgia in October of 1977. This Conference was attended by 66 Member States and observers from two non-Member States.

The Tbilisi Conference resulted in unanimous agreement concerning the important role of environmental education in the preservation and improvement of the world’s environment. From this conference came a document (the Tbilisi Declaration and 41 Recommendations) which delineates a substantive structure for EE and recommends policies and strategies to be followed world-wide (Connect, 1978). This document, without a doubt, is one of the most important single contributions to EE.

A number of the components of the Tbilisi Declaration and Recommendations appear in this document in Chapter III. Of critical importance to EE, however, is the Recommendations persistent reference to the need for EE to get citizens actively involved at all levels in working toward the resolution of environmental problems. Coupled with this is the realization that all individuals must acquire the knowledge, skills, attitudes, and commitments necessary to protect and improve the environment. Thus, the Declaration and Recommendations face squarely the major challenge and ultimate goal for EE - that of citizenship responsibility for and participation in environmental problem solving.

Currently, EE curricular patterns throughout the world demonstrate a wide variety of goals. Many of the goals reflected by these curricula are consistent with the objectives presented in the Tbilisi Recommendations. However, if one looks at the objectives of the Recommendations as a continuum, beginning with environmental awareness and ending with citizen participation, a great deal of variation exists. Some curricular efforts deal primarily with ecological principles and others go beyond ecology to attempt to show the relationships existing between ecological concepts and environmental issues. A few
reach further along the continuum and attempt to deal with participation variables associated with the investigation, evaluation, and remediation of issues. Few common threads appear which allow one to synthesize a model one could call "current environmental education curricula." Diversity seems to be the major pattern one observes.

However, in many curricular endeavors there seems to be a strong desire on the part of developers to attempt to instill an environmental ethic (perhaps consistent with that condition called "environmental literacy") within the learner populations whether made up of young children or adults beyond the college years. In keeping with the UNESCO research cited earlier in this chapter, educational programs based on real problems and solutions to real problems remain underrepresented on a global basis.

Given the many environmental crises that can be observed around the world and the many issues surrounding these crises, it seems time for professional educators to develop research-based curricular programs and leave behind many intuitively-based programs which do not work. Efforts are being made by some curriculum developers to bring social relevance to EE. This is very important in an era when world citizens are beginning to realize that environmental issues are, themselves, interdisciplinary, e.g., the many environmentally-related social issues associated with sustainable development.

Even though few of these kinds of projects exist today, future curricula throughout the world should provide for similar goals as a function of the citizen(s) participation objective established by the Tbilisi Conference (Unesco, 1977).

Research findings in a number of instances are quite clear in that learners who are involved in environmental programs based on awareness objectives cannot be predicted to become active participants in environmental issue resolution (Ramsey, et al., 1981). Conversely, however, a growing body of knowledge indicates that learner groups who have been trained in citizenship participation strategies will, indeed, be prone to become citizen participants in issue remediation (Ramsey, 1989; Hungerford and Volk, 1990). This research information plus the guidelines established by the Tbilisi Conference and the UNCED Conference as detailed in Agenda 21 should serve to guide curriculum developers to establish programs which strive for citizenship participation.

---

Our [human] numbers are now so large and our forms of technology so powerful that we are at a critical turning point in human cultural development - a new hinge of history. Today there are increasing signs that we have no more than 50 to 75 years to make the next cultural transition - or an unwanted transition will be forced upon us.

G. Tyler Miller, 1988
CHAPTER III
EE CURRICULUM AND MATERIALS DEVELOPMENT

"... 'to defend and improve the environment for present and future generations has become an imperative goal for mankind.' This undertaking urgently calls for new strategies ... and [to] bring together, as soon as possible, all available resources. Education utilizing the findings of science and technology should play a leading role in creating an awareness and a better understanding of environmental problems. It must foster positive patterns of conduct toward the environment and nations' use of their resources.


Guidelines for Designing EE Curriculum Format

Environmental educators have spent considerable time and effort defining the goals and purposes of EE. The general consensus is that EE should be training world inhabitants who are both capable and willing to choose lifestyles and behavior which allow the environment to maintain itself in a sustainable manner. This would be equivalent to training learners to become environmentally literate citizens. There are, of course, many dimensions implied by such a mission. They are more formally defined in this chapter. The purpose of this section is to give direction to EE so that choices regarding the format of the environmental education curriculum can be made.

Models for EE Formats

EE has traditionally been considered "interdisciplinary" due to the complexity of its nature and its reliance on practically all other disciplines, e.g., science, math, geography. In fact, there has been some reluctance to refer to EE as a "discipline" lest its holistic nature be lost. However, it would be far better to consider EE as a "discipline" to provide an opportunity to identify and communicate a substantive structure for it. Only with a known and valid substantive structure can good curriculum development, curriculum implementation, and sound evaluation take place. Furthermore, EE is no less an academic discipline
than disciplines such as biology or social studies which, in turn, represent "interdisciplinaries" of subsumed subjects.

The implementation of EE into the curriculum must reflect this complexity. Generally, two models have most commonly been utilized in EE curriculum development and implementation. These models are diagrammed in Fig. 1. Terminology associated with the two models in Figure 1 can be confusing. For the purposes of this document, the creation of a discrete course or series of courses (K - 12), unit or other curricular package shall be termed an interdisciplinarity (single subject) approach (Model A). The incorporation of EE components in other established, interrelated disciplines will be referred to as a multidisciplinary (infusion) approach (Model B).

There are a number of considerations that must be made in order to make sound decisions regarding curricular organization. Both the interdisciplinary and multidisciplinary formats have advantages and disadvantages. These advantages and disadvantages must be weighed carefully. Table I has been prepared in order to summarize a number of factors to consider in deciding which curriculum organization should be selected for use in a particular school, region, or nation.

Guidelines for the Acquisition and Transfer of Knowledge and Skills

The production of environmentally literate citizens through formal education implies that knowledge, cognitive skills, and attitudes not only be acquired in the classroom, but also that these be transferred to the decision-making processes of the learners throughout their lives. Acquisition and transfer of information and cognitive processes are, of course, not unique endeavors of EE - they are shared by most other disciplines. Unfortunately, many of the components of curriculum in education reflect only the goal for learners to acquire knowledge and cognitive skills. It is equally important for EE curriculum developers to strive for the ultimate goal of transfer in selecting curricular formats and methodologies. The following discussion emphasizes some of the guidelines to be considered if curriculum developers are to achieve both acquisition and transfer.
Interdisciplinary (Single Subject) Model
VS
Multidisciplinary (Infusion) Model

Vocational Studies

Life Sciences

Physical Sciences

Earth Science

Environmental Education

Mathematics

Social Studies

Arts/Humanities

Communications

A. Interdisciplinary Model

Vocational Studies

Life Sciences

Physical Sciences

Earth Science

Environmental Education

Mathematics

Social Studies

Arts/Humanities

Communications

B. Multidisciplinary (Infusion) Model

Figure 1. Interdisciplinary Model Compared To The Multidisciplinary Model.
Table I
Interdisciplinary vs. Multidisciplinary (Infusion) Formats for EE: Advantages and Disadvantages.

<table>
<thead>
<tr>
<th>Considerations</th>
<th>Interdisciplinary (Single Subject) Characteristics</th>
<th>Multidisciplinary (Infusion) Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Ease of Implementation.</td>
<td>Easier to implement as a single subject if time permits in the curriculum; teacher training is less of a problem.</td>
<td>Requires that more teachers be trained; greater coordination of curriculum necessary; requires less time/content in the existing curriculum.</td>
</tr>
<tr>
<td>2. Teacher Competencies.</td>
<td>May require fewer teachers but with more in-depth training in EE; thus teacher training is less demanding in terms of teacher numbers but more demanding in terms of level of competencies required.</td>
<td>Requires that teachers of all disciplines be competent to adapt and/or use EE materials, although perhaps not to the same depth as in single subject approaches.</td>
</tr>
<tr>
<td>3. Demand on Curriculum Load.</td>
<td>Requires addition of this discipline to an already crowded curriculum.</td>
<td>May be effectively implemented with minimal demands on existing curricular load.</td>
</tr>
<tr>
<td>4. Ease of Curriculum Development.</td>
<td>Components easier to identify and sequence.</td>
<td>Components must be effectively identified, sequenced, and accommodated by the existing curriculum.</td>
</tr>
<tr>
<td>5. Evaluation.</td>
<td>A comprehensive evaluation is much easier to accomplish in a single subject curriculum.</td>
<td>Comprehensive evaluation difficult due to the number of variables involved.</td>
</tr>
<tr>
<td>6. Age Level Appropriateness.</td>
<td>May be more appropriate at secondary than elementary levels. For some types of EE goals, may be essential at secondary and tertiary levels.</td>
<td>Appropriate at all age levels with some exceptions at secondary and tertiary levels.</td>
</tr>
<tr>
<td>7. Effectiveness in Teaching for Transfer.</td>
<td>More difficult to use in effectively teaching for transfer. Requires special efforts to do so.</td>
<td>Teaching for transfer is inherent in this approach when properly used. Infusion permits decision-making to take place in other disciplines in an environmental context.</td>
</tr>
<tr>
<td>8. Ability to Provide In-Depth Coverage of Environmental Issues</td>
<td>Budget consideration entirely dependent on the nature of the course being developed. A highly sophisticated course demanding many field excursions or laboratory equipment could prove costly.</td>
<td>Monetary considerations very dependent on the nature of the curriculum being developed. Monies required could be greater than in a single subject curriculum due to numbers of learners involved across numerous grade (age) levels.</td>
</tr>
</tbody>
</table>
Research into the transfer of learning has provided some useful generalizations for curriculum developers (Travers, 1972). It seems that transfer of knowledge and skills is more likely to take place . . .

(1) . . . when students have experience with a diversity of problems. Exposure to a wide range of problems helps to develop an expectancy that each problem will have to be solved in a somewhat different way.

(2) . . . when students learn to apply principles in situations with distracting and irrelevant elements. This is necessary if the student is to learn to discriminate between relevant and irrelevant features of situations so that the principles involved may be identified and accurately applied . . .

(3) . . . when opportunities are provided for the pupil to learn and use knowledge in a variety of situations. This is based on research findings that acquired knowledge tends to be most used in the situation in which it was acquired.

In effect, research says that if we want transfer to occur, we must teach for transfer. These principles of transfer may be— and should be applied in both interdisciplinary and multidisciplinary curricular formats. However, these principles offer a defense for the argument that EE should be infused throughout educational systems. Multidisciplinary infusion would allow students to apply EE concepts and problem solving skills in a great variety of situations over a long period of time.

Many of the concepts and mental processes which are desired as outcomes of EE have traditionally been taught separately in other disciplines. For example, students often learn how their government works in civic or social studies classes. However, in spite of the acquisition of such knowledge, students fail to use knowledge effectively as citizens in environmental (or other) problem solving. A major factor contributing to this lack of use may be inferred from the principles listed above. Students were taught about government decision-making, but not how to use the knowledge in their daily lives.

Perhaps one more example will help to make the case for using the multidisciplinary model. Teachers should not expect students who learn about ecology in science classes to apply those understandings consistently or effectively when considering concepts of economics, social studies, or other disciplines unless they are taught to do so. If students consider ecological consequences of issues in a variety of situations throughout their formal
education, there is greater reason to expect them to use this knowledge in their own non-academic lives as well.

The above discussion is not intended to exclude an interdisciplinary approach as an effective format for EE. An effective, total EE program must include curricular components of both designs with increasing use of interdisciplinary materials at higher levels and/or where greater depth of comprehension is desired. Sound educational procedures must be used in either format if EE goals are to be achieved (e.g., the transfer of critical thinking/problem solving skills). Curriculum developers must keep all of these considerations in mind when selecting formats for EE materials at various grade levels.

The guiding principles for EE, as outlined by the Tbilisi Conference, reflect a definite need for both the acquisition and transfer of learning in environmental education. Program developers should strive to reflect these guiding principles in any curriculum development project, making certain that the need for both acquisition and transfer is met. These guiding principles follow:

Environmental education should:

- consider the environment in its totality - natural and built, technological and social (economic, political, cultural-historical, moral, esthetic);
- be a continuous lifelong process, beginning at the pre-school level and continuing through all formal and nonformal stages;
- be interdisciplinary [see footnote below] in its approach, drawing on the specific content of each discipline in making possible a holistic and balanced perspective;
- examine major environmental issues from local, national, regional and international points of view so that students receive insights into environmental conditions in other geographical areas;
- focus on current and potential environmental situations and international cooperation in the prevention and solution of environmental problems;
- explicitly consider environmental aspects in plans for development and growth;
- enable learners to have a role in planning their learning experiences and provide an opportunity for making decisions and accepting their consequences;
- relate environmental sensitivity, knowledge, problem-solving skills and values clarification to every age, but with special emphasis on environmental sensitivity to the learner's own community in early years;
- help learners discover the symptoms and real causes of environmental problems;
- emphasize the complexity of environmental problems and thus the need to develop critical thinking and problem solving skills;
- utilize diverse learning environments and a broad array of educational approaches to teaching/learning about and from the environment with due stress on practical activities and firsthand experience.

Training is one of the most important tools to develop human resources and facilitate the transition to a more sustainable world. It should have a job-specific focus, aimed at filling gaps in knowledge and skill that would help individuals find employment and be involved in environmental and development work. At the same time, training programmes should promote a greater awareness of environment and development issues as a two-way learning process.

*Agenda 21, Chapter 36.*

**Criteria for Decision-Making in Environmental Curriculum Development**

The environmental curriculum can be defined as the sum total of all of the experiences learners have under the auspices of the school that relate to the knowledge, skills, attitudes, and human behaviors associated with the acquisition of an environmentally-appropriate life style.

