DOCUMENT RESUME

ED 187 568 SE 030 970

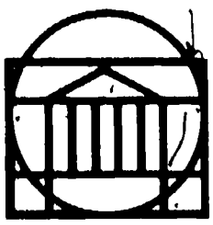
AUTHOR Warfield, John N.
TITLE Development of an Interpretive Structural Model and Strategies for Implementation Based on a Descriptive and Prescriptive Analysis of Resources for Environmental Education/Studies. A Sourcebook for the Design of a Regional Environmental Learning System, Volume II: You Create a Design.
INSTITUTION Virginia Univ., Charlottesville. School of Engineering and Applied Science.
SPONS AGENCY Office of Education (DHEW), Washington, D.C. Office of Environmental Education.
REPORT NO UVA/522032/EE79/125
PUB DATE 31 Aug 79
CONTRACT 300-700-4028
NOTE 82p.; For related documents, see SE 030 969-974 and ED 173 172.

EDRS PRICE MF01/PC04 Plus Postage.
DESCRIPTORS Change Strategies; *Curriculum Development; Educational Assessment; Educational Needs; Educational Planning; Educational Research; *Elementary Secondary Education; *Environmental Education; Models; *Nonformal Education; Planning; *Postsecondary Education; *Program Development; Science Education

ABSTRACT

Discussed in this volume is the development of a design for a Regional Environmental Learning System. This design begins with the generation of options from which later design changes will be made. Topics covered include: (1) mission for environmental education; (2) political perspectives for design; (3) the task of conceptual design; and (4) considerations of the Environmental Education Act. An appendix of methods is included. (RE)

RESEARCH LABORATORIES FOR THE ENGINEERING SCIENCES



SCHOOL OF ENGINEERING AND APPLIED SCIENCE

UNIVERSITY OF VIRGINIA

Charlottesville, Virginia 22901

DEVELOPMENT OF AN INTERPRETIVE STRUCTURAL MODEL AND STRATEGIES FOR IMPLEMENTATION BASED ON DESCRIPTIVE AND PRESCRIPTIVE ANALYSIS OF RESOURCES FOR ENVIRONMENTAL EDUCATION/STUDIES

VOLUME II
YOU CREATE A DESIGN

Submitted to:

Office of Environmental Educaton
Department of Health, Education and Welfare
400 Maryland Avenue, S.W.
FOB #6, Room 2025
Washington, D. C. 20202

Submitted by:

John N. Warfield

Report No. UVA/522032/EE79/125

August 1979

RESEARCH LABORATORIES FOR THE ENGINEERING SCIENCES

Members of the faculty who teach at the undergraduate and graduate levels and a number of professional engineers and scientists whose primary activity is research generate and conduct the investigations that make up the school's research program. The School of Engineering and Applied Science of the University of Virginia believes that research goes hand in hand with teaching. Early in the development of its graduate training program, the School recognized that men and women engaged in research should be as free as possible of the administrative duties involved in sponsored research. In 1959, therefore, the Research Laboratories for the Engineering Sciences (RLES) was established and assigned the administrative responsibility for such research within the School.

The director of RLES—himself a faculty member and researcher—maintains familiarity with the support requirements of the research under way. He is aided by an Academic Advisory Committee made up of a faculty representative from each academic department of the School. This Committee serves to inform RLES of the needs and perspectives of the research program.

In addition to administrative support, RLES is charged with providing certain technical assistance. Because it is not practical for each department to become self-sufficient in all phases of the supporting technology essential to present-day research, RLES makes services available through the following support groups: Machine Shop, Instrumentation, Facilities Services, Publications (including photographic facilities), and Computer Terminal Maintenance.

DEVELOPMENT OF AN INTERPRETIVE STRUCTURAL MODEL AND STRATEGIES FOR IMPLEMENTATION BASED ON A DESCRIPTIVE AND PRESCRIPTIVE ANALYSIS OF RESOURCES FOR ENVIRONMENTAL EDUCATION/STUDIES

A SOURCEBOOK FOR THE DESIGN OF A REGIONAL ENVIRONMENTAL LEARNING SYSTEM.

VOLUME II

YOU CREATE A DESIGN

Contract No. 300-700-4028

Work Supported Under the
Environmental Education Act of 1970
P. L. No. 91-516,
P. L. No. 93-278 and P. L. No. 95-482, as amended

Submitted to:

Office of Environmental Education
Department of Health, Education and Welfare
400 Maryland Avenue, S.W.
FOB #6, Room 2025
Washington, D. C. 20202

Submitted by:

John N. Warfield

Department of Electrical Engineering
RESEARCH LABORATORIES FOR THE ENGINEERING SCIENCES
SCHOOL OF ENGINEERING AND APPLIED SCIENCE
UNIVERSITY OF VIRGINIA
CHARLOTTESVILLE, VIRGINIA

Report No. UVA/522032/EE79/125

August 31, 1979

Copy No. 11

A SOURCEBOOK FOR THE DESIGN OF A REGIONAL ENVIRONMENTAL LEARNING SYSTEM

VOLUME 2

YOU CREATE A DESIGN

A SOURCEBOOK FOR THE DESIGN OF A REGIONAL ENVIRONMENTAL LEARNING SYSTEM

VOLUME 2

YOU CREATE A DESIGN

TABLE OF CONTENTS

A SOURCEBOOK FOR THE DESIGN OF A REGIONAL ENVIRONMENTAL LEARNING SYSTEM
VOLUME 2: YOU CREATE A DESIGN

PREFACE

This is one of six Volumes of a report which, collectively, is intended to be a Sourcebook for the Design of a Regional Environmental Learning System. The report was prepared under Contract 300-700-4028 with the Office of Environmental Education.

This six-volume report presumes some background concerning the concept of a Regional Environmental Learning System, and with environmental education as a whole. Considerable relevant background was supplied in Volume 9 of the 4th Quarterly Report (A Descriptive Analysis of Environmental Education) and in the 5th Quarterly Report (Conceptual Basis for the Design of Regional Environmental Learning Systems), both of which are available from the Office of Environmental Education.

Volume 1 contains an Overview of the Sourcebook, with short summaries of the other Volumes.

A SOURCEBOOK FOR THE DESIGN OF A REGIONAL ENVIRONMENTAL LEARNING SYSTEM

VOLUME 2: YOU CREATE A DESIGN

EXECUTIVE SUMMARY

Environmental education can be perceived as contributing to three great purposes of education, with emphasis upon qualifying the learner to contribute to the civilization of the future. Against this perspective, the special mission of environmental education can be stated in capsule form: "environmental education should equip the learner with a knowledge of how to analyze interactions among the major conponents of the total human environment, to the end that the learner becomes able to contribute to the civilization of the future through informed decision-making relevant to the environment of the future."

An elaborated mission statement presents in a one-page graphic a set of outcomes desired from environmental education, and a way of interpreting how these outcomes are interrelated.

The mission statements provide a basis for proceeding toward a design of a Regional Environmental Learning System (RELS). The design begins with the generation of options from which design selections will later be made. Next the options are sorted into categories. These are examined to determine whether they are necessary in system design. If they are deemed necessary, they are designated as systems dimensions, otherwise they are discarded.

A one-page drawing is prepared showing the options, grouped into system dimensions, and a tie line to be used in formalizing and portraying design decisions. This drawing is called an options field. The ten dimensions of the options field are shown and the options under these dimensions are discussed.

The process of choosing options is broken up into three steps to make the work of the design group easier. A skilled facilitator is needed to help the group work through these steps. In the first step the interdependence of dimensions is structured. In the second step the group decides in what sequence the dimensions will be addressed in choosing design options, using the information stemming

from the first step. At the conclusion of these two steps, the design group has a good understanding of the options, their interrelations, and the priority with which the dimensions will be addressed in choosing options. The third and last of the three steps involves selecting options in each of the dimensions according to the priority sequence developed in the second step.

As choices are made in the third step, the selected options are tied to the "tie line" by means of a line, to show what has been selected at any given point in the design process, and to show the total design concept at the conclusion of the process. The collection of lines showing the design choices makes up the options profile for the system design.

Subsystems who contribute to the total system effort can also construct options profiles for their subsystem, and a visual overlay of transparencies of options profiles can be used to show the composite of the subsystem profiles, which combine to form the system profile.

The design methods are related to various kinds of projects identified in the Environmental Education Act. The specific types mentioned in the Act include research projects, demonstration projects, pilot projects, and evaluation projects.

A RELS may be a comprehensive project in that it involves a substantial scope within the region, and also in that it may or may not include parts of the four project types mentioned. On the other hand a RELS may be a comprehensive pilot project, or it may be a comprehensive demonstration project, depending upon local situations and project aims.

A RELS may embrace all of the kinds of activities mentioned in the Environmental Education Act, but it need not conduct all such kinds. Rather it must provide focus and direction.

Evaluation that cannot address the content of environmental education is not meeting the ultimate goals of environmental education. Thus other types of evaluation should stress benefits that justify support.

CHAPTER 1

A MISSION FOR ENVIRONMENTAL EDUCATION

Environmental education can scarcely advance beyond early development levels, unless it can be perceived in relation to the whole of education. If it can be seen in relation to the whole, then questions of how to integrate it, how to resolve role assignments or career directions, how to relate subject matter, how to balance the allocation of resources across various objectives, all can be dealt with through modest changes in the prevailing frameworks of education. If it cannot be seen in relation to the whole, all such questions present roadblocks to the advance of environmental education.

But we cannot perceive environmental education in relation to the whole of education, unless we have some perception of that whole. And such a perception of the whole must be operational to our thinking.

Let us, therefore, perceive the whole of education from the standpoint of three great purposes. These may be stated as follows:

- To put the learner in possession of the cultural inheritance
- To enable the learner to participate in the contemporary world
- To qualify the learner to contribute to the civilization of the future

We may view each of these three great purposes of education as overarching the whole of educational experience, in the sense that they span the past, the present, and the future. Within this framework, no discipline can claim sole jurisdiction. The routes toward achievement of these purposes are varied. The emphases differ from discipline to discipline. The elaboration of these purposes into the vast realms of human knowledge has produced the educational systems that we have today.