The definition of the environmental curriculum stated above implies far more than the preparation of documents intended for use in the classrooms of a school or a nation. It implies - additionally - the responsibility of curriculum developers to prepare curricula that will stimulate learning of conceptual knowledge, provide for the attainment of problem solving skills, allow for the modification of beliefs and values, provide for training in and opportunities to apply appropriate citizenship behaviors which will result in a population's lifestyle that balances the quality of life with the quality of the environment. Therefore, the entire process of curriculum development involves far more than the preparation of materials. Involved in this process would be decision-making concerning goals and objectives, subject matter to be used to meet the desired goals and objectives, the organization of that subject matter, methods to be used in teaching the subject matter, and the evaluation of the extent to which the content and methods meet the desired goals and objectives.

Other critical elements which must be considered in any curriculum development project include determining the validity of the goals, analyzing the need for inservice teacher training, shaping the curriculum so that it fits within the physical and financial resources of the school, making sure the social and cultural characteristics of the community are taken into account and determining the criteria that govern the selection of the content to be used in the curriculum.

Although a number of models and proposals exist which deal either with EE curriculum development or a substantive structure for EE, the writers choose - somewhat arbitrarily - to focus on the goals established by the Intergovernmental Conference on EE, organized by Unesco in cooperation with UNEP, Tbilisi, Georgia (USSR) in October
1977. Because this conference was attended by representatives of 68 Member States and because the now-famous Tbilisi Declaration and Recommendations were drafted there, it is appropriate to utilize those Recommendations as the guiding focus for curriculum development in EE.

The Tbilisi Recommendations provide a substantial footing for decision-making in EE. They communicate criteria for developing environmental education programs, goals for EE, categories of EE objectives, and guiding principles. Any school system - large or small - should focus on these components when making curriculum decisions in environmental education. Of particular concern to this section of this document are the goals and objectives of environmental education established by the Tbilisi Conference. They follow:

The goals of environmental education are:

- to foster clear awareness of, and concern about, economic, social, political and ecological interdependence in urban and rural areas;
- to provide every person with opportunities to acquire the knowledge, values, attitudes, commitment and skills needed to protect and improve the environment;
- to create new patterns of behavior of individuals, groups and society as a whole towards the environment.

It is important to note that Agenda 21 programme areas for EE are based on the fundamental principles established by the Tbilisi Conference. What follow are the categories of objectives which were established at the Tbilisi Conference.

The categories of environmental education objectives are:

AWARENESS: to help social groups and individuals acquire an awareness and sensitivity to the total environment and its allied problems.

KNOWLEDGE: to help social groups and individuals gain a variety of experience in, and acquire a basic understanding of, the environment and its associated problems.

ATTITUDES: to help social groups and individuals acquire a set of values and feelings of concern for the environment and the motivation for actively participating in environmental improvement and protection.

SKILLS: to help social groups and individuals acquire the skills for identifying and solving environmental problems.

PARTICIPATION: to provide social groups and individuals with an opportunity to be actively involved at all levels in working toward resolution of environmental problems.

Can these goals and objectives be translated into an effective EE curriculum? The writers believe that they can be highly appropriate, particularly if an intermediate set of goals for curriculum development is adopted. This intermediate set of goals would communicate specific goal statements which could then be translated into instructional objectives around which EE materials could be developed.

If developed logically and validated, goal statements can make the task of curriculum development easier by providing developmental guidelines for a logical scope and sequence. Because appropriate developmental syntax is crucial to effective curriculum development, logically arranged goal statements will help control for a major source of program development error, i.e., a program developed without regard for a logical and developmental scope and sequence.

Such a set of goals - based on the Tbilisi Declaration objectives and validated by a panel of distinguished environmental educators - has been developed for use by the writers in cooperation with Dr. Richard J. Wilke of the University of Wisconsin. These goals will be used in this document as a model consistent with the Tbilisi Declaration. Although curriculum developers in other nations may find it necessary or desirable to modify these goals to meet local and/or national needs, the developmental and syntactical structure of the goals presented here should serve as a structural example and facilitate the development of a locally useful set of curriculum goals. Thus, the goals presented here can serve a major role in EE curriculum decision-making.

The curriculum development goals that follow are organized into four levels. Although hierarchical with respect to the development of knowledge, skills, and attitudes, they are not necessarily restricted to particular grade levels. This could be extremely important in curriculum development situations calling for a spiral development of knowledge, skills, and attitudes, i.e., a situation where these components are taught with increasing thoroughness as learners mature.

**Level I** goals focus on ecological concepts. **Level I** is a knowledge level, providing learners with that knowledge which can help them make ecologically sound environmental decisions. **Level II** is also at a knowledge level, focusing on information (awareness) concerning many aspects of human environmental behavior. **Level III** is at a cognitive process or skills level, focusing on those skills needed for issue investigation, evaluation, and values clarification. **Level IV** is also a process or skills level, focusing on those processes important to citizenship action (participation).
GOALS FOR CURRICULUM DEVELOPMENT
IN ENVIRONMENTAL EDUCATION

(Adapted from Hungerford, Peyton & Wilke, 1980
as requested by Unesco/UNEP specifically for use in this document)

Goal Level I: Ecological Foundations Level.

Goal Level I seeks to provide learners with sufficient ecological knowledge to permit them to eventually make ecologically sound decisions with respect to environmental issues.

The Ecological Foundations Level would include a minimum of the following conceptual components:

A. Individuals and populations.
B. Interactions and interdependence.
C. Environmental influences and limiting factors.
D. Energy flow and materials cycling (biogeochemical cycling).
E. The community and ecosystem concepts.
F. Succession.
G. Homeostasis.
H. Humans as important members of ecosystems.
I. The ecological implications of human activities and a variety of human communities (e.g., urban, rural, agricultural, etc.).


Goal Level II seeks to develop a conceptual awareness of how individual and collective actions can influence the relationship between quality of life and the quality of the environment . . . also, how these actions result in environmental issues which must be resolved through investigation, evaluation, values clarification, decision-making, and finally, citizenship action.

Level II provides opportunities for learners to conceptualize . . .

A. . . . how human cultural activities (e.g., religious, economic, political, social, etc.) influence the environment.
B. . . . how individual behaviors impact on the environment.
C. . . . a wide variety of environmental issues and the individual, cultural, and/or ecological implications of these issues.
D. . . . the alternative solutions available for solving environmental issues and the ecological and cultural implications of these alternatives, e.g., sustainable development.

E. . . . the need for environmental issue investigation and evaluation as a prerequisite to sound decision-making.

F. . . . the roles played by differing human values in environmental issues and the need for personal values clarification as an integral part of environmental decision-making.

G. . . . the need for responsible citizenship action (e.g., persuasion, consumerism, legal action, political action, ecomanagement) in the solution of environmental issues.

**Goal Level III: Investigation and Evaluation Level.**

Goal Level III provides for the development of the knowledge and skills necessary to permit learners to investigate issues and evaluate alternative solutions for solving these issues. Further, values are clarified with respect to these issues and alternative solutions. Goals at this level are presented in two components.

**Level III. Component A.**

Goals in Component A are designed to develop in learners . . .

A. . . . the knowledge and skills needed to identify and investigate issues (using both primary and secondary sources of information) and to synthesize the data gathered.

B. . . . the ability to analyze environmental issues and the associated values with respect to their ecological and cultural implications.

C. . . . the ability to identify alternative solutions for specific issues and the value perspectives associated with these solutions.

D. . . . the ability to evaluate alternative solutions and associated value perspectives for specific environmental issues with respect to their cultural and ecological implications, e.g., environment and development implications.

E. . . . the ability to identify and clarify their own value positions related to specific issues and their associated solutions.

F. . . . the ability to evaluate, clarify, and change their own value positions in light of new information.
Level III: Component B.

Goals in Component B provide learners with opportunities to . . .

G. . . . participate in environmental issue investigation and evaluation.

H. . . . participate in the valuing process in a manner as to permit the learners to evaluate the extent to which their values are consistent with the major goal of achieving and/or maintaining a dynamic balance between quality of life and quality of the environment with particular attention given to sustainable development.

Goal Level IV: Environmental Action Skills Level: Training and Application.

This level seeks to guide the development of those skills necessary for learners to take positive environmental action for the purpose of achieving and/or maintaining a dynamic balance between quality of life and the quality of the environment. Goals at this level are presented in two components.

Level IV. Component A.

The goal for Component A is to develop in learners . . .

A. . . . those skills which will permit them to effectively work toward ends which are consistent with their values and take either individual or group action when appropriate, i.e., persuasion, consumerism, political action, legal action, or ecomanagement.

Level IV. Component B.

The goals for Component B are to provide learners with opportunities to . . .

B. . . . make decisions concerning environmental action strategies to be used with respect to particular issues, e.g., population and sustainable development.

C. . . . apply environmental action strategies to specific issues, i.e., to take citizen action on one or more issues.

D. . . . evaluate the actions taken with respect to their influence on achieving and/or maintaining a dynamic balance between quality of life and the quality of the environment.

NOTE: Level IV Component B goals are stated in such a way as to imply only that opportunities be provided for these behaviors. In the realm of environmental action it may be ethically inappropriate to assign a learner the responsibility of taking direct action. However, the writers believe that opportunities should be provided which permit the learner(s) to use action skills which have been acquired.
Figure 2. Developers' Validity Assessment: A Comparison of the Goals for Curriculum Development in Environmental Education to the Tbilisi Conference Categories of Objectives

<table>
<thead>
<tr>
<th>Tbilisi Objectives</th>
<th>Developers' EE Curriculum Goals by Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level I. Ecological Foundations Level</td>
<td></td>
</tr>
<tr>
<td>Subcomponents</td>
<td></td>
</tr>
<tr>
<td>Level II. Conceptual Awareness Level</td>
<td></td>
</tr>
<tr>
<td>Subcomponent:</td>
<td></td>
</tr>
<tr>
<td>A</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td></td>
</tr>
<tr>
<td>E</td>
<td></td>
</tr>
<tr>
<td>F</td>
<td></td>
</tr>
<tr>
<td>G</td>
<td></td>
</tr>
<tr>
<td>Level III. Investigation and Evaluation</td>
<td></td>
</tr>
<tr>
<td>Subcomponent:</td>
<td></td>
</tr>
<tr>
<td>A</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td></td>
</tr>
<tr>
<td>E</td>
<td></td>
</tr>
<tr>
<td>F</td>
<td></td>
</tr>
<tr>
<td>G</td>
<td></td>
</tr>
<tr>
<td>H</td>
<td></td>
</tr>
<tr>
<td>Level IV: Action Skills Level</td>
<td></td>
</tr>
<tr>
<td>Subcomponent:</td>
<td></td>
</tr>
<tr>
<td>A</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td></td>
</tr>
</tbody>
</table>

Key: 1 = Awareness; 2 = Knowledge; 3 = Attitudes; 4 = Skills; 5 = Participation
Earlier it was noted that the developers of these goals conducted a comparison of the goals with the Tbilisi Conference Categories of Objectives. This comparison can be observed in Figure 2. Each time the developers' goals favorably matched one or more of the Tbilisi Objectives, the situation was noted with "x". This validity comparison is presented here to provide an opportunity for the reader to judge that comparison personally and/or as a model should the reader(s) choose to develop another set of goals which could be compared against the Tbilisi Objectives.

Benefits Derived From Using the Goals for Curriculum Development in the Production of Instructional Programmes for EE

The Goals for Curriculum Development in Environmental Education have a potential usefulness that transcends current practice in EE and even transcends EE itself. As noted elsewhere in this document, research that has been conducted on a world-wide basis indicates that EE programmes are often of an awareness nature with little emphasis being placed on problem investigation or solution. The goals presented here allow for - even require - the development of issue investigation and solution skills. Further, the content used in the development of empowered issue investigators need not be the classic content of environmental education.

The content used in curriculum development can transcend EE in the traditional sense by dealing with crucial socio-cultural issues which plague humans throughout the world. Many issues are associated with sustainable development, e.g., providing food security for all people, reversing the deterioration in resource productivity, providing access to family planning and reproductive health services, and providing "clean energy" to sustain economic growth. Other problems could include, for example, issues related to personal, village, or public health on a broader scale. They could include issues related to tillage, crop production, and food preservation. Of course, issues such as these are closely tied to the environment.

Young people and adults in all nations can be helped to understand their role in the total environment by becoming astute observers, investigators, and decision-makers. In addition, the investigation of issues from both an ecological as well as socio-cultural perspective enables the learner (regardless of age or socio-economic status) to view the issue holistically and perceive the interrelationships that exist between the natural environ-
ment and man's cultural activities. The goals provided in this document, if appropriately applied, will aid in this process.

More importantly, perhaps, is the opportunity to train effective decision-makers who will, in their own villages, communities, or cities, act in consort with ecological principles which will promote a quality of the environment as well as a quality of life for the individual. The goals described in this document promote the development of citizenship responsibility skills and provide for an opportunity for learners at all age levels to demonstrate these skills through responsible environmental behavior.

The Goals for Curriculum Development in Environmental Education do, indeed, allow for the development of a comprehensive and holistic environmental education curriculum - one which considers not only ecological principles but the implications of man's activities in an infinite number of ways. The goals permit the curriculum developer to use those issues/problems which are critical to the immediate area in which the curriculum is to be used (or globally, whichever is desired and necessary). Thus, the goals act as a generic vehicle for the development of comprehensive EE programmes in all nations.

Applying the Goals - An Instructional Model

Regardless of the set of goals used by the curriculum developer, a functional instructional model must be applied in order to achieve validity in the final product. To produce curricula without serious consideration being given to the act of instruction usually results in invalid, inappropriate, and inconsistent materials.

An instructional model which could be used in any school district, region, or nation for EE curriculum development is diagrammed in Figure 4. This diagram provides a model for the curriculum developer which, if applied rigorously, can result in organized, internally consistent, and valid EE materials for any learner group. Further, it can be applied to any grade level and any content area. Of major significance is the fact that this model can be applied by any curriculum development team using any set of appropriate curriculum goals, i.e., the goals being applied do not necessarily have to be those presented in the previous section of this document.

Parts A, B1, B, and C of Figure 3 constitute the heart of curriculum and instruction. Pretesting (B1) should be incorporated only when needed, i.e., there are times when a par-
ticular learner group, receiving a certain instructional package, will not need pretesting based on information already known to the instructor.

Goals (A1) and curriculum evaluation (D) have also been included in Figure 3 to show how they are related to curriculum and instruction as such. Goals have already been discussed in this document and evaluation is considered in another section. Therefore, these components will not be discussed here except to note that they, too, are interrelated with all other components.

Each of the major components of the model seen in Figure 3 will be discussed briefly below:

**Instructional (Performance or Learner) objectives (A)**

Instructional (performance) objectives are critical to the entire process of curriculum development and instruction. This component establishes what the learner is to learn, i.e., what the instructor is to teach.

The selection of instructional objectives should be based on: (1) the curriculum goals being used, (2) the scope and sequence of the curriculum under development.

---

![Diagram](image)

Figure 3. This diagram reflects the components of the instructional process plus original curriculum goals and curriculum evaluation. A, B, and C are the critical components of instruction. Pretesting (B1) must also be considered as an integral component when needed in the instructional process. Note the interrelatedness of all of the components. These relationships must be constantly respected in any curriculum development effort in order to guarantee validity.
(3) what behaviors the students are expected to demonstrate subsequent to instruction, (4) what the students' capabilities are at the beginning of instruction, and (5) the resources available to the instructor (school).

Once the instructional objective is selected it should be inspected for consistency in order to permit the instructor to measure its acquisition during or subsequent to instruction. Several examples of performance objectives appropriate for the goals used in this document are stated in the following list:

<table>
<thead>
<tr>
<th>Goals</th>
<th>Performance Objectives</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level I Part A</td>
<td>(1) Following a unit on population dynamics, learners will be able to explain how a population of animals can become eruptive and exceed the maximum carrying capacity of its environment.</td>
</tr>
<tr>
<td>Level I Part G</td>
<td>(2) Following a unit on homeostasis, the students will visit a local, stable ecosystem and identify at least two variables that contribute to the homeostatic condition of that ecosystem.</td>
</tr>
<tr>
<td>Level II</td>
<td>(3) Following a unit on man's cultural activities and the environmental impact of these activities, students will be able to describe at least three ways regional ecosystems are threatened by human activity.</td>
</tr>
<tr>
<td>Level III Part A</td>
<td>(4) After completing the chapter on issue investigation using secondary sources, the students will select one of fifteen issues identified by the instructor and locate at least six references dealing with that issue from the card catalog and/or the Readers' Guide (or any other sources assigned by the instructor).</td>
</tr>
<tr>
<td>Level IV Part A</td>
<td>(5) Students completing the chapter on environmental action will be able to write a suitable definition for consumer action and name at least two issues that might be influenced by that kind of action.</td>
</tr>
</tbody>
</table>

Note: The five instructional (performance) objectives found above are examples only and do not necessarily reflect the writers' recommendations for objectives for particular goal levels.

The benefits of using performance objectives (P.O.'s) are many. A few of these benefits follow: (1) P.O.'s contribute to the logical sequencing of content in curriculum development. (2) P.O.'s contribute to effective communication concerning expected outcomes between developers, students, teachers, and parents. (3) P.O.'s help provide a mechanism whereby both instruction and curricula can be
evaluated. (4) P.O.'s promote efficient learning when students realize what is expected of them. (5) P.O.'s facilitate pretesting when this component is appropriate. (6) P.O.'s help researchers measure the acquisition of particular goals.

**Pretesting (B1)**

Pretesting is undoubtedly of great value when an instructor is beginning a new unit or working with a group of unfamiliar students. When used, pretesting should involve an evaluation of the extent which students have already mastered the objectives in the curriculum. Pretesting must be consistent with the objectives and anticipated instruction if it is to be of value. In situations where the instructor is thoroughly familiar with the learners - or where courses are very sequential in nature - pretesting for every unit or module may not be necessary.

**Instruction: Content and Methods (B)**

Instruction involves the selection of the content most appropriate for getting students to master the objectives in question. Also involved are the selection of suitable methods, the selection of instructional materials to be used, and the sequencing of activities used in instruction.

Content used for achieving particular goals may differ from school to school or nation to nation. Certainly, students living in a tropical rain forest should learn the concepts associated with "ecosystem" by interacting with the rain forest. It would be foolish to ignore the student's own regional biome and focus on another in a distant region, e.g., tundra. Similarly, environmental issues vary from region to region and those of immediate concern to the student would be used - at least initially - when curricula are being prepared.

The availability of instructional materials will also differ from school to school and region to region. Some schools may have access to many visual aids while others do not. The same is true for library resources, access to the representative biome, and laboratory facilities. These considerations must be kept sharply in focus when developing curricula. Modes of instruction are critically important to the curriculum developer and instructor. The best available methods should be employed when designing instructional sequences. A field trip may prove eminently more profitable than a lecture about a resource. Debate may provide considerably more values clarification than simply reading about an issue. A laboratory may well teach far more about an ecological principle than a discussion about that principle. Methods can make the difference between a powerful learning experience and one that fails to result in the acquisition of desired knowledge, skills, or attitudes.

24
Posttesting may be a poor term to describe all of the attributes of this component because it infers that evaluation will take place upon the completion of a unit or module. Certainly, many objectives can and will be evaluated enroute, as students progress through the learning sequence. Many affective objectives, for example, can be evaluated by the instructor’s observation of learner behavior during a variety of activities, e.g., the student’s involvement in the values clarification process during a debate, a case study analysis, or a simulation activity.

Still, many objectives will be evaluated subsequent to instruction. Regardless of when evaluation takes place, the critical thing to keep in mind is to guarantee that students are evaluated on the objectives as stated, in a manner consistent with instruction. Herein lies a much too common problem in education, that of preparing objectives, providing instruction, and then evaluating learners on some other set of objectives.

If the performance objectives have been carefully prepared and clearly stated, evaluation becomes a relatively simple matter. Of course, the evaluation mode or strategy will depend entirely on the way in which the objectives have been stated, i.e., the evaluation instrument will measure what the objectives specify as appropriate human behavior following instruction.

Oftentimes educators infer that the evaluation process is measuring only student success. This is only partly true in that posttesting is a remarkably good indicator of the suitability or success of instruction, particularly if the objectives and instruction are sound. Posttesting is also a powerful mechanism for establishing the need for revision in either the objectives or instruction or both. When revision is called for it should be undertaken promptly and with careful planning.

Thus far the reader has been introduced to a set of goals for curriculum development which have been validated against the Tbilisi Declaration and a model for curriculum development and the instructional process. It appears appropriate to include with this document a series of sample activities which have been thoroughly developed in accordance with the infusion process, the goals for curriculum development, and the curriculum development model.

The reader will find a set of sample activities in Appendix A. These activities are individual, discrete ones and, in themselves, do not represent complete units or curricular packages. They do, however, represent lessons that could be incorporated into curricula based on the goal statements found in this document.
Procedural Guidelines and Considerations for Curriculum Development

Curriculum development takes on a variety of profiles in different situations. Sometimes it is completed under the auspices of a very small group which has a specific focus and a well defined task. At other times it is the charge of a much larger group of individuals. It can be done independently within a particular educational agency or it can be done commercially for profit. In this document it is assumed that it will be the job of an educational agency using numerous people having a variety of skills.

Thus, this section will identify and discuss in some depth a number of steps or activities which might guide those responsible for the organization and completion of a curriculum development project. Under no circumstances should the reader infer that these steps should be taken in all instances under all conditions. The discussion which follows may sound prescriptive but the section is here strictly as a guide to assist in the thinking and planning of the curriculum developers.

The key activities being presented in this section follow:

I. Organizing a curriculum Core Development Team (CDT) or Committee.
   A. Selecting Core Development Team (CDT) members.
   B. Establishing tasks and timelines for the CDT.
   C. Collecting appropriate resources, e.g., curriculum materials and professional references.
   D. Identifying the local and national environmental, development and population issues.
   E. Identifying the constraints that will impinge upon the curriculum development effort and plan for resolving same.

II. Identifying professional consultants who will serve as a Recommended Support Team (RST).
    A. Establishing tasks and timelines.
    B. Identifying liaison procedures to be used between RST and CDT.

III. Developing the curriculum's scope and sequence.
    A. Defining curriculum goals.
    B. Identifying concepts, skills and attitudes to be incorporated as objectives into the curriculum (the scope).
    C. Assigning objectives to appropriate grade levels and content areas (the sequence).

IV. Evaluating the existing school program with respect to potential EE infusion elements.
    A. Identifying EE objectives which already exist in the present curriculum.
B. Identifying materials in present curriculum which could be modified to meet EE objectives.
C. Identifying deficiencies in present curriculum where new materials must be selected or developed to complete the proposed EE scope and sequence.

V. Inventorying and evaluating the community/regional resources available for use in the EE curriculum.

VI. Preparing the EE curriculum.
A. Reviewing and evaluating the materials which have been collected for potential adaptation or adoption.
B. Organizing writing teams to adapt or develop EE materials needed to complete the curriculum.

VII. Developing plans for both a pilot implementation and full scale implementation.

VIII. Developing a comprehensive evaluation program.

The Complete Curriculum Development Committee (Team)

The actual size of this team or committee may ultimately be determined by the scope of the curriculum being developed. However, areas of expertise are recommended in two key sub-groups: The Core Development Team (CDT) and the Recommended Support Team (RST). Members of the CDT might include content area representatives and/or generalists, a teacher coordinator, and representative(s) of the administration. The RST could include curriculum development specialists, EE specialists, environmental scientists, appropriate community representatives and program evaluation specialists. One member of the CDT should be selected as the team leader.

The CDT has a major responsibility for curriculum development. The members of the RST should be available for specific tasks (some of which are described below) during the curriculum development phase. Ideally, the services of all recommended committee members would be available at all times. However, time and financial support may inhibit using this approach.

Content area representatives and generalists should be selected from disciplines that will be affected by the final EE curriculum. It is expected that most of this group would be teachers, preferable (although not necessarily) with training or experience in EE. Elementary teachers without specialist training would serve as generalists on the committee.

The teacher coordinator is a vital part of this committee. This person will participate not only in the development of the curriculum, but in its implementation, evaluation
The EE coordinator should be an accomplished classroom teacher with excellent training, experience, and interest in EE. During the implementation phase, this person must also be able to work with other classroom teachers in many roles to facilitate the effective implementation of the curriculum. Above all, this person's EE philosophy should be consistent with current thrusts in EE, particularly those evolving from the Thilisi Conference.

It is also essential that administrators be represented on the CDT so that the efforts of the team be supported by the administration. The administrator chosen must be sympathetic to the team's mission. Implementation of the final curriculum will also be enhanced if administrators understand its importance and particular needs.

Curriculum development specialists (RST) should be available to consult with the team during the initial phases. This expertise will aid in establishing the scope and sequence of the EE curriculum and in planning specific procedures for selecting and developing materials. These consultants may be needed at key points throughout the curriculum development process.

The EE specialists will be used in the development of a valid scope and sequence, in the identification of available EE materials, and refinement of materials developed by writing teams. Environmental scientists may contribute significantly to the development of the content in the curriculum. For example, case studies may be developed around the experiences of scientists working in the field of environmental problem solving, e.g., wildlife managers, fisheries biologists, grassland ecologist.

Community representation is often helpful not only in reflecting the interests and resources of the community, but in getting community support for the curriculum development and implementation. These representatives could well be chosen from parent groups as well as from other community leadership groups. It is sometimes very productive to choose representatives who have serious interests in the environment.

The program must be evaluated and revised to make it most effective. Developing an evaluation scheme will require the use of someone especially trained in program evaluation. A program evaluator (or evaluation team) should be available in the final stages of the curriculum development, and during the implementation and evaluation stages as well.

The table found in this section attempts to identify the minimum roles to be played by each committee member.
<table>
<thead>
<tr>
<th>ROLES</th>
<th>Plan Committee Approach</th>
<th>Define Goals and Objectives</th>
<th>Assign Objectives to Grade Levels</th>
<th>Assess Existing Curriculum Resources</th>
<th>Review Available Curriculum Materials</th>
<th>Select Materials for Adoption</th>
<th>Develop New Materials</th>
<th>Develop Implementation Plan</th>
<th>Develop Evaluation Plan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teacher Coordinator</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Administrator</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Content Specialists</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Curriculum Specialist</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>EE Specialist</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Environmental Scientist</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Program Evaluator(s)</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Community Representatives</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>
Committee Decision-Making

Since many of the committee's efforts will be directed toward decision-making on difficult and important issues, it seems appropriate to consider some creative problem solving strategies for small groups. Problem solving efforts can be made more efficient and effective when structured approaches are utilized.

Several phases of the curriculum development process would be appropriate for the use of creative problem solving sessions. Some of the more important, potential applications are listed below.

SMALL GROUP/COMMITTEE DECISION-MAKING POTENTIAL
1. Identifying the responsibilities of the curriculum development team.
2. Establishing priorities and/or sequencing tasks.
3. Identifying major constraints to the effective development and implementation of the EE curriculum.
4. Identifying strategies for circumventing major constraints to the committee's goals.
5. Identifying and selecting specific content components of the curriculum. These could include, as examples, major concepts to be included in Level I ecological foundations goals or desired outcomes of Level II goals.
6. Establishing guidelines for the selection of appropriate teaching materials and/or strategies.
7. Coordinating the infusion of the EE curriculum scope into appropriate segments of other disciplinary curricula.

Collecting References

Another major organizational task at this phase is the collection of references and resources. Many of these will be used throughout the project and some attempt should be made to establish a reference library at the onset. Additions may be made to the collection as committee members become better acquainted with the EE literature. References could include the following topics (the bibliography of this document will provide suggestions for many of these).
Involving the curriculum development team in locating some of these references will familiarize members with available materials and sources of materials. Further, this provides an opportunity for members to exchange information and to begin developing a common pool of knowledge.