In our systems, knowledge is carved up like a chicken. Here one finds a back, there a gizzard, elsewhere a thigh, and a neck. Nowhere, it seems, is the chicken a major concern.

We need look no farther than our most renowned institutions of higher education to find the dilemma manifested. In the past few years we have observed faculties at these institutions grappling with the difficulty of trying to define what constitutes an acceptable program of study for a liberal arts degree or for a business degree.

The student faces an overwhelming array of college courses and disciplines, from which the student is supposed to be able implicitly to construct a satisfactory program. In considering a revision of the curriculum in the liberal arts, Harvard University planners recognized that there had evolved a monstrous array from which the student was able to elect a pot pourri of courses enroute to a degree, and that the capacity of the students to synthesize respectable education programs from such an array is severely limited. The Harvard response was to restructure degree requirements to move toward a program where one could anticipate that students getting degrees would have some knowledge that one might expect from educated persons. In commenting on the wisdom of this move, a University of Chicago dean remarked that he never asks the students to do what the faculty cannot.

More recently, in his Annual Report, President Bok of Harvard stressed the narrowness of education in the School of Business, and the need to broaden the curriculum to prepare leaders to cope with factors in the business environment.

We conclude from evidence of the type just mentioned that it is possible to do better in relation to the second and third purposes, and that there is recognition of this. But is there adequate recognition of what needs to be done to achieve the second and third purposes?

In our view these two purposes differ <u>only</u> in terms of their respective time scales. For a capacity to participate in the contemporary world <u>ought</u> to imply informed participation, and certainly contribution to the civilization of the future ought to imply the same thing.

How are we to understand what is meant by the third great purpose "to qualify the learner to contribute to the civilization of the future?" Does it mean to subject the person to a study of parts of

the chicken, assuming thereby that at some point in life a miraculous capacity will suddenly appear that enables the person to understand the whole chicken? If this is true, why do we educate at all? Why not just wait for that power to appear, whereupon it can be applied to any whole, including the whole chicken gizzard?

We have been advised by the philosopher, Alfred North Whitehead, that we can never fully understand anything. Some part of the knowledge is always denied us because we are finite humans. But this truth was not offered as a reason to avoid the effort to comprehend how the fragments of our world relate to each other. Rather it serves to alert us to the difficulty of such an endeavor, and should suggest to us that studies aimed specifically at understanding interactions should become a part of our qualification to participate in contemporary society as well as to contribute to the civilization of the future.

If we do not doubt the three purposes, we may nonetheless suspect that, lacking the capacity to integrate, to see interrelationships adequately, we will forever lack the balanced emphasis in education that carries these three purposes as far as possible within available resources and human limitations. Thus there will always be room for improvement, for adjustment of emphasis. And if, in education, we can make advances in our understanding of complexes of things, how these complexes function as wholes, how their parts influence the wholes, and thereby how we, as individuals can "contribute to the civilization of the future" by the decisions we make as we "participate in the contemporary world", then we can say that we are preparing people to be citizens, in the full sense of the responsibility implied by that term.

While we cannot go back and explore in detail the reasoning of the Congress when the Environmental Education Act of 1970 was passed, it is not a great leap from the wording of the Act to the conclusion that the Congress had in mind something like what we have been saying in the preceding paragraphs. The emphasis on relationships, on a "process dealing with...relationship", on "relation...to the total human environment", all point toward development of a functional grasp of the whole as opposed to fragmented consideration of the parts.

Thus any elaboration on the Act, or any statement of mission for

environmental education, can be informed by and tested against the ideas we have set forth here.

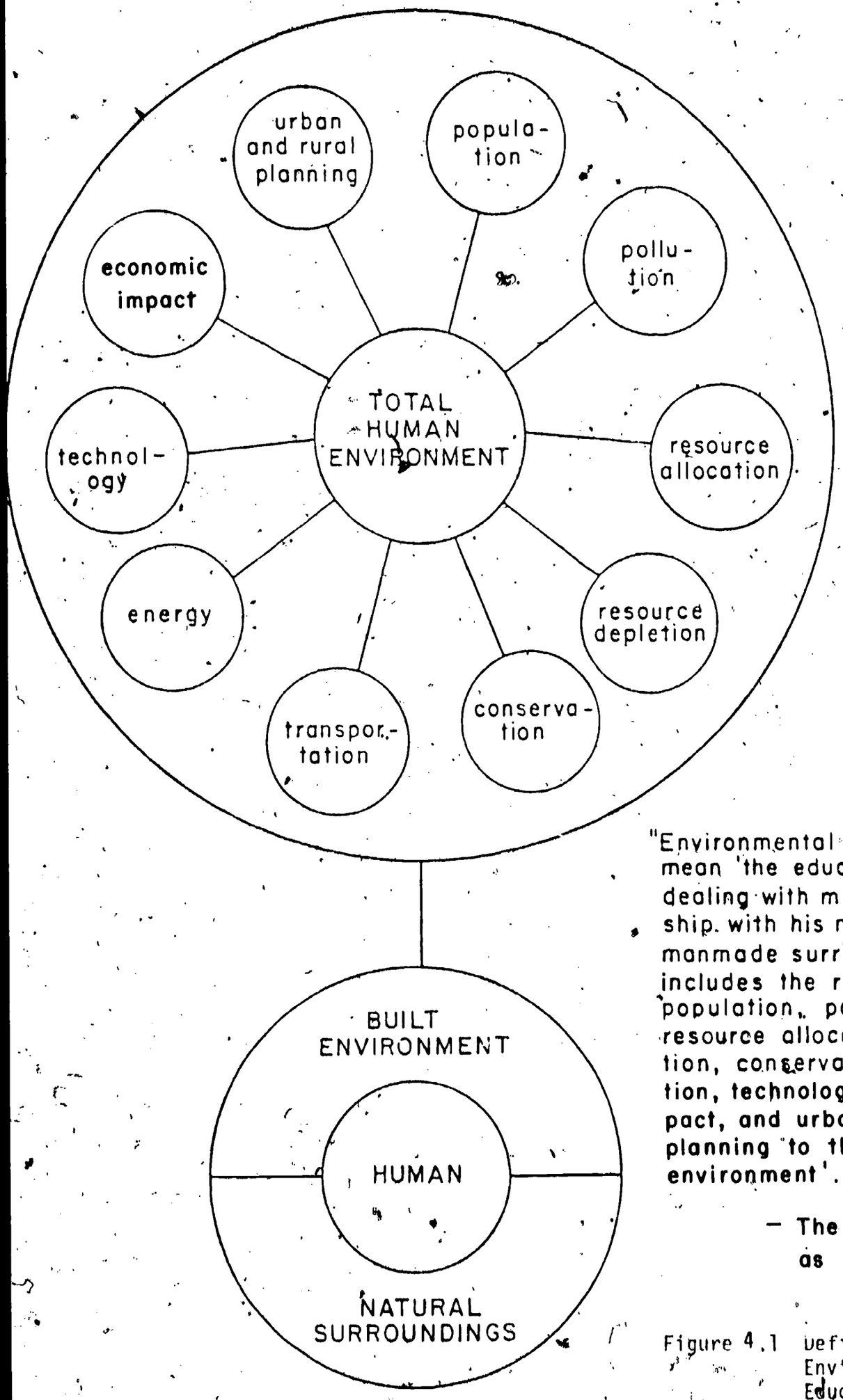
Figure 1.1 illustrates in prose and in graphics two of the five definitions of environmental education that we presented and discussed in Chapter 4 of Volume 1 of this Sourcebook. As we proceed toward an operational statement of mission for environmental education, we keep this definition in mind.

Also we recognize the need for a capsule mission statement and an elaborated mission statement. The capsule mission statement is brief and general. The elaborated mission statement is more specific.

The elaborated mission statement should relate to the three great purposes of education. It should exemplify the kind of understanding of relationships and interdependence that it recommends. And it should provide a basis for the planning and design of environmental learning systems.

A CAPSULE MISSION STATEMENT

Environmental education should equip the learner with a knowledge of how to analyze interactions among the major components of the total human environment, to the end that the learner becomes able to contribute both to present civilization and to the civilization of the future through informed, future-oriented, decision-making.



"Environmental education shall mean 'the educational process dealing with man's relationship with his natural and manmade surroundings, and includes the relation of population, pollution, energy, resource allocation and depletion, conservation, transportation, technology, economic impact, and urban and rural planning to the total human environment'."

– The EE Act of 1970, as amended.

Figure 4.1 Definitions of Environmental Education

THE LARGE MISSION STATEMENT

The Large Mission Statement is shown in Figure 1.2. Since the format of this statement may be unfamiliar to the reader, we will explain how to read this statement.

To read this statement, you need to understand the following:

- That each individual phrase in Figure 1.2 represents a desired learning outcome, an objective for environmental education.
- That the structure is intended to show how the attainment of one learning objective should help achieve the attainment of another learning objective
- That a box that contains more than one learning objective is called a cycle
- How to read a cycle
- What is meant by a walk on the structure
- That a walk corresponds to one or more sentences
- How to read the sentences that are represented by a walk on the structure

Let us begin by learning how to read a cycle.