Planning the Curriculum Scope and Sequence

The scope and sequence phase of the project is critical since it will provide direction for further development of curriculum materials. The first step in establishing this direction is to identify goals for the curriculum. The goals of an EE curriculum are broad, general statements which reflect the underlying value priorities and philosophy of the program. The following, overriding goal for EE was adopted at the World Intergovernmental Conference on Environmental Education held in Tbilisi, USSR, 1977.

To develop a citizenry that is aware of, and concerned about, the total environment, and its associated problems, and which has the knowledge, attitudes, motivations, commitment, and skills to work individually and collectively toward solutions of current problems and the prevention of new ones.

The refining of the general goals of EE into an integrated system of sub-goals, objectives, curriculum materials, teaching strategies and classroom activities is a continuous process in curriculum development and implementation. Earlier sections of this chapter present examples of the refinement of the overall goal presented above into separate goal levels, sub-goals, sample objectives, and teaching activities.

If the goal levels and sub-goals suggested in this document are chosen for use by the committee, the group is still faced with the major task of developing a curriculum scope and sequence before teaching materials can be selected and/or written.

The scope (or breadth) defines the extent of coverage by the curriculum in terms of objectives (cognitive, affective, and psychomotor) or statements of ideas or conceptual
schemes. The sequence assigns these elements to grade levels based on a hierarchy of concepts, skills, and attitudes.

Figure 4 presents a conceptual model of a curriculum based on the goal levels found in the Goals for Curriculum Development in EE (presented in this document). This model presents a conceptual scheme to illustrate how the scope (operationalized from the goal levels) may be integrated through grade levels (vertical organization) and across appropriate disciplines (horizontal organization). In order to translate this conceptual scheme to a completed EE curriculum, it may be best to proceed through the following three steps:

1. Develop the curriculum’s scope by expanding the separate goals within each goal level into specific knowledge, skill, and attitude objectives.

2. Assign these objectives to appropriate grade levels.

3. Assign the objectives within discrete grade levels to appropriate discipline/content areas.

When preparing the scope of the curriculum, each goal (or sub-goal) must be operationalized by analyzing that goal to determine those behaviors that will lead to the accomplishment of that goal. For example, the concept of "ecosystem" may have to be operationalized as several subordinate concepts which can be translated into performance objectives. These performance objectives should provide a comprehensive framework within which the acquisition of the ecosystem concept can be assessed subsequent to instruction.

Just as conceptual (knowledge) components are specifically developed and stated, so must the scope of cognitive skills and attitudes be identified and developed. For example, a Level III goal in the Goals for Curriculum Development in EE is to "... develop in learners the knowledge and skills needed to identify and investigate issues ..." The curriculum development team must identify the nature of these knowledge and skill components so they can be translated into objectives (see Figure 5 which illustrates this procedure) and thence into instructional strategies.

Some goals will need to be operationalized as guidelines rather than specific instructional objectives. For example, both Levels III and IV of The Goals for Curriculum Development in EE include a Component B which identifies goals of EE to provide learners with certain experiences rather than cognitive or affective instruction as such. These components will be reflected in the scope of the curriculum, but only as guidelines or vehicles appropriate for use in accomplishing those goals in particular school, regional, or national situations. For example (Level III, Component B - Part G), after students
Figure 4. A Conceptual Model Illustrating The Integration Of Curriculum Scope Through Grade Levels And Across Subject Areas Within Grade Levels.
have acquired the skills needed for issue investigation and evaluation, the curriculum will provide opportunities for learners to choose issues of local, regional, or national significance for investigation under the direction of the instructor. Of course, objectives can be written which relate to the products of this investigation and evaluation. These objectives can be used to assess student performance or to draw up contracts which provide direction to the students during issue investigation and/or evaluation.

Figure 5. Selected Objectives to Illustrate Scope Development at Four Curriculum Development Goal Levels

The examples of objectives provided here in Figure 5 are intended to show the specific nature of a partially-developed curriculum scope based on goal levels of the Goals for Curriculum Development in Environmental Education which are described elsewhere in this document. Once the scope of a curriculum is fully developed, components must be assigned to grade levels (vertical organization) and to subject areas within grade levels (horizontal organization).

**Goal Level I. Ecological Foundations Level:**

Sample Objectives: . . . students will be expected to be able to . . .

1. . . . given a description of a population interaction in a community, identify the interaction as predator-prey, competition, or mutualism.

2. . . . diagram the flow of energy through a community by constructing a food chain.

3. . . . give an example of a successional change in an ecosystem.

4. . . . name three animals which are very successful in the biosphere because they have broadly based niches. Briefly describe these niches.

5. . . . name three animals which are threatened by extinction because they have rather narrowly defined niches. Briefly describe these niches.

**Goal Level II. Conceptual Awareness Level - Issues and Values:**

Sample Objectives: . . . students will be expected to be able to . . .

1. . . . communicate a definition of "sustainable development".

2. . . . list at least three interactions that take place between human beings and their environment which could interfere with the goal of sustainable development.

3. . . . prepare and communicate a list of at least five environmental issues which are closely related to the overall concept of sustainable development.

4. . . . (after reading several articles on global overpopulation) identify the major players involved in this issue, the players' positions on the issue, the players' beliefs related to this issue, and the values associated with these beliefs and positions.
Goal Level III. Investigation and Evaluation Level:

Sample Objectives: ... students will be expected to be able to ...

1. ... identify governmental or private agencies to which they can write for specific information about an environmental issue.

2. ... write a sample letter to an agency asking for information about a particular environmental issue. [The letter is to be correct in terms of its general structure, the agency chosen to be contacted, and the kinds of information requested.]

3. ... read two environmental news articles on a particular issue, compare the two articles, and identify at least one differing value position inferred by this comparison.

4. ... cite several environmental issue topics which lend themselves to gathering information using a survey strategy.

5. ... identify one or more local (or regional) issues which impact upon sustainable development and which could be investigated with the use of a questionnaire.

Goal Level IV. Environmental Action Skills Level - Training and application.

Sample Objectives: ... students will be expected to be able to ...

1. ... (given a specific example of an environmental action) apply the thirteen action analysis criteria, providing logical answers to each of the thirteen questions.

2. ... identify a given persuasive action as an emotional appeal, logical appeal, coercion, or combination of these.

3. ... produce an example of an effective persuasive action on some issue which combines both logical and emotional reasons for taking action and follows appropriate guidelines for persuasive action.

4. ... describe the dangers of persuasive actions based only on emotion and give one example of an actual environmental issue in which such actions were taken.

5. ... identify three different modes of persuasion and explain how each could best be put to use in an effort to resolve local or regional issues associated with sustainable development.

Figure 5. Selected objectives illustrative of a partially-developed scope for an environmental curriculum.


The completed curriculum scope will be an extensive collection of concepts, skills, and attitudes which essentially define the body of the EE curriculum as seen by the
developers. The bibliography of this document contains references to some other curriculum projects which will help the developers in this task of operationalizing the goal level components. These EE curricula have been organized around themes other than those represented by the goal levels in this particular document. However, many serve as excellent sources for specific cognitive and affective curricular components.

The completed curriculum scope will be an extensive collection of concepts, skills, and attitudes which essentially define the body of the EE curriculum...

It may be appropriate to stress that much work has been accomplished in identifying conceptual, skill, and attitudinal components of EE. The curriculum committee should take advantage of the availability of such materials in its efforts. The primary responsibilities of the team will be in the organization of the curriculum - designing the use of EE materials so they efficiently and effectively infuse into the existing curriculum according to the needs and constraints of the situation. As the scope is refined, for example, it should begin to reflect the needs and resources of the population for which it is designed by referring to local cultural impacts, environmental resources and issues, etc.

Extreme care should be taken to assure the acquisition and use of sample curriculum models which promote a rational perspective of EE. A number of curriculum samples exist. Not all, however, focus on environmental education as defined in this document. Some promote numerous other activities under the guise of EE including outdoor education, stress challenge programs, nature interpretation, outdoor recreation, etc. Some exist solely at the issue awareness level without any effort to provide the learner with ownership and empowerment. The curriculum development team (CDT) must be constantly on the alert to screen out documents which do not fit the parameters of the desired curriculum design.

Once the scope of the curriculum has been developed, it must be sequenced into grade levels. Developing the vertical organization or grade level sequence of the curriculum can be made more effective if the services of curriculum development specialists are available. Special skills and knowledge may be required to make these critical decisions. Consulting other EE curriculum projects which have been found to be effectively designed may also prove valuable.

The basis for sequencing the objectives may, in part, be a hierarchy inherent within the scope itself. For example, the curriculum committee may perceive that some elementary concepts of ecology should precede consideration of what constitutes an environmental issue. Similarly, training in the skills of investigation would probably pre-
Figure 6. How A Complex Concept Develops: An Example From Ecology.

THE ECOLOGICAL COMMUNITY CONCEPT

THE DISCIPLINE

STAGES OF INCREASING CONCEPT COMPLEXITY

"ECOLOGY"

Stage I

Stage II

Stage III

Stage IV

Etc.

Possible Concepts:

Plants and animals living together in a given area

Possible Concepts:

Interacting populations of plants and animals

Note: Each stage adds new information (concepts themselves) to the complex concept of "ecological community"

Possible Concepts:

Producers
Consumers
Decomposers
Scavengers

The Complex Concept

ECOLOGICAL COMMUNITY

Predator-Prey Relationships:
Food Chains
Food Webs
Energy Transfer

Stages I + II + III + IV + More

Narrow Concept → Increasingly Meaningful Concept

Simple → Complex
cede the independent investigation of issues by students. Similar sequences would occur in citizenship action skills training and other areas.

Another basis for developing the sequence is the application of learning theory. Certain components of the scope may be more appropriate for some learners than for others. For example, consideration and evaluation of several alternative solutions to environmental problems may be beyond the ability level of a concrete thinker in the primary grades and be more appropriate for students capable of developing formal thought patterns. This would be an application of learning theory proposed by Piaget.

A particularly effective strategy in curriculum design is the "spiral approach". In this design, concepts, cognitive skills, and/or attitudes may be spiraled vertically through the curriculum, increasing depth and complexity with successive exposures. Figure 6 provides an example of how the "ecological community concept" might be built vertically through the curriculum.

Horizontal organization involves the assigning of the scope components to appropriate disciplines (content or subject areas) within each grade level. In this task, the committee must use its combined expertise to determine how the EE objectives are related to other disciplines in the curriculum and where they might be most efficiently and effectively accomplished. The content specialists will be familiar with teaching approaches, materials, and objectives in their own disciplines. And too, they can identify points at which objectives in the infused discipline may parallel, complement or supplement each other.

In assigning EE scope objectives to appropriate subjects within grade levels, it may be useful to consider the following questions:

1. How can existing disciplines be used to accomplish the objectives of EE?

Many learning experiences in the existing curriculum may already be accomplishing the goals of EE and require little or no modification to give these experiences an environmental context. For example, the objectives of a geography unit to provide learners with a knowledge of limited water resources throughout the world may be entirely consistent with those identified in the EE curriculum.

Many other situations will be identified where existing objectives (and teaching materials) may be "environmentalized" to allow needs of both curricula to be met. For example, objectives in math to provide learners with graphing skills may accommodate EE objectives if the data presented for the graphing activity illustrate human population trends throughout the world (or other appropriate data).
2. How can EE objectives be used to accomplish the objectives of the existing curriculum?

The principle of using the knowledge, skills, and attitudes in a variety of situations to teach for transfer in EE also applies in other disciplines. An investigation of some environmental problem (e.g., dwindling fisheries or the loss of timber resources) which involves learners in objectives from all EE goal levels could also be used to develop and/or reinforce the application of communication skills, math skills, and knowledge from several other disciplines.

3. How often should EE objectives be reinforced throughout the curriculum?

Achieving either acquisition or transfer of knowledge, intellectual skills and attitudes is enhanced through repetition. The more complex these components are, the greater need for their inclusion at several points throughout the curriculum. The knowledge, intellectual skills, and attitudes involved in the investigation of environmental issues should be infused into several disciplines at all grade levels (with increasing frequency and depth at higher levels of education).

4. How can infusion be accomplished to maximize the use of existing facilities and expertise?

The use of teacher expertise and facilities such as libraries, outdoor laboratories, classrooms, and others may be a consideration in the organization of the EE curriculum. For example, EE objectives concerned with the knowledge and skills of persuasive action may best be assigned to subject areas taught by teachers with training in communication. Other decisions for this type of organization may be made based on opportunities for effective team teaching.

5. Are the EE objectives more appropriate for a multidisciplinary model or interdisciplinary model?

When considering higher levels of education (middle school through tertiary levels), it may be more effective and efficient to provide an interdisciplinary experience to accomplish certain EE objectives. In-depth involvement in environmental issue investigation, evaluation and action taking at middle school or higher levels may be such an example.

6. How can EE objectives be infused into the curriculum so that not only sound educational principles of acquisition and transfer be followed, but also so that learners are able to synthesize their experiences in various disciplines into a meaningful EE context?

The infusion process must not isolate objectives of EE so extensively that this synthesis does not take place. This implies careful planning and an effective curriculum articulation both vertically (through grade levels) and horizontally (assignment to subject areas).

Preparing the EE Curriculum

An analysis of the existing school's program for EE content will have been initiated to some extent during the scope and sequence development phase. This analysis
must be continued to identify and evaluate existing curricular components (e.g., materials and activities) which achieve EE objectives, or could be modified to accommodate EE objectives. This phase should also identify specific needs for new EE materials and activities to be adapted or developed, and infused into the program.

Once the nature and extent of curriculum preparation needs have been defined as distinct units or lessons, the development committee should assess existing materials resources (such as many of those contained in the bibliography) available for use in the EE curriculum. As discussed earlier, many teaching activities have been developed to achieve EE objectives. Some of the curriculum needs may be accommodated by adapting these materials so they reflect a local emphasis and are consistent with the philosophy, scope and sequence of the EE program being developed.

If the EE curriculum is to provide the learner with an awareness of the local environment, an inventory and evaluation of available community and regional resources should be made. Such resources may include sewage treatment plants, land use management projects, ecosystems, or situations reflecting specific environmental issues (e.g., urban sprawl, land fill areas, desertification, erosion, channelization projects, wetland management problems, water pollution sites).

During this resource inventory, each potential resource should be identified and annotated as to its description, availability, limitations of use (e.g., seasonal usage, number of students permitted, costs involved, distances) and application to the EE curriculum. Further, resources should be inventoried with respect to appropriate program objectives and suggestions for use. The final form of this inventory may be a card file, computer programme, or resource manual which may be used by writing teams in adapting or developing learning activities. The resource inventory should also be made available to all instructors just as soon as possible when completed.

The final phases of curriculum preparation involve the writing and adapting of materials and organizing these into a physical format for use by teachers. The exact format will be determined by local needs and the characteristics of the program itself.

**Preparation of EE Teachers**

The infusion of an effective EE curriculum into existing school programs will necessitate that teachers possess the knowledge, cognitive skills, and affective attributes they are expected to impart to students. They must not only acquire these attributes, but do so in a manner that encourages them to transfer EE knowledge, skills, and attitudes to
their teaching methods. The implications seem quite straightforward: Classroom teachers should experience training in curricula based on the same criteria as the EE curricula they are expected to teach! This principle is a crucial one and cannot be stressed too much!

Following is a set of guidelines for the development of teacher preparation programs. While the opportunities and strategies for utilizing the guidelines differ for inservice and preservice groups, attempts should be made to follow the guidelines in any EE teacher training effort.

Teacher Preparation Guidelines

Teacher preparation in EE should . . .

1. . . . focus on and reflect the many-faceted and interdisciplinary nature of EE. In so doing, teachers should be provided with opportunities to acquire and apply the knowledge, skills, and attitudes important in environmental education. At the very minimum, this preparation should include:

(a) basic training in ecology.
(b) field and/or laboratory experiences for teachers in the area of environmental science.
(c) knowledge of environmental issues and problems of resource management.
(d) competencies in environmental problem identification, investigation, evaluation, and citizenship action.
(e) opportunities to develop value clarification skills and knowledge of the roles of human values in environmental issues.

2. . . . provide instruction and experience with multidisciplinary (infusion) curriculum as well as instructional activities and methods similar to those they might use in their own classrooms.

3. . . . provide for an opportunity for preservice teachers to experience a multidisciplinary or infusion model in their own training, i.e., be a student in a tertiary infusion model of EE.

4. . . . provide instruction on the philosophy and goals of EE and the nature of interdisciplinary and multidisciplinary (infused) EE curricula. Further, teachers should be trained in the implementation of these models.

5. . . . provide specific training - particularly at the elementary level - in the use of EE content as a vehicle for teaching basic general education skills, e.g., in language arts, reading, and mathematics.

6. . . . provide opportunities for teachers to develop skills in identifying, invento- rying, and evaluating local resources for use in environmental education.

Classroom teachers should experience training in curricula based on the same criteria as the EE curricula they are expected to teach!
Implementing EE Curricula

In many instances, the development of an EE curriculum is easier than its implementation and maintenance in the school. Far too often, a curriculum is placed within a school and, for one reason or another, fails to complete the mission for which it was intended. Similarly and perhaps of even greater importance is the fact that, in many curricular failures, faulty implementation is responsible. In many instances, program failure could easily have been avoided with sound implementation procedures.

The exact nature of the implementation process will vary according to the educational structure and character of the school, region, or nation involved. In addition, implementation will be affected by the nature of the curriculum program itself. Considering these problems, it becomes difficult to produce a single set of rules or guidelines for implementation that can be universally applied. However, it remains crucial to develop an implementation strategy that guarantees the successful incorporation of the EE curriculum. Therefore, the writers have chosen to prepare an implementation checklist which will have to be modified to meet the needs of a particular school, region, or nation. This checklist is presented in this section and diagrammed in Figure 7.

The variables associated with implementation can be arbitrarily classified under three headings. These headings are: (1) Program Approval by Inschool Vested Interest Groups; (2) Program Approval by Out-of-School Vested Interest Groups; and, (3) Critical Concomitant Variables. Implementation personnel will probably have to consider all three of these categories in order to maximize the probability of a successful program implementation. In most situations, one finds both inschool and out-of-school groups that have some kind of control over the success of an educational program. These groups must be brought into the implementation process in order to assure their support and approval. Concomitant variables found both within and beyond the school must also be considered and dealt with. Of course, concomitant variables will vary with the nature of the program itself and the discrete characteristics of the school, region, or nation in which the implementation process is taking place.

What follows is an implementation checklist, suitable for modification as needed by implementation personnel. Spaces have been provided to permit the identification and addition of particular groups and/or variables. Explanatory comments or questions have been added where necessary for clarification purposes.
## The Implementation Checklist

**Category I. Approval by Out-of-School Vested Interest Groups:** Have implementation personnel successfully contacted those out-of-school groups which have direct influence over the success of curricular programs?

<table>
<thead>
<tr>
<th>Category</th>
<th>Approval</th>
<th>Contacted Groups</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Accreditation Agencies, such as . . .</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Regional/State/National Education Offices, such as . . .</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Parent Groups, such as . . .</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Community Leadership groups, such as . . .</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Labor/Business/Professional Groups, such as . . .</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Other:</td>
</tr>
</tbody>
</table>

**Category II. Approval by In-School Vested Interest Groups:** Have implementation personnel successfully contacted those in-school groups which have direct influence over the success of curricular programs?

<table>
<thead>
<tr>
<th>Category</th>
<th>Approval</th>
<th>Contacted Groups</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Administration</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Instructional Supervisors</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Teaching Faculty</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Student Population</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Other:</td>
</tr>
</tbody>
</table>
Figure 7. Curriculum Implementation Variables. Diagram of three separate categories of program implementation variables that could prove crucial to an implementation process. Variables will vary with the particular program being implemented and/or the nature of the school, region, or nation involved.
Category III. A Checklist of Critical Concomitant Variables: Many of these "concomitant variables" are crucial to the total implementation process. They are also ones that should be considered, whenever possible, during the curriculum development process itself. However, since this is not always accomplished, these variables are described here as part of the implementation process.

1. Scheduling/Time Considerations.

Problems associated with scheduling vary according to the manner in which the school is organized, educational levels, and the type of curriculum being implemented. Certain kinds of curricula are easier to implement at various grade levels than others. Certainly, a single subject approach is much easier to implement and coordinate than an infused curriculum. In this document, however, an emphasis has been placed on the infusion model due to current worldwide EE thinking. Therefore, scheduling/time considerations will be discussed that relate directly to the infusion-type curriculum.

A number of critical scheduling/time variables must be considered. For example, is time available for the infusion of an EE curriculum into content areas of elementary, self-contained classroom? If time is a critical consideration, how can schedules be structured to yield sufficient time

Where necessary, how can EE instruction be used to teach basic skills now being taught using some other content vehicle, e.g., reading, language arts, math, and critical thinking skills. Furthermore, it appears important to consider the very real possibility that, if curriculum developers intend for elementary teachers to use EE activities to teach basic skills, these same teachers must be trained in both the content and methods involved in this process.

In the upper grades where courses are taught on a departmentalized basis, even more critical concerns face the implementation team. If EE content is to be infused throughout the regular curriculum, is every content teacher both willing and able to incorporate the multidisciplinary model? Again, time considerations become critical and problems associated with time must be overcome.

2. Program Coordination.

Of all the variables impinging on successful implementation, coordination is one of the most critical. Lack of initial and ongoing coordination have led to the failure of many EE programs throughout the world. Some professional individual, thoroughly familiar with the curriculum, must be responsible for its coordination. This principle is even more critical when the curriculum is based on a multidisciplinary-type model.

Not only must the coordinator have expertise with the program, he/she must also be given the time and authority needed to accomplish the many tasks associated with coordination. In addition, the coordinator must have
considerable rapport with the instructional staff in order to accomplish the his/her mission.

3. Initial and Ongoing Inservice Teacher Education.

This is one of the most critical of all implementation variables. However, it is discussed elsewhere in this document and will not be discussed further here.

4. Facilities.

In a curriculum where certain inschool and out-of-school facilities are critical to the success of the program, consideration for some must be given as early as possible in the implementation process. Are the facilities adequate? How do they relate to the curriculum? If facilities are not adequate, can either the facilities or the curriculum be revised to make implementation successful.

5. Resource Utilization.

Allied to facilities is a variable that is sometimes overlooked during environmental program implementation - that - of resource utilization. In those EE programs calling for direct interaction between students and out-of-school (or even inschool) resources, consideration must be given to whether resources can be used in a manner as to safeguard those resources. It is often inappropriate, for example, to place a great deal of stress on an environmentally-related establishment or facility, e.g., a family planning agency, city park, nature center, etc. Implementation personnel should consider whether the planned student-resource ratio is appropriate to a given resource. An environmentally-related agency must not be expected to spend the majority of its time meeting the needs of a particular curriculum.

Interestingly, some environmentally-oriented curricula have been found to be detrimental to resources being used. A particularly small ecosystem is especially liable when it comes to over utilization. Too, some ecosystems - even large ones - are very sensitive to human use and abuse. It is totally inappropriate for a program purporting to support and maintain the environment to find itself degrading that same environment.


The question of whether a school has appropriate materials and equipment to implement a curriculum is very important. What happens in a program calling for the duplication of large numbers of worksheets in a school where duplicating supplies are always in short supply? What of laboratory equipment and supplies in the upper grades? Are they suitable? In a multidisciplinary programme these questions must be asked of a number of content areas besides science, e.g., home economics.
7. Budget.

Does the curriculum call for either an initial investment of money or an ongoing investment or both? If so, is the money available? If not, can it be made available? Again, can the curriculum be revised to meet budgetary constraints if this proves necessary?

Comprehensive EE Curriculum Evaluation

By and large, in today's education systems, curriculum evaluation consists mostly of observations directed toward an assessment of how well students meet particular objectives or sets of objectives. Certainly, this is one facet of curriculum or product evaluation. However, it is only a small part of what should be included in the total evaluation process.

In evaluating EE curriculum programs, a comprehensive evaluation strategy should be utilized. This kind of evaluation model is partially diagrammed in Fig. 8. A thoroughly comprehensive evaluation will go beyond even those components shown in Fig. 8. As an example, a critically important aspect of curriculum evaluation is the determination of whether the curriculum has internal consistency, i.e., are goals, objectives, instructional procedures, and student evaluation strategies consistent with each other? This consistency or interrelation has been diagrammed for the reader in Fig. 3 of this document.

The reader may wish to see an example of internal consistency as related to an EE curriculum. Recalling Level IV, Component A of the Goals for Curriculum Development seen earlier in this chapter, one notes that this goal relates directly to learners having the skills needed to take environmental action. One would expect that students would somehow be evaluated on their ability to apply one or more of these skills. However, if the student is evaluated solely on whether he/she can define the modes of action and identify issues on which those modes could be applied, the evaluation falls far short of the goal. In order for the goal to be attained, the student would have to be observed applying those skills in at least a surrogate, role-playing situation. Anything less than this is truly inadequate and inconsistent with the desired terminal behavior.

This area of evaluation should begin even during the curriculum development process and continue into and beyond initial implementation phases. It is not accomplished easily because evaluation is largely a judgment-related procedure. Whether goals, objectives, instruction, and student evaluation maintain high internal consistency must be
Figure 8. Schematic Diagram Of Curriculum Evaluation. Curriculum evaluation must be thought of as an ongoing, continual process. It must be both formative and summative in nature, focusing on the consistency of all elements and their interrelationships. Above all, evaluation must not be simply an investigation into the extent to which learners are meeting desired objectives and goals. In order to be maximally effective, it must also include the evaluation of the instructional process and those concomitant variables so often considered basic to the curriculum implementation process.
judged - at least initially - on a subjective basis. Everyone concerned with curriculum development and implementation should be constantly attuned to this evaluation need and participate in it. It is also highly appropriate to bring in a professional and competent consultant or consultant team to analyze the curriculum from this standpoint. Any inconsistencies should be immediately noted with the curriculum subsequently revised.

**Measurement in the Evaluation Process**

The degree to which students are achieving the objectives for a particular lesson, unit, or module is certainly an appropriate consideration as part of the evaluation process. Assessing the acquisition of objectives is often dependent on some form of *measurement*. Measurement, in the scientific sense, is the process used to determine the degree to which learners reflect particular desired behaviors or characteristics. Thus, if one wishes to measure the extent to which students are involved in citizenship action with respect to environmental issues, the professional must devise some sort of measurement device to assess this trait.

In the case of environmental action, direct observation would probably be the most valid source of information. However, since environmental action is a behavior that usually should be autonomously applied, direct observation by the educator may be impossible due to the expenditure of time and energy it would necessitate. Therefore, the educator turns to some other measurement source for his/her information. A number of possibilities exist.

The educator could use a self-reporting instrument which has learners report the types of action taken (if any) and the number of times these actions were taken. Or, parents can act as data sources and report environmental action behavior (via a questionnaire) as they have observed it in and around the home and community. Both of these strategies have been successfully used in certain instances by the writers. Whenever self-reporting or second-party reporting are used, some safeguard needs to be incorporated to help assure that the results will be as valid as possible. Even with validity concerns present, the second-party strategy may be the only alternative. In any event these data collection procedures constitute the *measurement phase* of evaluation.

Using environmental action data as a source of information about the action behaviors of learners, one can make judgments about the effectiveness of the curriculum in meeting one of the major goals on which the curriculum was based. This judgment or decision is, in effect, evaluation. Evaluation is, to a great extent, a value judgment based
on the extent to which certain objectives have been met and the relation of these objectives to one or more curricular goals.

*Measurement*, then, becomes the process of data collection which is, in turn, an integral phase of evaluation. The two terms are not synonymous but they are related.

**Comprehensive Evaluation and Concomitant Variables**

In a comprehensive evaluation of curriculum, there exists a need to evaluate much more than the extent to which instruction is effective and the degree to which students are acquiring the behaviors associated with the curriculum's objectives and goals.