Reading a Cycle

To any pair of objectives that appear in a cycle, there correspond two sentences. One sentence asserts that achievement of one of the objectives should help achieve the other, and the other sentence asserts that the converse is also true. For example, in the bottom cycle containing three elements, two of the sentences would read as follows:

> "If the learner can analyze complex systems, this should help the learner achieve the capacity to synthesize concepts from many different disciplines"

and

> "If the learner can synthesize concepts from many different disciplines, this should help the learner achieve the capacity to analyze complex systems"

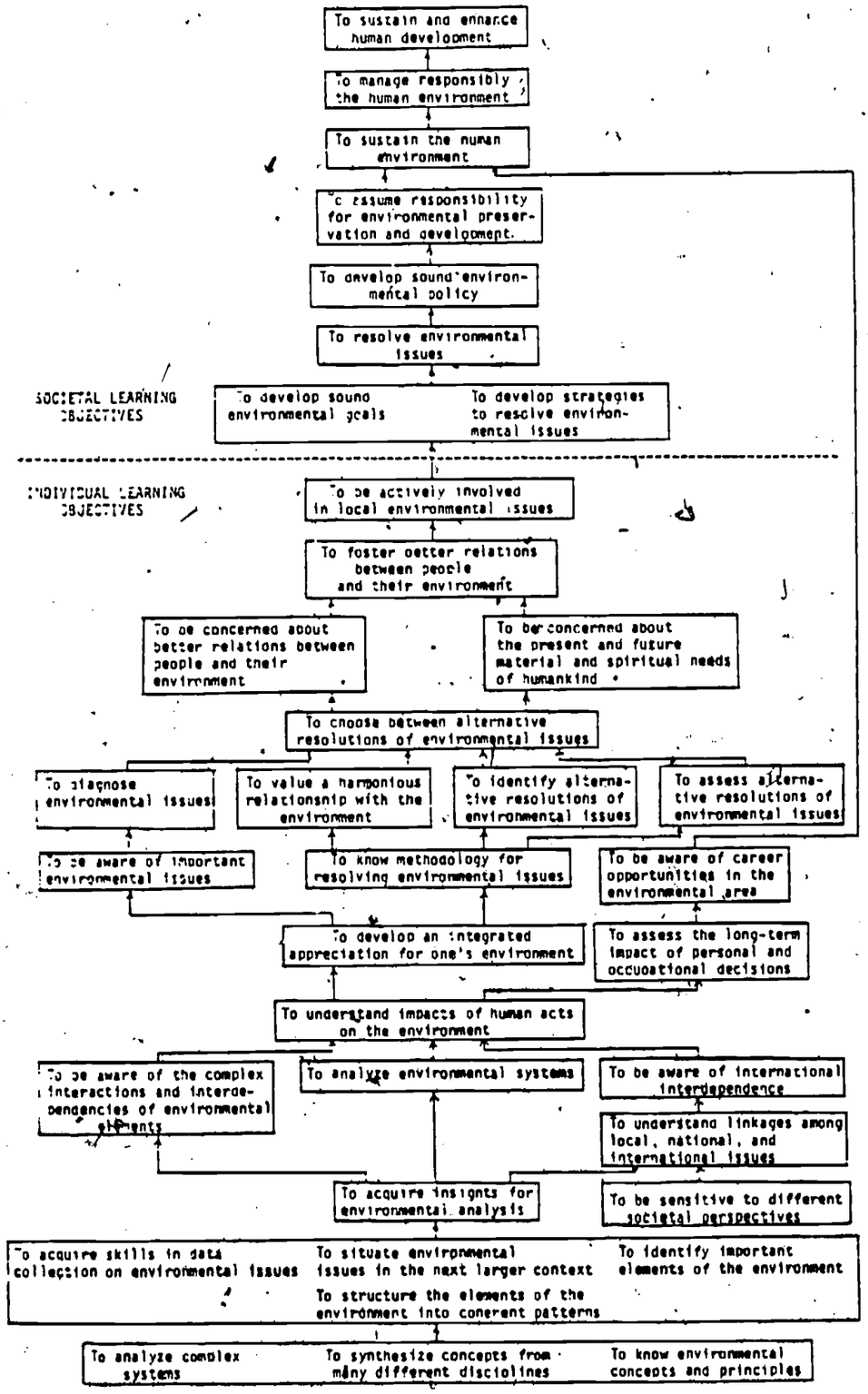


Figure 1.2 A Mission Statement for Environmental Education (An Intent Structure)

A Walk on the Structure

Suppose that the structure shown in Figure 1.2 is enlarged and is on the floor. Suppose that you are standing on top of one of the boxes. If you then walk from one box A to a second box B, following the arrows, you are taking a walk on the structure. Every walk generates information. Specifically, if you walk from A to B, you can imagine that you are generating one or more sentences (depending on how many elements are contained in boxes A and B). Each sentence will have a form like those we discussed with respect to the bottom cycle. There will be one sentence linking any phrase in box A to any phrase in box B. For example, in walking from the very bottom of Figure 1.2 to the very top, one of the sentences you generate is:

> "If the learner can know environmental concepts and principles, this should help the learner achieve the capacity to sustain and enhance human development"

Two more such sentences correspond to this same walk, because the bottom box in Figure 1.2 is a cycle with three learning outcomes.

Sentences on the Structure

While you will probably not want to bother to count the number of sentences on the structure of Figure 1.2, if you did you would find that you can generate 582 sentences in the manner we described above. This would fill up about ten pages of double-spaced text. So you can see that there is a considerable advantage to presenting the material in the format shown. At the same time, you should not expect to be able to read such a condensed page in the same time as you would read a single page. Instead the reading time to read the whole structure should be about the same time as it would take to read ten pages.

As you study the mission, perhaps you will be struck by the ambitious nature of it, as well as by the difficulty of achieving it. It is our belief that the challenge of this mission has to be met, if it is to be met, by collective effort. We believe that it is necessary to use an organized approach to achieving it. We believe that it is necessary to begin to divide up the effort, knowingly and thoughtfully, in order to make inroads on this mission. That is why, in Volume 1, we set forth approaches and a strategy aimed at moving ahead.

As we mentioned in Volume 1, we believe that learning about environmental issues with a regional focus is one good way to try to move ahead. We also believe that the mission requires attention to the design of learning systems involving a division of labor, coordinated to work toward the achievement of the mission.

We do not see any viable approach to this other than generation of local initiative, and we believe that this should begin with the design of the Regional Environmental Learning System, or RELS. This offers a way to move ahead with a comprehensive project aimed at working toward the achievement of the mission.

That is why, in this Volume, we offer one approach to carrying out a collective design effort. And in later Volumes, we offer an approach to implementing such a system.

CHAPTER 2

A POLITICAL PERSPECTIVE ON DESIGN

Before we proceed to discuss a methodology for the conceptual design of a Regional Environmental Learning System, we want to share a political perspective on such design. Our purpose is to establish a context from which we perceive design taking place. It is inevitable that part of this context will be drawn from the past. More specifically, the context will involve tensions that have been apparent throughout the history of the Office of Environmental Education, and in several documented discussions concerning the Environmental Education Act of 1970 and its amendments.

We hope to use this discussion of a political perspective to bring the environmental education community into a more cohesive posture toward environmental education. It is hard to see how this can be done without formal recognition of the tensions. It seems to us that some of the problems that beset environmental education can be put into analogy with alcoholism. They can't be cured without admission that they exist, and then they can be cured only if there is a strong and unflinching desire to cure them.

CESISEE

In the beginning, it is important to find a way to express the dominant feature of our discussion. We have chosen the coined word "Cesisee", which can perhaps be remembered as being something like "sesame seed".

This word is intended to reflect the combination of the following:

- The complexity of the educational system*
- The complexity of environmental issues
- The complexity of environmental education

* Complexity of the educational system, complexity of environmental issues, and the complexity of environmental education.

As we see it, one of the strong tendencies in response to Cesisee is to fragment. Administration is fragmented, issues are dealt with outside the formal system of education, education itself is fragmented by disciplines, and integration is left to the untutored individual.

In our judgment, fragmentation is not an enemy to be eliminated, but rather a natural phenomenon that can be expected to coexist with holistic environmental education. What is the enemy is Cesisee itself, not its manifestations. Thus prescriptions for environmental education need not discuss how to eliminate fragmentation. However we may discuss ways to take advantage of fragmentation in building environmental education.

On the other hand, certain aspects of fragmentation have to be singled out as potentially destructive. Remember it is not fragmentation as a whole that is bad, but that does not mean that it does not involve some undesirable features.

SPAMTU

We identify three undesirable aspects of fragmentation that collectively are referred to as "Spamtu". This can perhaps be remembered by associating it with "Spam to you".

The three major ingredients of Spamtu are:

- o The politics of selfishness
- o Poor administration of the EE Act
- o Turf

The politics of selfishness has been described in a series of three articles in the Washington Monthly by Gans, North, and Peters, respectively [1-3]. It is documented that the percentage of eligible Americans who vote in presidential elections has been declining substantially, and that this has coincided with a decline in the influence of the political parties.

The parties which, in the past, "provided electoral order, trained political leaders, honed the lines of political debate, created a healthy competitive partisanship, and offered the only

possible means of translating political promise into legislative and executive action" [2] are being outrun by Political Action Committees [3]. Established through election law changes in the early 1970's, the PAC's have become an increasingly significant force for what has been called the "politics of selfishness". Becoming known as "one-issue groups", the PAC's threaten to turn the United States into a "committee of lobbies".

This development is directly counter to the concepts of environmental education as set forth in Volume 1. As Ralph Barton Perry, a wise philosopher of education, remarked: "democracy is that form of social organization which most depends on personal character and moral autonomy...the cultivation and firm implanting of enlightened good will in the body of its citizens is, then, the fundamental task of education for citizenship in a democracy."[4].

Enlightened good will means, to the citizen, a knowledge of the issues facing the society, and the capability of comprehending how these issues are interrelated and intertwined. It means the capacity to analyze and resolve these issues through synthesis of ideas, to arrive at positions that promote the general welfare of the society when it is clearly in conflict with postures of individual pressure groups.[5]

The poor administration of the EE Act, especially in its early years, has been partly documented. The Congress held a series of hearings on this Act before it was passed. Thirteen days of hearings are well documented in [6]. The variety of viewpoints represented is notable. Anyone interested in the EE Act would find this documentation interesting and informative. Yet almost as soon as the Act was passed, poor administration began to be evident.

One might mention first that the authorization for the Office of Environmental Education (OEE) for its first year was $5,000,000, but the first appropriation was just $2,000,000, so that there was a considerable discrepancy between what was authorized and what was appropriated. This situation was to continue indefinitely;

Then, in exercising its oversight function, Congress held hearings to see how the executive branch went about administering the Act. Efforts to exercise initial oversight are described in fascinating

detail in [7]. Introducing the efforts, it was stated that:

> "Almost one year after the EE Act was passed Congress within three weeks held three sets of oversight hearings into the way the law was being carried out."

In these hearings it was clearly established that the executive branch had been "dragging its feet" in moving ahead to do what the Act set forth. Evidently there was considerable role confusion involved. The executive branch apparently did not see its role as one of administering the law, but rather as one of eliminating it. This view is reinforced by testimony offered in the House of Representatives Report No. 93-402, reflecting administrative opposition to the continuation of the OEE.