The functional environmental education curriculum is likely to prove to be a comprehensive set of goals, objectives, instructional procedures, and student evaluation mechanisms extending across a wide range of age (grade) levels. In so being, there may also be a large number of interactions existing between curriculum developers, implementors, coordinators, administrators, teachers, students, parents, budgets, materials, and curricular-related resources. Many of these interactions are tangibles and can be dealt with fairly easily, e.g., the longevity of materials and equipment, unforeseen budget difficulties, etc. Many of these interactions are, however, ones which involve personal attitudes, values, and concerns. What is the acceptance level of the faculty? What are their attitudes toward the curriculum? How enthusiastic are they? If problems exist, could steps be taken to resolve them? Should these steps be ones related to implementation? The curriculum itself? Etc.!

Whether the comprehensive evaluation strategy seems unwieldy will depend upon the thought going into it initially. As noted earlier, critical concomitant variables associated with implementation would be considered early in curriculum development. The same holds true for these variables and how they relate to evaluation since each and every concomitant variable related to implementation should also be evaluated. Many of these variables were diagrammed and discussed under the section dealing with implementation. An exhaustive list is not possible here simply because these variables are closely allied to and defined by the educational system of the school, region, or nation undergoing curricular change.

The appeal here, then, is for the curriculum development/implementation/evaluation team(s) to carefully analyze the entire process in light of the conditions peculiar to its/their situation. The major responsibility for a comprehensive evaluation lies with the professionals involved in the entire process. The success or failure of the curriculum may well depend on how well these professionals accomplish this task.
CHAPTER IV
SUMMARY/CONCLUSIONS

Chapter I of this document presented a needs-statement concerning environmental education curriculum development and suggestions for the use of materials presented here. Chapter II briefly traced the roots of EE, summarized UNESCO-UNEP's research findings concerning the status of world-wide EE curricula, and compared current program offerings with the challenge presented by the Tbilisi Declaration. Above all, Chapter II emphasized the need to bring EE curricula to maturity by providing for training in the skills of citizenship participation, i.e., responsible environmental action.

Chapter III attempted to identify the major steps for initiating the development of an EE curriculum, and to suggest strategies and/or guidelines for executing the developmental stages. The flow chart found in Chapter III has been prepared to help the reader conceptualize these strategies as an overall curriculum development process.

The strategies and guidelines discussed in this document have adhered to the trends and goals for EE identified by the Intergovernmental Conference on Environmental Education (Tbilisi, USSR, 1977). A summary of the major principles, strategies, and guidelines (of Chapter III) is presented as follows:

1. Formats for EE curriculum design may be either interdisciplinary or multidisciplinary (infusion). Both approaches have utility in a comprehensive K-12 (or higher) curriculum and should be selected for use where most appropriate.

2. EE must provide not only for the acquisition of knowledge, cognitive skills and attitudes, but for their transfer to decision-making by learners. Thus the content, sequencing, and teaching strategies encompassed by an EE curriculum must reflect appropriate principles of learning and cognitive development.

3. The content, sequencing, and teaching strategies of the EE curriculum should reflect the priorities established by worldwide, professional environmental educators.

4. The criteria for decision-making in environmental education are inherent in operational goal levels (e.g., Goals for Curriculum Development in Environmental Education).
Selection of objectives, content, and teaching strategies must be consistent with these operational levels.

5. A proven, internally consistent instructional model must be used in the development of EE curricular materials if desired outcomes are to be achieved and evaluated.

6. The development and implementation of an effective EE curriculum will require the combined efforts and expertise of internal (e.g., in-school) personnel supported by consultation with external consultants and resource people.

7. Since "teacher-proof curricula" cannot be designed and few existing preservice teacher education programs adequately prepare teachers to adapt and/or utilize EE materials, an EE curriculum development project must consider the need for inservice teacher training. The training program should reflect accepted guidelines to maximize efforts.

8. Implementation plans must provide for program approval by both in-school and out-of-school vested interest groups and for other critical and related variables such as program coordination, program facilities, resource utilization, and budget considerations.

9. A comprehensive program for evaluating the EE curriculum is necessary to determine the need for revision in order to achieve program goals. Components of a comprehensive evaluation plan include evaluation of goals, objectives, concomitant variables, and instructional effectiveness.

10. Results of EE curriculum evaluation may result in the modification of the implementation process as well as the curriculum itself.

There may be other things which schools could or should do, but they could or should do these things only after they have, . . . , patiently and persistently as they can, taught the use of that unique instrument of their humanity, the restless, questing mind. . . . Whenever a boy or girl . . . receives a less challenging, less appropriate, less worthy education than he or she mentally and morally deserves, there is a diminishing of the person, an impoverishing of a life, possibly a great loss to the nation . . .

William H. Cornog - 1963
APPENDIX

SAMPLE ACTIVITIES BASED ON THE INFUSION PROCESS AND THE GOALS FOR CURRICULUM DEVELOPMENT FOUND IN THIS DOCUMENT
Sample Activity I - Ages 6-8

Toothpick Worms - Protective Coloration

Instructional Objectives:

Upon or during completion of the activity called "Toothpick Worms" students will he expected to be able to...

1. ... report the number of "worms" preyed upon by color.

2. ... suggest a logical rationale for the discrepancy observed when unequal numbers of worms (by color) were retrieved.

3. ... explain the advantages and disadvantages (to the prey organism) of being a particular color in the environment in which the activity took place.

4. ... name at least two locally observed organisms which are protected from predation by color.

5. ... explain how protective coloration enables the organism named in No. 4 above to survive predation.

(Note: These objectives are not exhaustive for this lesson. Also, this lesson can be adapted and used with more mature learner groups. The writers have developed a lesson, based on this activity, for use with inservice elementary teachers.)

Instruction:

Preparation: Prepare for this activity by dyeing at least 250 toothpicks with food coloring. Fifty should be dyed green, fifty yellow, fifty brown, fifty red, and fifty blue. An
additional 50 should be left the original wood color and used along with the dyed toothpicks. Total = 300. (Colored yarn may be substituted for dyed toothpicks.)

Select an area outside at least 20 meters square. This area should be a grassy one but the vegetation need not be a rich green. Any color soil will probably be effective.

The 300 toothpicks should be thoroughly mixed and randomly distributed over the chosen area. This scattering of toothpicks should be accomplished without the children being present.

The activity: Explain to the children that they are going on a worm hunt. Tell them that you know of an area where there are green, yellow, brown, red, blue, and wood-colored worms. Ask three or four of the children to volunteer to hunt the worms. Explain to the remainder of the group that the worm hunters will have two minutes to collect as many of the worms as possible and that the class will observe the worm hunt.

Take the observer children to the worm hunt area. Distribute them around the perimeter of the area and establish boundaries. Then, bring the worm hunters to the area and give them instructions once again. Have them hunt worms for two minutes.

After the worm hunters are finished, have the class see how many of the remaining toothpick worms they can find. Of course, keep the worms collected during the two minute hunt separate.

Return to the classroom. Count the originally retrieved worms by color. Record on the board the number of each color retrieved. Ask the children how different the totals are. Ask if they can explain why the differences exist (making certain that all children understand this concept before leaving it). Ask the children if they can identify those colors which would be a distinct disadvantage to worms living in that area. Ask which would have the biggest survival advantage.

Ask the children if they know of animals in the area which are helped to survive because of their color. If the children do poorly with this discussion the instructor could return to the outdoors with the children and actually search for organisms (e.g., insects) which are protectively colored. If this cannot be accomplished, the instructor can name several common animals that are adapted for survival because of coloration. A discussion should follow which focuses on why this coloration protects the organism.

The discussion should progress to the point where the children understand that not all organisms are color-protected for survival. If the children can grasp the idea that protective coloration increases the chances that a number of individuals will survive to reproduce, excellent! This will provide a beginning for the development of the concepts associated with "species population."
Evaluation: The evaluation of the objectives can be done in a number of ways. An excellent way is to wait a day and then reintroduce the topic of protective coloration and its survival benefits. Questions remaining can be answered.

The children can be orally questioned or, if mature enough to write sentences, they can respond on a duplicated evaluation handout. The following questions will measure the acquisition of the objectives:

1. Which color toothpick worm was the hardest to see in the outdoor environment?
   
   Green ______ Brown ______
   Blue ______ Yellow ______
   Red ______ Wood-Color ______

2. Write a sentence telling why this color was the hardest one to see.

   (Note: If the evaluation is accomplished orally, simply transpose the statement to a question and ask it of the children. Similarly, all of the evaluation tasks that follow can be transposed into an oral evaluation format.)

3. Write a sentence telling why it is important for some animals to be protected by color.

4. Write the names of two animals that live in our area that are protected by color.

5. Go back to No. 4 and circle the name of one of the animals you wrote down. Now, write a sentence telling how this animal's color helps it survive
Sample Activity II - Ages 9-11

Making Decisions About Electrical Appliances

Curriculum Goals - Level III

Investigation and Evaluation Level

Goal: . . . identify and clarify their own value positions . . .

(Part E)

Ages: 9 - 11 (and higher)

Content area: Science, Social Studies, Home Economics, and others.

(Note: This activity, like so many others in EE, is probably better used in a
developmental situation rather than an episodic one, e.g., in an instructional
sequence focused on the environmental impacts of human activity, quality of life
and sustainable development. The activity could well be incorporated into a unit or
module related primarily to Goal Level II - Parts A or B. Another focus such as an
introduction to values clarification could provide the developmental focus. The
important point here is that an activity such as this could be used in a number of
different situations for a number of reasons. The writers have arbitrarily chosen to
focus here on Goal Level III - Part E.)

Instructional Objectives:

Upon or during completion of the activity related to electrical appliances, students will be
expected to be able to . . .

1. . . . identify electrical appliances found in their homes and record decisions
   concerning which of those they could do without completely and which, if
   any, they are totally dependent on.

2. . . . infer (orally or otherwise) why people have appliances in their homes
   which are really not necessary.

3. . . . identify those appliances they value highly and explain why they decided
to value these appliances to such a great extent. In addition, students will be
able to analyze their values in terms of quality of life as compared to the impact
of these values on the environment.

4. . . . explain why man's present culture is so largely dependent on the con-
sumption of electrical energy.

5. . . . engage in a dialogue with fellow students on the need for and/or value of
certain electrical appliances. (This dialogue would impinge heavily on the
values clarification process, particularly as students think through their own
values and publicly affirm those which they feel willing to act on.)
6. ...make tentative decisions concerning whether or not significant amounts of electricity could be conserved if a community-wide effort was employed to modify the use of electrical appliances.

(Note: These objectives are not exhaustive for this activity. Other objectives could be written for particular purposes and/or age groups. The ones seen here are simply examples of those that could yield productive results in many classrooms.)

Instructions:

Preparation for this activity will depend largely on the context in which it is being used, i.e., whether used as an activity in an energy unit, values clarification unit, issue investigation unit, etc. The instructor must make a decision about when the activity should be incorporated to maximize its effectiveness. (Or, the curriculum developer(s) should determine when it should be utilized in a particular scope and sequence.)

The activity can be duplicated so that each student has a copy as a work sheet. At the appropriate time, the work sheets can be distributed.

It is extremely important for the instructor to facilitate discussion after the initial inventory has been completed. A number of discussion question appear at the end of the inventory. Other questions can be generated by referring to the objectives. In most instances the instructor should ask students to communicate the bases for their value decisions - to tell why they answered as they did. In this manner the students' rationales can be inferred and evaluated.

---

**Work Sheet**

**Making Decisions About Electrical Appliances**

In this activity, you are asked to think about your home and write down ten (10) electrical appliances found there. After writing these down, you will be asked to make some hard decisions concerning their use. Write the names of the appliances in the table that follows and then read on for further instructions.

<table>
<thead>
<tr>
<th>Code</th>
<th>The Item</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>W</td>
<td>E</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.</td>
<td>Refrigerator (One example)</td>
</tr>
<tr>
<td></td>
<td>2.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4.</td>
<td></td>
</tr>
</tbody>
</table>

(Note: Continue until ten spaces are provided.)
Now, go back and decide which of the appliances you could do without completely. For those you could do without completely, place an (X) under the column marked "W". When you have done this, go back over the list and decide how many of the remainder you could do without during a power emergency. For these, place an (X) under the column marked "E". Finally, go back over the list and decide which of these appliances you value highly for use in your own life. For these, place an (X) in the column headed by "Value Highly".

Some Questions for You to Consider:

1. Look closely at the appliances you checked that you value highly. Could any of these be consuming amounts of energy that are too great when we are in the middle of an energy crisis? If so, which ones?

2. Why do you think that people have appliances in their homes which are really not necessary for personal health or survival?

3. Which, if any, of the appliances in your list are extremely important in terms of staying alive or healthy? Why is this the case? If ALL energy was shut off during a natural disaster, could you survive without these appliances? Why? Why not?

4. Man uses a tremendous amount of electrical energy today. Why does man depend so much on electrical energy?

5. Do you think that large amounts of electrical energy could be conserved in your home or in the community as a whole? If so, how could this be accomplished? Can you think of a plan that might work? How would you go about getting such a plan into practice?

End of Work Sheet

Evaluation: Activities which are largely values clarification activities are difficult to evaluate, even with the use of instructional objectives. Ethical considerations preclude evaluating students' values against those deemed worthy by the instructor. Therefore, students must be evaluated, instead, on the processes involved in values clarification including the students' rationales for values held or under development.

The instructor must also be aware that some students may come from homes which live a very conservative existence with respect to the consumption of electricity. If these students already have values consistent with energy conservation and act on these values, little values clarification may actually take place as a result of an activity such as this one. If this is the case, these students must not be penalized simply because they have a set of entry values consistent with a quality of life and a quality of the environment perspective.

Evaluation remains, however, an important consideration for the teacher. Referring back to the instructional objectives, evaluation suggestions follow:
1. Does the student identify appliances found in the home? Is the student able to identify those which are absolutely necessary and those that could be deleted without negatively influencing a quality of life?