Official administration opposition took many forms, but one was to argue that environmental education was being carried out at a much higher level than was authorized in the Act, and this made the Act unnecessary and the OEE superfluous.

The minority report set forth in Report No. 93-402 misrepresented the purpose of the Act so badly as to reflect a blatant distortion of its purposes. The single purpose of the Act, as described in the minority report, had little in common with the eight specific purposes identified in the 4-page Act.

Figure 2.1 shows a comparison of the funding requested by grant applicants during the first six years of the existence of OEE with the funds appropriated. The huge discrepancy between requests and appropriations was bound to drive a large wedge between the OEE and those persons in the society who sought to carry out projects under the grant program set up by the Act.

Figure 2.2 shows a comparison of the authorizations and appropriations for the OEE over a period of several years. Again the discrepancy between authorization and appropriation is notable.

The Office was demonstrably understaffed throughout the period, and was hampered by being moved around in the bureaucracy. [During our own contract work, the OEE has lacked a secretary for most of the time, even though it is supposed to be communicating with substantial numbers of people.]

Figure 2.1

FUNDING OF THE ENVIRONMENTAL EDUCATION ACT OF 1970 (P.L. 91-516, amended by P.L. 93-278 and P.L. 95-482)

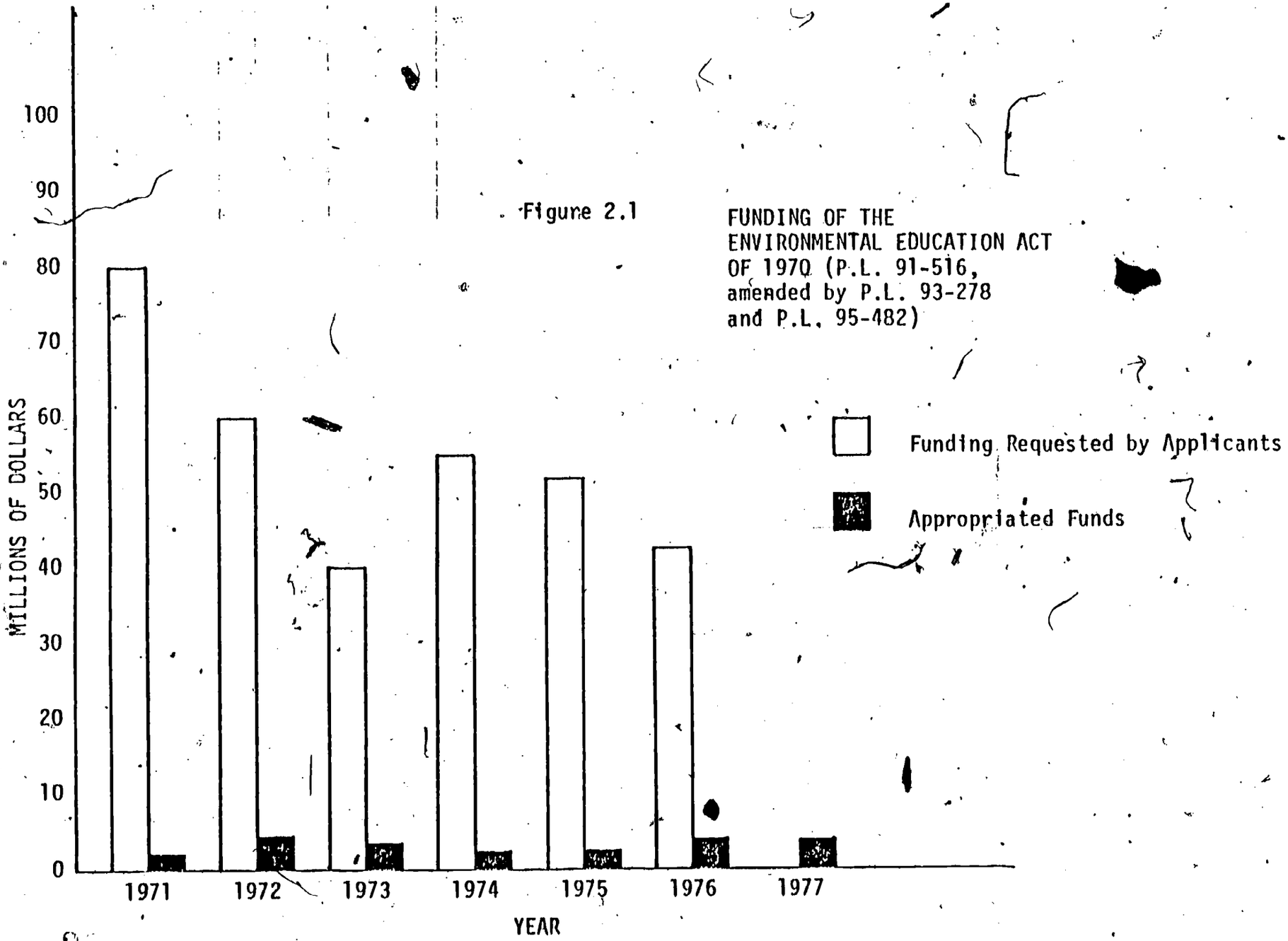
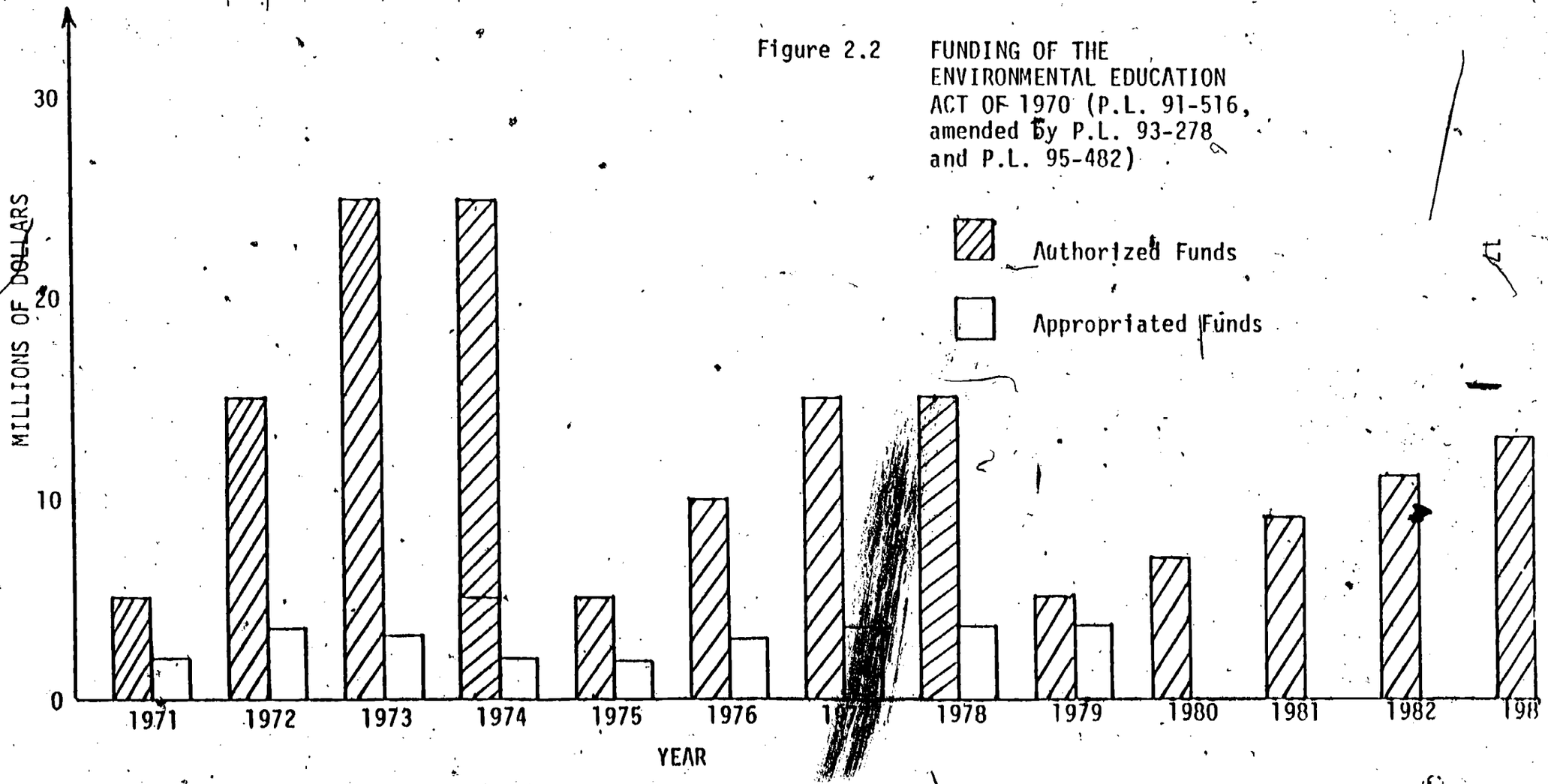


Figure 2.2 FUNDING OF THE ENVIRONMENTAL EDUCATION ACT OF 1970 (P.L. 91-516, amended by P.L. 93-278 and P.L. 95-482)



What we are trying to point out here is that there was a gross discrepancy between what the EE Act asked be done and the staff and facilities provided to do it, between the funding authorized and the funding appropriated, between the funds applied for and the funds available, and between the intent of the Act and the way the executive branch received and administered it. The inevitable consequence of this would be a turning away from this outstanding legislation into other pursuits, many of which might be expected to be unconstructive.

As to matters involving "turf", we can identify several different aspects of this topic. "Turf", of course, refers to the scope of responsibility and authority of agencies and individuals, and involves questions of overlap, conflict of authority, and the like. But at the individual level, turf comes very close to the concept of individual human identity. Thus it is a genuine matter for concern because of how it touches the lives of people, as well as for its impact on programs.