2. Is the student able to identify the cultural influences which promote having an increasing number of appliances in the home, e.g., advertising?

3. Can the student communicate a rationale for his/her values concerning those appliances highly valued? Is the rationale one related to actual survival/need or is it related to a consumptive life-style? Is the student able to communicate the extent to which his/her life-style is consistent with maintaining a quality environment?

4. Is the student able to identify variables which contribute to intensive electrical consumption in the culture, e.g., electric heating, industrialization, businesses remaining open after dark, etc.?

5. To what extent does the student participate in a dialogue with classmates concerning the need for and/or the value of certain electrical appliances? Does it appear that the student's dialogue is rational and based on carefully thought out values? Or, does it appear as though the student's values are being clarified as a result of an ongoing dialogue?

6. Can students prepare a plan whereby significant amounts of electrical energy could be conserved in the home and/or in the community? Can they offer suggestions for implementing such a plan?

The instructor may wish to employ a check list for recording his/her impressions of students' reactions to the above. This check list could be in a yes-no format for some items or employ instructor-determined point values which would reflect the quality or number of responses. A number of possibilities exist for engaging in the evaluation process.

Regardless of the evaluation mechanism employed, the instructor should always look at the consequences of instruction to help determine whether the act of instruction was effective. In this manner, decisions concerning revision and/or the modification of methods can be made.
Sample Activity III - Ages 12 - Adult

Resource Management: The Commons Dilemma*

Curriculum Goals - Level II

The Conceptual Awareness Level: Issues and Values

Goal: . . . how Man's cultural activities and individual behaviors influence and/or impact on the environment. (Parts A & B)

Ages: 12 - Adult

Content Areas Possible: Science, Social Studies, Agriculture, and others.

Introduction to the Teacher: This particular activity attempts to look at the behavior of consumers of a resource in a "commons" or shared ecosystem. This is a particularly excellent example of an activity which could help facilitate an awareness of the impact of resource use on quality of life and sustainable development. In this activity, the commons - which is supposed to be an ocean and fish - is represented by a large bowl filled with peanuts (or some other edible item).

Instructional Objectives:

Upon or during completion of the activity related to a commons, students will be expected to be able to . . .

1. . . . describe what is meant by a "commons".
2. . . . describe the results associated with a "self-interest" versus a "cooperative strategy" for managing a renewable resource.
3. . . . explain how the stewardship of a resource can help prevent exceeding the carrying capacity of an ecosystem or the earth as a whole.
4. . . . discuss how this activity could relate to the concept of "sustainable development" in resource management.

Materials Needed: Two pounds of peanuts in the shell and one large container for every group of four students. (Peanuts can be substituted for by using pieces of candy or some other desirable item.)
Directions: Discuss the Ground Rules for this activity. Supply only the information needed to get the learners started. The dilemma and a discussion should come about as an outcome of the activity. Divide the students into groups of four and give each a bowl with 16 "fish" (peanuts) in it.

Ground Rules:
1. The object of this activity is for you to harvest (remove from the bowl) as many fish as possible (from the sea).
2. The carrying capacity of this ocean is sixteen (16) fish. For every four (4) fish you harvest, you will receive one (1) point. The more fish you harvest the more points you will receive.
3. When the activity begins, you may harvest all, some, or none of the fish.
4. You will have four (4) twenty-second trials in which to harvest fish. You will be notified when to start and stop each trial.
5. If fish remain in the sea after each trial, a new fish will be added for each one remaining. If there are four (4) fish left, four (4) more will be added. But for each new trial, the total number of fish cannot be more than the carrying capacity of sixteen (16) fish.

Repeat the activity with eight (8) students to a group to help demonstrate human population growth and its effect on the resource.

Discussion Questions:
1. What were the maximum number of points achieved by any individual? Group?
2. Why were some fish replaced if some remained in the bowl after each trial?
3. What happens to members of a group that do not use cooperative strategies?
4. What was the best cooperative strategy for harvesting from the commons?
5. What are some "commons" that all humans share on the planet earth?
6. How will cooperative stewardship of resources help us to resolve the commons dilemmas and prevent exceeding the carrying capacity of the environment?

* - This activity contributed for use in this document by Dr. John Ramsey of the University of Houston (Texas). It was modified slightly for use.
Sample Activity IV - Ages 12 - Adult

Environmental Issue Investigation and Evaluation: A Focus on Endangered Species

<table>
<thead>
<tr>
<th>Curriculum Goals - Level III</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Investigation and Evaluation Level</strong></td>
</tr>
<tr>
<td>Goals: Component A: all goals are potentially covered. (Parts A - F)</td>
</tr>
<tr>
<td>Ages: 12 - Adult</td>
</tr>
<tr>
<td>Content Areas Possible: Science, Social Studies, Home Economics, Agriculture, and others.</td>
</tr>
</tbody>
</table>

Introduction to the Teacher: This particular "activity" - if it should be called that - is one of the major assignments that is inferred by The Goals for Curriculum Development in Environmental Education discussed earlier in this document. It is a key assignment that follows the content learning and skill development aspects of the goals. In fact, this assignment, in the opinion of the authors, is the heart of the environmental education program because it is from the results of this assignment that citizenship action training, planning, and activity take place. The issue investigation assignment has been used in several editions with great success in a number of curricula.

Hopefully, presenting this assignment here without all of the preliminary activities will not prove a hardship for the reader. It should be remembered that this particular assignment follows a good deal of skill development in the classroom. In published curricula it precedes the citizenship action training. In fact, it is the experience that motivates most learners to want to take citizenship action.

Here the assignment is presented as one which focuses on endangered species. This was done for several reasons: (1) endangered animals are of great interest to middle and secondary school learners, (2) endangered species exist almost everywhere on the earth which makes the topic a good one for presentation here, and (3) the concept of "endangerment" is one closely allied to sustainable development, i.e., wildlife resources must be considered along with all others when development of any kind takes place.

It is important, however, to note that numerous issues associated with sustainable development could be the focus of this assignment. Included would be issues related to agriculture, forestry, land-use management, population, energy, and global warming. The topic endangered species is simply one example of many that could be focused on.
The major assignment now is an **issue investigation**. An issue investigation is a research process using scientific methods to ask (and answer) one or more questions about an endangered species or a related issue.

The issue investigation you and your instructor select will focus on an issue or issues associated with the management of animals which have been classified as endangered or ones which are, somehow, threatened. In particular, you should try to look at an endangered species issue which is somehow related to sustainable development as many of them are. Issues such as habitat loss, deforestation, large scale poaching, illegal plant removal and sales, fisheries management and the like would be candidates for such an investigation.

Of course you will need to write good research questions and develop an instrument which is designed to answer those questions. A data collection strategy would be planned involving you and your classmates. A timetable for completing the various stages of the investigation would be adopted. A data interpretation method would be devised. There is a lot to be done!

The *Model for an Endangered Species Issue Investigation* found on the next page suggests a step-by-step approach for conducting an issue investigation. The *Issue Investigation Planning Worksheet* which follows the model identifies the important decisions that must be made. You will find it to be very useful.

---

**Typically, issue awareness does not lead to behavior in the environmental dimension. This means that we must look to a new model of instruction if behavior is important. And, because all environmental behavior is somehow issue related, it appears as though issues must be the focus of instruction . . .**

Harold Hungerford and Trudi Volk, 1990

64
A Model for an
Endangered Species Issue Investigation

Step 1: Review the problems, issues, and solutions associated with endangered species. Especially important would be those issues which have an important relationship to sustainable development.

Step 2: Identify the specific endangered species issue to be the focus of the investigation.

Step 3: Identify the specific variables about which data are to be collected. Variables refer to the specific factual information, respondents' knowledge and/or perceived knowledge, and respondents' attitudes and/or behaviors which are to be measured.

Step 4: Write research questions containing the variables identified.

Step 5: Write letters for information and interview resource people (as needed).

Step 6: Develop a data collection strategy to collect data which could answer the research questions.

Step 7: Develop, pilot, and revise a survey instrument.

Step 8: Collect the data.

Step 9: Organize the data into tables, charts, and graphs.

Step 10: Interpret the findings, making conclusions, inferences, and recommendations.

Step 11: Produce a final issue investigation report. This report can be oral or written or both. In any case, it should be in the form assigned by your instructor.

The worksheet on the pages 66, 67, and 68 will help you and your classmates deal with the many decisions necessary in planning an issue investigation. When this worksheet is complete, you will have a tentative but comprehensive plan for your endangered species issue investigation.
Planning the Endangered Species Issue Investigation

1. What endangered species problem/topic has been chosen for investigation?

2. What specific issue has been selected as the focus of this investigation?

3. What are the research questions related to this issue?

4. Exactly what information will be collected by the instrument used in this investigation? That is, what are the variables of the study?

5. Is the instrument to be a . . . interview; survey; questionnaire; opinionnaire; or combination?

6. In what geographic area will the data collection take place?

7. If this is to be a questionnaire or opinionnaire . . .
   A. What is the exact population from which data are to be collected?
B. How large should the sample be in order to be representative of the population? Please explain.

C. How will you go about selecting the sample?

D. What data collection method will be used, e.g., house to house survey, telephone survey, mail survey, etc.?

8. If this is to be an opinionnaire, what are the exact beliefs and/or opinions being investigated?

9. What are the exact procedures necessary to collect data with this instrument? That is, who will collect the data? How will it be recorded? During what periods of time will it be collected?

10. How can the instrument be piloted and revised before actual data collection?
11. How can the data be recorded and organized in a data summary sheet?

12. What secondary sources of information are available, e.g., experts, agencies, periodicals, etc.?

The last word in ignorance is the man who says of an animal or plant: 'What good is it?' . . . If the biota, in the course of eons, has built something we like but do not understand, then who but a fool would discard seemingly useless parts? To keep every cog and wheel is the first precaution of intelligent tinkering.

Aldo Leopold, 1949

68
Sample Activity V - Ages 12-15

Consumer Product Need and Environmental Cost Assessment

Curriculum Goals - Level III

Investigation and Evaluation Level

Goal: ... analyze environmental issues and the associated values ... (Part B)

Ages: 12-15

Content Areas Possible: Social Studies, Home Economics, and others

Instructional Objectives:

Upon or during completion of the product need and environmental costs assessment activity, students will be expected to be able to . . .

1. . . . state six questions (criteria) which must be answered to assess the environmental impact of a product.

2. . . . state three considerations (criteria) to be made in assessing the need of a product.

3. . . . apply the criteria of product need and environmental cost to a product which he/she consumes, and give reasons for the final assessment decision.

4. . . . explain the roles of information (knowledge) and values (feelings) in determining the product need and environmental cost.

5. . . . identify, locate and utilize reliable sources in making a thorough search for information needed in the application of environmental cost criteria.

6. . . . based on his/her own product assessment, identify at least three alternative actions concerning the product for further evaluation (e.g., boycott, conservative use, substitution).

Instructions: The specific approach to be used here depends upon the context of the activities used. However, several basic guidelines may be described to make the learning experience effective. For purposes of this discussion, assume the activity is being used
in a middle school social studies class which has been involved in the study of the impact of human activity on quality of life and sustainable development.

The approach taken here is to present students with an overall concept, then model the criteria to be applied, and finally allow students to apply the criteria to a product of their own choosing. The activity might also be used in an inquiry (inductive) mode which would allow large or small groups to generate their own criteria as well as apply them to products. In the approach used here, the following student materials should be prepared and distributed. When students have interacted with the reading and activity, the materials should be discussed to prepare students to achieve objectives 3, 4, 5, and 6. Finally, students (individually or in small groups) will identify their own product for assessment and apply the criteria.

### Consumer Product Need and Environmental Cost Assessment

As consumers of services and products, we take consumer actions every day which affect our environment. Consider the following list of products. Most of these you probably use at least occasionally.

1. soft drinks (pop) in disposable cans
2. electric hair dryers
3. plastic sandwich bags
4. automobiles
5. refrigerators
6. hamburgers in disposable containers

Certainly, you could add other products to this list. Are the effects of these products on the environment negative or positive?

Actually, it is nearly impossible to classify a product as completely good or bad for the environment. Instead, a comparison must be made between the harmful effect the product has on the environment (environmental cost) and the need for the product.

### Assessing Environmental Costs of Products

Assessing the damage a product may do to the environment is not an easy task. To help in making an assessment of environmental cost, a list of questions is presented below.
Consider each of these. As an example of how the questions may be used, they are applied to the disposable pop can.

1. Is the product made from natural resources which cannot be renewed?

   FOR POP CANS: Pop cans require the use of metal in their manufacture. Since metals cannot be replaced once they are mined from the earth, the answer is definitely YES, they do require nonrenewable resources.

2. When the natural resource (or product) is taken from the environment, does it change the environment in any permanent and undesirable way (damage the environment)?

   FOR POP CANS: Metal for producing cans must be mined. Mining operations always have a measurable effect on the environment. The wastes produced by the mine may pollute waterways; the earth is often scarred permanently. Of course, there is also the matter of very large amounts of energy it takes to remove minerals from the earth.

3. If the change (damage) is not permanent and can be repaired, is it being repaired?

   FOR POP CANS: Unfortunately, much of the damage remains because repair (recovering the mined land and cleaning polluted waters) is so expensive.

4. Does the manufacture, transport, and/or storage of the product damage the environment?

   FOR POP CANS: The transport of canned pop is no more destructive to the environment than transport of bottles. However, the manufacture of pop cans causes pollution - air as well as water - and uses tremendous amounts of energy. This is especially significant, since most cans are used only once.

5. Does the use of the product damage the environment?

   FOR POP CANS: The actual "use" of the can does not.

6. Does the disposal of the product after use pose a problem for the environment?

   FOR POP CANS: This is one of the biggest problems with pop cans. Although it is economical to recycle the metals in pop cans, most are still thrown away.