The first way we will address the turf issues is to say that people have found it very hard to identify and accept a "subturf", in respect to the EE Act of 1970. The EE Act clearly specified that OEE should be "responsible for...the coordination of activities of the Office of Education which are related to environmental education." Anyone who reads [6] and House Report 93-402 will see how little attention was paid to this. On the other hand, the Federal Interagency Committee on Education, established by executive order of the President in 1964 (updated 1974), saw no problem in establishing a "superturf" for environmental education. Acting under the Chair of the Assistant Secretary for Education, and through its Subcommittee on Environmental Education chaired by a member of the Council on Environmental Quality, a report was prepared titled "Fundamentals of Environmental Education" that did not even mention the definition of environmental education set forth in the EE Act of 1970, but rather drew its impetus from the U. S. National Environmental Policy Act of 1969.

Other turf issues relate to statutory responsibilities of other mission agencies. A survey report on Environmental Activities of Federal Agencies [8] presented short reports from each of 43 agencies to help the interested reader learn how these agencies perceived their activities in environmental education.

Many of these agencies were involved in what they considered to be environmental education before the passage of the EE Act of 1970. However what they were doing, and what was being done at the time of the development of [8], is only marginally responsive to the challenge of the EE Act, with two or three exceptions. What the Act did was to define environmental education in such a way that previous definitions or concepts of it were included, not as disconnected parts, but rather as integrated parts. In effect this said that while a lot of activity was going on under the title "environmental education", most of this did not do the kind of comprehensive integration that the Congress felt was needed.

We interpret this to mean that Congress was identifying a "superturf", in which the turfs of the various mission agencies were included, and to which no threat was intended. But on the other hand, Congress was saying that something more needed to be done that was not being done. Many of the agencies have not shown any evidence of recognizing this. There has been little recognition of a sharing concept, and too often emphasis has been placed on competition at the expense of progress.

For example, there are some who recommend that all available federal monies for environmental education go into formal education exclusively, while others put the formal education down and insist that all such monies go into non-formal education.

Schafer [9] called attention to the turf problems, and insisted that unless mutual respect for turf could be established among several kinds of agencies, environmental education would continue to be held back from its goals.

We could go on and on with discussions of turf, but the point is that turf problems have and will continue to beset environmental

education.

Thus we see Spamtu as a set of historical artifacts that are part of the record of environmental education. More often than not, Spamtu is an enemy of environmental education. Worst of all, Spamtu tends to cast a blight over all of the fragmented work that is going on, and make it hard to perceive it as a potentially synergistic whole, with avenues for mutual respect, cooperation, and effectiveness.

METHAROL

Against the combined difficulties posed by Cesisee and Spamtu, we propose to prescribe "Metharol". This term, hopefully, has not been preempted by any prescription drug. It is chosen to represent the combination of Methodology and Roles, where a suitable combination of methodology and roles is arrayed against the forces of Cesisee and Spamtu, hopefully to overcome the first and circumvent the second.

Before we describe Metharol a bit more, let us first look at some other prescriptions that have been forthcoming.

In the light of Figures 2.1 and 2.2 and other difficulties we have discussed, it is not very surprising that the environmental education community is not enthralled with the present state of affairs in environmental education. They have been active in presenting prescriptions. We shall now look at the most prominent of these.

The primary recommendations of which we are aware are these:

- A series of conferences, beginning at the grass roots, moving up the jurisdictional hierarchies, and terminating in a national conference on environmental education [10].

(This would, it seems be similar to the pattern that prevails in the "White House Conference" series, such as is now underway in such areas as small business and problems of the aging.)

- A National Environmental Education Center

(This would, it appears, consist of a "small permanent staff ... augmented by additional full time individuals, detailed on a rotating basis...an EE Advisory Commission" and would primarily be involved in "promoting collaboration","establishing a communications network", "supporting and participating in an international network", facilitating "public involvement", "monitoring progress", and "reporting on the state of the art".[11])

- A National Commission on Environmental Education Research

(This would involve a participative effort to develop an annotated bibliography of research on environmental education, review current learning theories and values clarification methodology, outline environmental education research strategies for the 1980's and identify promising young researchers [12].)

These three proposals all seem consistent with Barton's commentary on the state of environmental education:

> "...the [EE] movement's number one problem is its lack of cohesion. We are many bodies (some federal, some state, many private) in need of a head. The arms, the branches, are all laboring mightily, but without enough coordination." [13].

Also they seem consistent with Schafer's comment that it is necessary that four groups come together in order to develop an effective approach to environmental education: state departments of education, state resources management agencies, the federal establishment, and the many non-governmental organizations (citizen conservation associations, business and industry, professional societies, museums, others).

All of these recommendations have in common an allegiance to a national effort, i.e., something that culminates in action at the federal level.

We will only say that there has been action at the federal level, and as we assess it it has not been entirely satisfactory. Funding has been miniscule, misunderstanding of the EE Act has been common (whether calculated or due to lack of information), turf sensitivity has been on the wrong side of the scales, and like problems have been apparent throughout the environmental education movement, as illustrated by the existence of several different professional or semi-professional organizations, none of which appears to merit allegiance throughout the movement.

It is reasonable, it seems to us, to question whether the prominence of recommendations for federal action results from a belief in the capacity of the federal establishment to be highly effective, or whether other things are being sought that are less prominent in the recommendations.

In our view, there is a merry-go-round going on in environmental education where all the principal actors can justifiably say that each of the others has been deficient. Let us run through the list. Congress, after passing a brilliant but highly-demanding piece of legislation, failed to follow through with appropriations. The executive branch failed to administer the law with dispatch and sensitivity. The colleges and universities failed to become familiar with the politics of the situation, and did not provide support in the form of informed political support. The persons involved in formal education did not make much effort to discover how to do what the law asked for. The persons involved in non-formal education did not mount a drive to help the formal education system do its job in a way that would assist non-formal education groups to do what the law asks. Furthermore, some of them tried to circumvent the law to perform advocacy roles, and thus jeopardized the Act by being selfish.

Let's go back for a moment to Cesisee. Figure 2.3 shows only a part of the structure that is involved in environmental education. With at least a seven-level inclusion structure (bureaucracy at the top, students at the bottom), does anybody seriously believe that additional bureaucracy can coordinate this system?

It seems to us that what is necessary to make progress in environmental education certain things are essential:

- Money to pay for doing what is needed to make environmental education work
- People who will do the work to make environmental education work
- High quality educational materials
- A means of getting the materials into the hands of the persons doing the education
- Proper self-allocation of roles within the environmental education movement
- Means to sustain the dedication and enthusiasm of the people involved in environmental education

Of these, it is our belief that the people who will do the work are available, and that means of getting materials into their hands are likewise available. However four of the six factors are still in short supply: money, high quality materials, proper role allocations, and sustaining means. Therefore we believe that it is to these four factors that attention should be directed. Our first question is: is there a certain sequence in which these matters should be addressed? Our answer is yes.

The logical sequence is this: first the various environmental education entities now fragmented and kept apart for various reasons, mostly associated with Spamtu, should recognize the immensity of the task facing them, and form a single professional society. This need not mean initially the dissolution of their present affiliations, but probably should lead to this eventually, at least for many of them. An annual meeting should be held. Committees should deal with the several different interests. Journals should be upgraded, with high professional review standards known and enforced. Recognition should be provided through an awards committee

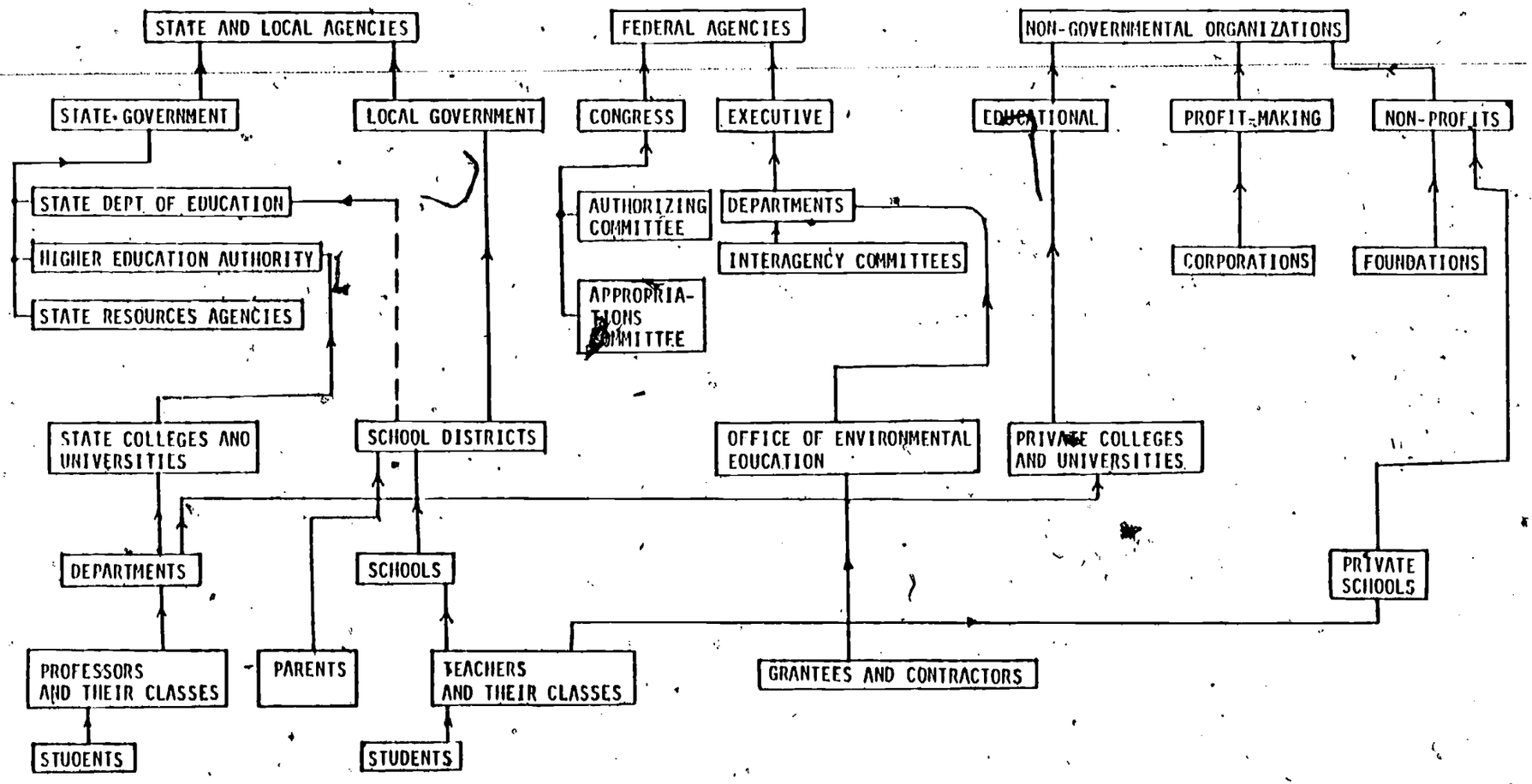


Figure 2.3 AN INCLUSION STRUCTURE SHOWING SELECTED ENTITIES IN THE ENVIRONMENTAL EDUCATION COMPLEX (International agencies are omitted in the interests of simplicity)

that rewards hard work and achievement.

Second, as soon as there is such a professional group, the second thing that can be done is to recognize just what kinds of roles are needed in environmental education, and to begin to legitimize these with an eye on quality. As soon as people can begin to accept legitimate roles in environmental education, there will be an opportunity to move ahead. Of course one of the first things to do is to recognize as legitimate certain roles that are already established.

Third, the society should become aware of what is going on in federal politics, and present a unified image to Congress of genuine capability and dedication to doing the hard work that has to be done to advance environmental education. In this way the Congress can be induced to part with enough money to pay for a worthwhile expansion of environmental education activity.

Then the fourth step is to begin to produce the high quality educational materials that are needed to do this job. This does not mean just textbooks. What is needed in non-formal education, for example, is often issue-oriented background information and processes for managing the information relevant to an issue in a responsible and timely way.

If these four things are done, we believe that the aims of the environmental education leadership will be met in a very satisfactory way.

Our Metharol prescription does not presume that the foregoing will be done, as we see no evidence to indicate that it is about to happen. Thus our prescription is designed to take advantage of the prevailing situation.

As we see the prevailing situation, there is sufficient impact of Spamtu and such sufficient difficulty as a result of Cesisee that we are forced to rely on a grass roots approach to environmental education.

However we anticipate troubles at the grass roots that are much like those we have already discussed. So our prescription focuses upon adding methodology and facilitator roles to the local situation.

Figure 2.4 shows a five-level inclusion map that we believe is easier to deal with than the institutionalized structure in Figure 2.3. In Figure 2.4, we have recast the linkage definition of environmental education to show how it is distributed. The total human environment is perceived in terms of three parts: people, information, and surroundings. The surroundings include everything other than people and information.

The people are perceived through their values, their knowledge, and the power that they hold through citizenship. Surroundings are perceived in terms of built environment and the non-person part of the natural environment.

The information is perceived as consisting of topical elements and relationships among these elements. The topical elements listed are those spelled out in the EE Act of 1970 (as amended). The kinds of relationships involved among these elements are classed to include comparative relationships, definitive relationships, influence relationships, and temporal relationships. The slant arrows in Figure 2.4 show where most of the deficiency in environmental education has been--namely in dealing with the relationships among the topical elements. This is precisely where the EE Act pointed in its definition of environmental education, and it is where most of the substantive difficulty lies in carrying out environmental education.

Our Metharol prescription holds that the topical elements and their relationships can be dealt with through the introduction of core themes into the formal education system, and through the treatment of issues in the non-formal system. However we believe that a quality treatment has to evolve gradually through interactions between the formal and non-formal components of education. Moreover we hold that the combined forces of Cesisee and Spamtu can yield only (if they will yield at all) to the introduction of two new roles into environmental education.

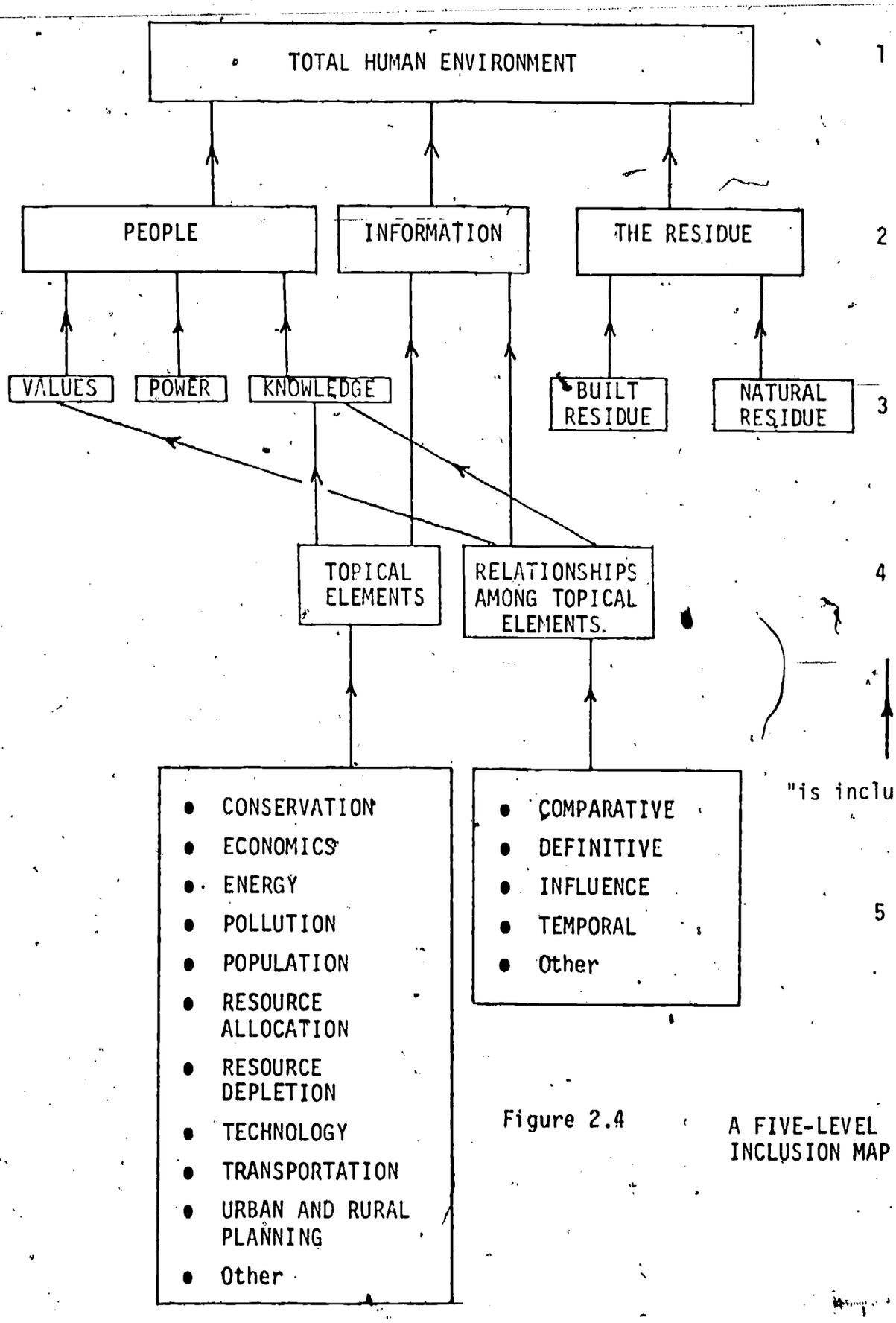


Figure 2.4 A FIVE-LEVEL INCLUSION MAP

The first role is a facilitator role, and we believe that this role should probably be filled from outside the environmental education movement. It involves a person who knows methodology that can be used by groups to make groups productive, so that they will continue to work together off and on for a prolonged period, in order to move ahead with environmental education.

The second role is a designer role, and we believe that this role should be filled locally from inside the environmental education movement, augmented by others who can be attracted to take part. The second role asks that people who may never have consciously designed anything take on a challenging and new activity. In order to make this work, we have developed a methodology for conceptual design (MCSD) that itself requires sub-methodologies and requires the use of the facilitator role.

Make no mistake about it. What we are saying is that if people want to move ahead in environmental education in an organized way, as some of the leaders in the field are suggesting, then they need to become designers, and then they need a design methodology, and then they need facilitators.

Many in the environmental education movement do not want to be constrained. They feel that many of the problems associated with the environment are caused by institutional constraints, and that it is constraint itself that becomes the villain. In our view, constraint is not a problem per se. It is the kind of constraint that is imposed that one should tune up to examine.

We see some scientists whose image of the public is that of an uninformed group too busy to work up scenarios, too uninformed to make good decisions, too irresponsible to be trusted with policy related matters, and too independent to be a part of responsible effort.

In our view, if faith is lost in the public to do what they say they want to do, the whole enterprise is down the drain. What we believe the public can't do well, however, is to work together in groups in an organized, efficient way and make good progress, unless they have an acceptable methodology and an unbiased facilitator.

We know of successful approaches to public issues where the Metharol prescription has been carried out. Groups at Kent State University, the University of Dayton, The Academy for Contemporary Problems, and elsewhere have found that the public typically has no interest in methodology or facilitation until they find out that it works. At that point they become quite interested. This is an illustration of something about Americans. They don't want to waste time experimenting, but they like things that work.

Now if the reader will not object, we will no longer refer to the Metharol name. It has served its purpose, we hope, by alerting the reader to the nature of our prescription.

In Chapter 3, we present the steps in conceptual design. Chapter 4 suggests how such a design might relate to the program of the Office of Environmental Education and to projects. An Appendix furnishes information that we think will be useful to the facilitator role.