   Americans consume about 400 soft drinks per person per year. Most of these come in non-returnable cans and bottles. That means that millions of cans will end up either as litter in the environment or as solid waste in a landfill or other garbage dumps.
Pop Can Assessment Summary

A summary of the pop can assessment might appear as follows:

<table>
<thead>
<tr>
<th>Question</th>
<th>Cost Assessment of Pop Cans</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>High</td>
</tr>
<tr>
<td>2</td>
<td>High</td>
</tr>
<tr>
<td>3</td>
<td>High</td>
</tr>
<tr>
<td>4</td>
<td>Very High</td>
</tr>
<tr>
<td>5</td>
<td>None</td>
</tr>
<tr>
<td>6</td>
<td>Very High</td>
</tr>
<tr>
<td>Total Assessment</td>
<td>High</td>
</tr>
</tbody>
</table>

Total Assessment Decision

The pop can represents a high cost to the environment.

Assessing Product Need

Even when an environmental cost assessment has been made for a product, a consumer decision cannot be made until the NEED for the product has been determined. Below are guidelines for assessing product NEED. After you have read and thought about them, apply these guidelines to determine your need for pop cans.

Guidelines for Assessing Product Need

1. Does the product serve a real need? A desired need, although not a real need? An imagined need?

2. Are there environmentally desirable (or at least less damaging) substitutes available? To what extent would you be willing to accept environmentally desirable substitutes, if available?

3. Do you value the benefits of the product greater than the costs to the environment?
Assessing the Need for the Pop Can: Answer each of the above questions with respect to your personal need for the pop can. Some space has been provided for your reasoning.

Question 1: Does it serve a real need? A desired need? An imagined need?

Reasoning:

Question 2: Environmentally desirable substitute available?

Identify:

Question 3: Willingness to accept substitute, if available?

Explanation:

Question 4: Do you value the benefits of the product greater than the cost to the environment?

Reasoning:

Question 5: How do your responses compare to those of your classmates? Do your responses reflect your values in any way? Your classmates? How?

Possible Actions

Identify 3 actions (behaviors) which you feel you should consider and evaluate as a result of the pop can assessment.

Applying Your Skills

Now that you have completed the product need and environmental cost assessment of pop cans, choose a product which you regularly consume (use) and apply the criteria to that product.

(Note: Student materials should include forms with stated criteria and spaces for writing out findings. Space does not permit the inclusion of a complete worksheet here).
Sample Activity VI - Ages 12 - Adult

The Two VS The Three Child Family:
Impact Over Time

Curriculum Goals - Level II

Conceptual Awareness Level

Goal: ... how individual behaviors impact on the environment. (Part B)

Ages: 12 - Adult

Content Areas Possible: Science, Social Studies, Home Economics, and Mathematics.

Instructional Objectives:

Upon completion of this activity, learners will be expected to be able to...

1. ... report accurately on their calculations of the result of each offspring from a two child family being responsible for the birth of two children each over a three generation time period.

2. ... report accurately on their calculations of the result of each offspring from a three child family being responsible for the birth of three children each over a three generation time period.

3. ... draw logical conclusions concerning quality of human life and environmental integrity when comparing a three generation two child family and a three generation three child family.

4. ... correctly infer the impact of these differing human behaviors in terms of resource use and sustainable development.

The activity: This activity is a fairly simple one but it can also be fascinating for the learners. The instructor can provide worksheets or oral instructions for this activity. Beginning with one union (male and female), the student is asked to diagram a typical family tree (the first generation after the union). Then, the student is asked to continue diagramming two more generations and calculating the resulting numbers of offspring.

Both two-child and three-child family trees are diagrammed. This allows the learner to accomplish Objectives 1, 2, and 3. Objective No. 4 will probably need some
discussion, either on a whole-class basis or in small groups. Hopefully, the impact on resource consumption will be discussed in some depth and appropriate inferences made.

A sample diagram is provided below.

The Two Child Family Across Three Generations

Extensions: Some interesting extensions can be applied to this activity. As examples:

1. What would be the results if the diagrams in this activity were taken out one additional generation?

2. How long a time period is associated with the typical generation? What ranges of years could the learners decide on. How many generations would be involved over a period of one century? What would these families look like after one century?

3. What kinds of numbers would result if one looked at four children? Five children? Six children? What would the environmental impacts be?

4. Students might be interested in researching the reproductive potential of their own families over the prior three generations. This activity should be done on a voluntary basis, however.

5. Is there a "typical" family size in the learners' own community? If so, what is it? Are there positive or negative environmental impacts resulting from this?

With population, it may take half a century or more to turn growth around. If there is good evidence that we are already too big, even immediate action may not be fast enough to achieve the optimum for generations to come, and delay compounds the problems and worsens the choices. . . . human impacts on the environment have grown to the point where they may even exceed natural processes. This awesome power imposes corresponding responsibilities.

Lindsey Grant, 1992
BIBLIOGRAPHY

Theory/Philosophy/Methods/Background


Curricular Programs and Related Publications


Outdoor biology instructional strategies (OBIS). Nashua, NH: Delta Education.


79

SCIS: Life science sequence (Grades 1-6). (1978). Nashua, NH: Delta Education.


Environmental Science/Issues/Sustainable Development


Ecology: Interrelationships in nature. (1976). Chicago, IL: Society for Visual Education. A series of eight sound filmstrips with the following titles:

(1) Organisms Living Together in Communities
(2) Community Food Energy Flow
(3) Hardwood Forest Community Structure
(4) Grassland Community Interaction
(5) Desert Ecosystem
(6) Swamp Survival Ecosystem
(7) Seashore: Interaction of Two Communities
(8) Man Made Communities

Environmental issues series. (1979). Chico, CA: Projected Learning Programs. A series of five sound filmstrips with the following titles:
(1) Environmental Issues: A Question of Values
(2) Energy Alternatives: Sources and Lifestyles
(3) Strip Mining Coal: A Classic Environmental Issue
(4) Land Use Issues: Serious Problems with Difficult solutions
(5) The Problem of Coastal Zone Management: A Lake Michigan Case Study


*Curriculum Development, Implementation, and Evaluation*


<table>
<thead>
<tr>
<th>N°</th>
<th>Title</th>
<th>Language</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Trends in EE since the Tbilisi Conference</td>
<td>A, E, F, S</td>
<td>1983</td>
</tr>
<tr>
<td>2</td>
<td>Guide on Gaming and Simulation for EE</td>
<td>A, E, F, S</td>
<td>1983</td>
</tr>
<tr>
<td>3</td>
<td>Education Module on Conservation and Management of Natural Resources</td>
<td>E, F, S</td>
<td>1983</td>
</tr>
<tr>
<td>4</td>
<td>Educational Module on Environmental Problems in Cities</td>
<td>E, S</td>
<td>1983</td>
</tr>
<tr>
<td>5</td>
<td>EE Module for Pre-Service Training for Teachers and Supervisors for Primary Schools</td>
<td>A, E, F, S</td>
<td>1983</td>
</tr>
<tr>
<td>6</td>
<td>EE Module for In-Service Training of Teachers and Supervisors for Primary Schools</td>
<td>A, E, S</td>
<td>1985</td>
</tr>
<tr>
<td>7</td>
<td>EE Module for Pre-Service Training of Science Teachers and Supervisors for Secondary Schools</td>
<td>A, E, F, S</td>
<td>1983</td>
</tr>
<tr>
<td>8</td>
<td>EE Module for In-Service Training of Science Teachers and Supervisors for Secondary Schools</td>
<td>E, S</td>
<td>1983</td>
</tr>
<tr>
<td>9</td>
<td>EE Module for Pre-Service Training of Social Science Teachers and Supervisors for Secondary Schools</td>
<td>A, E, F, S</td>
<td>1985</td>
</tr>
<tr>
<td>10</td>
<td>EE Module for In-Service Training of Social Science Teachers and Supervisors for Secondary Schools</td>
<td>E, S</td>
<td>1985</td>
</tr>
<tr>
<td>11</td>
<td>Energy: an Interdisciplinary Theme for EE</td>
<td>E, F, S</td>
<td>1985</td>
</tr>
<tr>
<td>12</td>
<td>Guide on EE Evaluation at School</td>
<td>E</td>
<td>1985</td>
</tr>
<tr>
<td>13</td>
<td>Guide on EE Values Teaching</td>
<td>E</td>
<td>1985</td>
</tr>
<tr>
<td>14</td>
<td>Interdisciplinary Approaches to EE</td>
<td>E, F</td>
<td>1985</td>
</tr>
<tr>
<td>15</td>
<td>A Problem-Solving Approach to EE</td>
<td>E, F</td>
<td>1985</td>
</tr>
<tr>
<td>16</td>
<td>Module éducatif sur la désertification</td>
<td>F, S</td>
<td>1985</td>
</tr>
<tr>
<td>17</td>
<td>A Comparative Survey of the Incorporation of EE in School Curricula</td>
<td>A, E</td>
<td>1985</td>
</tr>
<tr>
<td>18</td>
<td>The Balance of &quot;Lifekind&quot;: an Introduction to the Human Environment</td>
<td>A, E</td>
<td>1985</td>
</tr>
<tr>
<td>19</td>
<td>Pedagogical and Scientific Criteria for Defining Environmental Content of General University Education</td>
<td>E, R</td>
<td>1993</td>
</tr>
<tr>
<td>20</td>
<td>L'Éducation relative à l'environnement : principes d'enseignement et d'apprentissage</td>
<td>F</td>
<td>1985</td>
</tr>
<tr>
<td>21</td>
<td>EE Activities for Primary Schools</td>
<td>A, E</td>
<td>1992</td>
</tr>
<tr>
<td>22</td>
<td>Procedures for Developing an EE Curriculum – A Discussion Guide (Revised)</td>
<td>E, F</td>
<td>1994</td>
</tr>
<tr>
<td>23</td>
<td>Guidelines for Developing Non-formal EE</td>
<td>E, F</td>
<td>1986</td>
</tr>
<tr>
<td>24</td>
<td>EE in Technical and Vocational Education</td>
<td>A, E, F, S</td>
<td>1986</td>
</tr>
<tr>
<td>25</td>
<td>Strategies for the Training of Teachers in EE – A Discussion Guide (Revised)</td>
<td>E</td>
<td>1994</td>
</tr>
<tr>
<td>26</td>
<td>EE: A Process for Pre-Service Teacher Training Curriculum Development</td>
<td>A, E</td>
<td>1988</td>
</tr>
<tr>
<td>27</td>
<td>An EE Approach to the Training of Elementary Teachers: a Teacher Education Programme (Revised)</td>
<td>A, E, S</td>
<td>1994</td>
</tr>
<tr>
<td>28</td>
<td>EE in Vocational Agriculture Curriculum and Agriculture Teacher Education in Michigan, U.S.A., A Case-Study</td>
<td>E</td>
<td>1994</td>
</tr>
<tr>
<td>29</td>
<td>A Prototype EE Curriculum for the Middle School – A Discussion Guide (Revised)</td>
<td>A, E</td>
<td>1994</td>
</tr>
<tr>
<td>30</td>
<td>An EE Approach to the Training of Middle Level Teachers: a Prototype (Revised)</td>
<td>A, E</td>
<td>1994</td>
</tr>
<tr>
<td>31</td>
<td>EE Training Guide for Technical and Vocational Education Teachers (Revised)</td>
<td>E</td>
<td>1993</td>
</tr>
<tr>
<td>32</td>
<td>EE Curriculum for Industrial Schools (Revised)</td>
<td>E</td>
<td>1993</td>
</tr>
<tr>
<td>33</td>
<td>EE Curriculum for Pre-Service Teacher Training in Industrial Schools (Revised)</td>
<td>E</td>
<td>1993</td>
</tr>
<tr>
<td>34</td>
<td>EE Curriculum for Agricultural Schools (Revised)</td>
<td>E</td>
<td>1993</td>
</tr>
<tr>
<td>35</td>
<td>EE Curriculum for Pre-Service Teacher Training in Agricultural Schools (Revised)</td>
<td>E</td>
<td>1993</td>
</tr>
<tr>
<td>36</td>
<td>EE: Curriculum Guide for Pre-Service Teacher Education in the Caribbean</td>
<td>E</td>
<td>1994</td>
</tr>
<tr>
<td>37</td>
<td>EE: Curriculum Guide for Primary and Lower Secondary Grades in the Caribbean</td>
<td>E</td>
<td>1994</td>
</tr>
<tr>
<td>40</td>
<td>An EE Dimension of Curriculum for Primary School in the ASEAN Region</td>
<td>E</td>
<td>1994</td>
</tr>
<tr>
<td>41</td>
<td>An EE Dimension of Curriculum for Pre-Service Training of Primary School Teachers in the ASEAN Region</td>
<td>E</td>
<td>1994</td>
</tr>
<tr>
<td>42</td>
<td>An EE Dimension of Curriculum for Secondary School in the ASEAN Region</td>
<td>E</td>
<td>1994</td>
</tr>
<tr>
<td>43</td>
<td>An EE Dimension of Curriculum for Pre-Service Training of Secondary School Teachers in the ASEAN Region</td>
<td>E</td>
<td>1994</td>
</tr>
<tr>
<td>44</td>
<td>An EE Dimension of Curriculum for Secondary School in the Arab States</td>
<td>E</td>
<td>1994</td>
</tr>
<tr>
<td>45</td>
<td>An EE Dimension of Curriculum for Pre-Service Training of Secondary School Teachers in the Arab States</td>
<td>E</td>
<td>1994</td>
</tr>
<tr>
<td>46</td>
<td>An EE Dimension of Curriculum for Secondary School in Africa</td>
<td>E</td>
<td>1994</td>
</tr>
<tr>
<td>47</td>
<td>An EE Dimension of Curriculum for Pre-Service Training of School Teachers in Africa</td>
<td>E</td>
<td>1994</td>
</tr>
<tr>
<td>48</td>
<td>Module sur l'Éducation relative à l'environnement et le développement durable</td>
<td>F</td>
<td>1994</td>
</tr>
</tbody>
</table>