REFERENCES

1. Curtis Gans, "The Cause: The Empty Voting Booths", The Washington Monthly, 10, 7, Oct., 1978, 27-30.
2. James North, "The Effect: The Growth of the Special Interests", The Washington Monthly, 10, 7, Oct., 1978, 32-36.
3. Charles Peters, "The Solution: A Rebirth of Patriotism", The Washington Monthly, 10, 7, Oct., 1978, 37-38.
4. Ralph Barton Perry, Realms of Value: A Critique of Human Civilization, Harvard University Press, Cambridge, 1954.
5. John N. Warfield, "Systems Planning for Environmental Education", IEEE Trans. Syst., Man, and Cyber., December, 1979.
6. Irving Morrissett and Karen B Wiley, The Environmental Problem: Selections from Hearings on the Environmental Education Act of 1970, Social Science Education Consortium, Boulder, Colo., 1970.
7. Dennis W. Brezina and Allen Overmyer, Congress in Action: The Environmental Education Act, The Free Press, 1974.
8. John F. Disinger (Ed.), Environmental Education Activities of Federal Agencies, ERIC Center, The Ohio State University, Columbus, Ohio, February, 1978.
9. Rudy Schafer, "Is Environmental Education for People...Or for the Birds?", Trends, 16(1), Winter, 1979, 6-9.
10. William Stapp (and 12 others), "Toward a National Strategy for Environmental Education", presented at meeting of National Association for Environmental Education, Blacksburg, Va., May, 1979.
11. Alexander J. Barton, Walter E. Jeske, and George L. B. Pratt, "A National Center for Environmental Education", Trends, 16(1), Winter, 1979, 16-20.
12. Clay Schoenfeld, private communication.
13. Quoted in [12].

CHAPTER 3

DOING CONCEPTUAL DESIGN

We saw in Chapter 2 that various suggestions have been made for improving cohesion, coordination, collaboration, and communication in environmental education.

It is notable, we think, that the word "management" seldom appears in such discussions. Yet improving cohesion, coordination, collaboration, and communication are among the most important functions of management in any organization.

Apparently what is wanted are the benefits of management without the institutional constraints that typically accompany management. There does not seem to be a name in the literature for such a phenomenon, but since that seems to be what is wanted, we will have to talk about it. So we have coined the term "vicarious management" as a way of describing this phenomenon.

With vicarious management, financing is provided, cohesion is encouraged, coordination is practiced, collaboration takes place, communication is widespread, but nobody is in charge.

The question that we face is how to achieve this happy state in environmental education.

A PREVAILING TRICHOTOMY

It is our impression that most of what goes on in the relationship between the public at large and the federal establishment that involves a flow of funds from the federal government to outlying parties can be placed into one of three categories, which we collectively call a prevailing trichotomy.

Case 1. Change the Law. What is done in this leg of the milkstool is to lobby to get the law changed. The rationale seems simple enough. The law doesn't provide funding for what is desired. Therefore lobbying is carried out to build a case for what is desired, and to get it written into law and legitimized, so that funds can be obtained.

If vicarious management is intended, then the law must be tailored so that this can be achieved. It must provide for all of the management functions without the management authority.

Case 2. Circumvent the Law. In case 2, what is done is to present one face to the federal government to get the financing, and then do an about face and do whatever was intended, all the while maintaining a posture of innocence. This situation is fairly compatible with vicarious management, in that there is no authority with the resources and clout to cover all the conceivable petty violations, and the legal costs of trying to remedy the circumvention may often exceed any rational benefit to the government or to the country at large, in any single case.

Only when the circumvention is massive may there be opportunities to do more than simply make an example out of the relevant actors.

On the other hand, it is hard to see how cohesion, coordination, collaboration, and communication are served by this approach, because it would appear that a certain amount of cover-up, lack of openness, or outright lying would be incurred, in the belief that open admission and documentation of circumvention would invite prosecution.

Case 3. Honor the Law. In case 3, a conscientious effort is made to honor the law. If this is done and vicarious management is desired, one dilemma that arises is one of making the difficult judgment as to whether the law is reconcilable with vicarious management.

Does the law allow for the possibility of financing, having cohesion, coordination, collaboration, and communication, without having anyone in a management role?

Still another question to be addressed is whether the law allows what one wants to do to be carried out under its provisions.

It appears to us that one reason we have so many lawyers and courts is that the interpretation of the law is no simple matter. So we would argue that in attempting to honor the law, one should make a conscientious effort to correlate what is being funded under the law with specific provisions of the law itself.

Based on our own experience over a period of two years in working with this legislation, trying to interpret it in the framework of environmental education, and taking part in two technical-assistance meetings for grantees, it is our impression that it is not easy to establish a good correspondence between what applicants for funds under the Act want to do and what the Act asks be done in environmental education.

TECHNICAL ASSISTANCE

A part of the difficulty that is encountered in attempting to foster environmental education under the EE Act lies in the small size of grants, the large number of grants per year, and the load imposed on OEE. Thus we recommended in Volume 9 of our 4th Quarterly Report that the size of grants be increased, the number of grants per year be significantly decreased, and that longer terms be provided to allow grantees to get organized, carry out the work, and report it in a way that would be useful to others.

In the latest amendment to the EE Act, all such provisions were made. Thus the opportunity is available to propose more comprehensive activities (thereby increasing the opportunity for correlating what is proposed with the Act), to have more time and funds to do the work, and to do a first rate job of reporting.

However the question remains as to how to achieve the desired vicarious management. In our opinion the kind of vicarious management that is desired can never be fully met. As long as the federal law requires that there be accountability which involves showing a correlation between the authorized use of funds and the way in which they are being or have been used, there will always be a requirement for responsible management.

Nevertheless it is both technically possible and economically desirable to facilitate the drawing of legitimate connections between what applicants for funds desire to do and what the law authorizes. This can be done by the use of facilitators, whether drawn from the OEE or from the ranks of professionals who

are highly experienced and qualified in helping groups use information effectively, including the information bottled up in their own minds.

In our opinion, there is a further way in which technical assistance can be provided, and that is through the use of methodology. We see the use of methodology as a way of helping to attain some of the elements of vicarious management that seem to be desired. A major aim of the methodology is to assist grantees to develop for themselves the kind of discipline that would otherwise have to be provided through external management or not at all.

A guiding principle in the use of methodology is that it should not, of itself, interfere with the substantive aims of the group. That is, it should not invade the environmental education territory of interest to the group. Rather it should facilitate the expression of that territory, and the correlation of it with existing Law. In this way, the following benefits are made possible:

- An adequate proposal of what is to be done
- Correlation of what is proposed with what the legislation authorizes
- Definition of roles that are needed to carry out the work
- Definition of linkages and inherent constraints that relate to coordination, communication, and coherence
- Establishing a basis for responsible reporting
- Allowing accountability to be established between the proposed work and the EE Act
- Providing a framework for local project direction
- Improved understanding of what is to be done, and how it relates to other parts of environmental education
- Getting participation of those who will be involved at the very beginning

Our suggestion for attaining these benefits is to pursue a design approach to environmental education.

A NEW ROLE

Evidently, in asking that local citizens adopt the role of designer, a new challenge is being added to those that already are in abundance. We can only justify this by presenting a means whereby design can be carried out, with the aid of professional facilitation, in a reasonably short time, and reported to the group in a way that summarizes the product of their efforts compactly and usefully.

With this in mind, we proposed to discuss a series of steps in the conceptual design of systems, in particular of a Regional Environmental Learning System (RELS). If these steps are faithfully followed, you will emerge with a design and it will be communicable to others. In the Appendix to this Volume, we provide information for the facilitator.

The process that we describe allows for participation, documentation, and iteration. The examples that we give are illustrative only.

MISSION STATEMENT

Design begins with the development of a mission statement for the system to be designed. We have provided an example of a capsule mission statement and a Large Mission Statement (an intent structure for environmental education) in Chapter 1. These may, of course, be taken over directly, or totally changed.

OPTIONS GENERATION

Design proceeds with the generation of options that are available in pursuing the mission. By this we mean statements that describe system design features that might eventually be selected as part of a final design. It is well established that in generating ideas, it is quite appropriate to forego criticism or extensive analysis. Facilitators will know how to make this step go rapidly, in assisting the design group to develop <u>their</u> list of options.

Advances in methodology within the past ten years have taught us very efficient ways to generate ideas and to get these ideas across to each other in groups. We will not elaborate on these methods in this Volume, because we devote all of Volume 4 to methods for conducting collective inquiry, including field tests of such methods that show them to be favorably accepted.

Thus we believe that options generation should take place in a representative group, led by a facilitator with no stake in the design but with a stake in facilitating the group to achieve success in the task of options generation.

It is reasonable to suppose that a substantial percentage of all of the options for a RELS can be generated by a group in less than an hour, and that in a period of two to three hours the entire group can become reasonably familiar with the entire set of options.

SORTING OPTIONS

It has been our experience that, rather than look for categories initially, it is better to generate a large number of options and then try to find categories into which they can fit.

Thus, after a large number of options is generated, the next step is to place them in categories. If the number of options is not too large, and the options are not too complex, manual sorting may be satisfactory. Another alternative is to employ the method of Interpretive Structural Modeling (ISM) described in Volume 4, and use a group discussion method to sort.

After the sorting is finished, each category may be given a suitable name to identify the category.

IDENTIFYING DESIGN DIMENSIONS

It is entirely possible that the number of categories is quite large, and that there should be a test to see whether all of the options that were generated should be retained. Thus once the categories are named, a test should be conducted to see if each category is essential in a design.

Each category is inspected, in turn, and the following question is asked. "Do you feel that it is necessary to specify options in this category in order to pin down a system design?"

If the answer to this question is "yes", we dignify the category by calling it a design dimension. If the answer to this question is "no", we set aside that category and its list of options. This set aside information may be valuable for other uses, but will not be considered further in the design effort.

PORTRAYING THE OPTIONS FIELD

The next step is to portray the options field. By this we mean that we get an artist or draftsman to make a drawing that shows all of the options that are retained, grouped under the design dimensions, and arranged so that as we proceed later on to make design selections from the options, we can so indicate by connecting each selected option to a "tie line" drawn on the same drawing.

An example of such an options field for environmental education appears in Figure 3.1. Here you see ten dimensions identified by the letters A through J and the names that were assigned to these ten dimensions.

You will also observe that each option has a bullet in front of it, and that there is a tie line extending across the options field. Later on, as options are selected, a line is drawn to connect a selected option to the tie line. This symbolizes the selection of that option, and maintains a running record of the status of the conceptual design of the system.

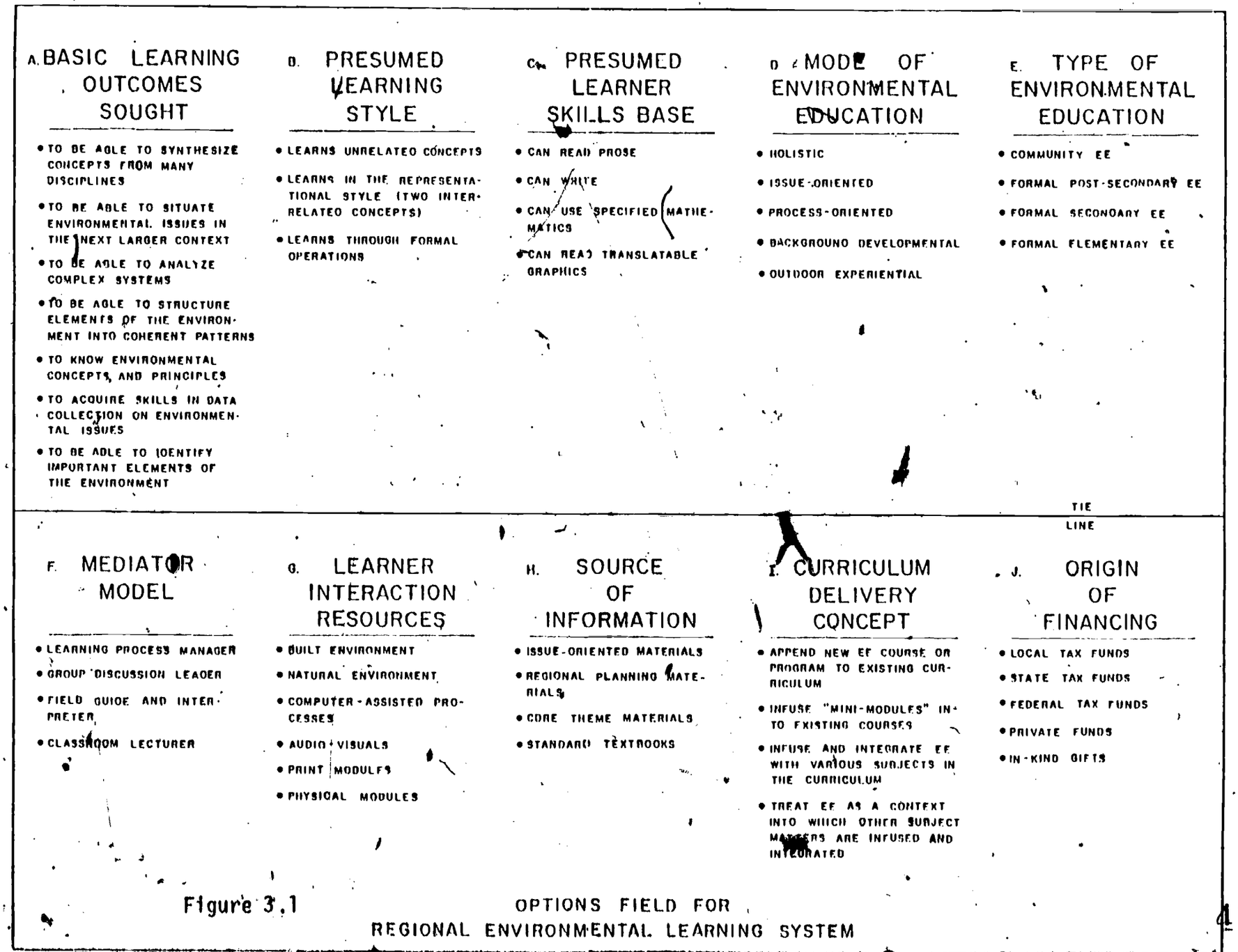


Figure 3.1 OPTIONS FIELD FOR REGIONAL ENVIRONMENTAL LEARNING SYSTEM

DESCRIBING THE CONTENT OF THE OPTIONS FIELD

The content of the options field should be explained in writing as part of the documentation accompanying it.

It is unlikely that any written description will be totally understandable, thus the purpose in documenting the options field is to convey most of the key thoughts so that a person reading the documentation to get background for engaging in the conceptual design can decide what questions to ask to get more fully aware of what is meant by the various options.

Some of the options will be self-explanatory in meaning and will not require clarification. They may require elaboration in specific design situations, however.

A. Basic Learning Outcomes Sought. In constructing the options field in Figure 3.1 you may observe that the basic learning outcomes sought were taken directly from the intent structure (the Large Mission Statement) and, in particular, were the lowest seven outcomes on that structure. This is an artifice to keep everything on one page for the options profile. However it is justified because each of these seven outcomes, if achieved, would help achieve all the other outcomes on the intent structure.

B. Presumed Learning Style. The learning styles mentioned refer to the image of how a learner acquires knowledge, based on the Piaget research and its successors. The learning of unrelated concepts is characteristic of children who haven't attained age 7. Learning in the representational style typically involves at most the capacity to deal with two inter-related concepts, and is typical of learner capability from age 7 upwards.

Learning through formal operations typically requires some kind of experience with detailed formal operations applicable to the subject being studied. It is argued from research that people seldom can do this kind of learning before age 12, and that most learning that goes on is not represented by this learning style.

We believe that to attain the kind of capacity called for in the mission, formal operations are required.

C. Presumed Learner Skills Base. We suspect that the options under this dimension will have to be sharpened in specific design situations. Common ways of specifying reading levels are through grade designations. For example, the average American is said to read at 8th grade level. The New York Times is said to require writing at the 10th grade level, and the Readers' Digest is said to have required writing at the 6th grade level.

Mathematical skills can be correlated with any of the relatively small numbers of mathematics curricula used in U. S. schools.

Figure 1.2 is an example of a translatable graphic, and the text discussion accompanying it showed how to read such a graphic.

D. Mode of Environmental Education. The various options given in the dimension "mode" differ in what is stressed. Elaboration has been given in Volume 9 of our 4th Quarterly Report, which is available from the Office of Environmental Education.

E. Type of Environmental Education. We are not very satisfied with the way we have stated the options under the "type" dimension. If we were doing this over, we would probably use the term "non-formal" instead of "community", or perhaps, in addition to community. In any case, users may find a set of options somewhat more appropriate to their region.

F. Mediator Model. The "mediator" is the name given to the person who is responsible for supervising the learning process; i.e., the person who is between the learner and that which is to be learned. Sometimes this will be a teacher, but it may also be someone who is active in the community and is not a professional teacher.

G. Learner Interaction Resources. We believe that these options can receive such local elaboration as may be appropriate.

The remaining dimensions are believed to be self-explanatory.

STRUCTURING THE CHOICE PROCESS

Our experience tells us that the most satisfactory results from group work are achieved when the effort is structured in such a way that it achieves these benefits:

- Contributions from everyone are facilitated by the process
- The group is not asked to create, in an ad hoc way, the process that they will use to perform their task
- Documentation is facilitated by an orderly approach
- Numerous decision points are defined and decisions are made in timely ways

In group design effort another key factor is very important. It is very desirable to structure the group work so that distinctions are made between preference and feasibility. If there were no constraints, no questions of feasibility in design, then design would be simply a question of arriving at what is preferred. Some theorists have treated design in this way, suggesting that everyone has certain preferences and if these can be reconciled success is at hand. But in almost all design work, preference can only be brought to bear when there is a hard-nosed recognition of what is possible.

One of the most time-consuming difficulties in design stems from the fact that the choice of some options may rule out the choice of other options. It is possible that every time an option is selected, the options field is diminished because some options are eliminated by that selection. The sheer mechanics of trying to keep all this straight in an ad hoc approach are overwhelming.

Thus we propose to structure the group effort to arrive at an initial conceptual design (subject to modification by review and iteration) into three parts. In the first part, the group explores the interaction among the dimensions to get a view of how choices in some dimensions affect possible choices in others. In the second part, the group decides in what sequence the dimensions will be addressed to make design choices. In the third part, the group makes design choices following the sequence established in the second part of the work.

One of the significant advantages of this three-part process is that by the time the group gets around to making selections of options, they will have discussed the options several times in the process of doing the first two parts.

In all three of these parts, the services of a skilled and experienced facilitator are essential. The reason is that the kinds of tasks the group is being asked to do are not the kinds that groups can do well under ordinary circumstances.

In addition, the group can benefit significantly if it makes use of structuring aids, especially the ISM process described in Volume 4. This process was designed to help groups structure and to help them participate and learn while they are doing the structuring. A skilled facilitator will know how to make this process serve the group, and help the group accomplish the design task.

STRUCTURING DIMENSIONAL CONSTRAINTS

We wish to develop the task of structuring dimensional constraints in detail with an example, so that it will be quite clear as to what is being said.

Suppose that we take, as an example, a part of an options field that we might find useful in designing an automobile. We choose this example as one that we think many people will be familiar with. Suppose that dimension A is the weight range of the car, and we will have three options:

- 3000 to 3499 pounds
- 3500 to 3999 pounds
- 4000 to 4500 pounds

Suppose that dimension B is the desired highway gasoline mileage, and we have these options:

- 10 to 15 miles per gallon
- 15 to 20 miles per gallon
- 20 to 25 miles per gallon
- 25 to 30 miles per gallon

Suppose that dimension C is the color of the car, and we have these options:

- Black
- Yellow

In what we are going to describe next, we want the reader to understand that all of the effort can be dealt with handily by a computer, except answering certain key questions. So you should not suppose that you would be engaged in filling in big tables.

What would be desired from studying the constraints would be information equivalent to what we show in Figure 3.2.

ITEM 1 \ ITEM 2	A	B	C
A	-	Yes	No
B	Yes	-	No
C	No	No	-

Figure 3.2

What is shown in Figure 3.2 is answers to six questions, all of which are of the following type:

> "Is there some option in dimension (ITEM 1) which, if selected, would eliminate an option in dimension (ITEM 2)?"

For example, one question would be:

> "Is there some option in the weight dimension which, if selected, would eliminate an option in the mileage dimension?"

We are asking about whether an option in dimension A would, if selected, eliminate an option in dimension B. What we indicate in Figure 3.2, in the column headed by B, is a "yes" answer to that question. This reflects our assumed knowledge that, for example, if we require that the car weigh between 4000 and 4500 pounds, we will not be able to get 25 to 30 miles to the gallon. Thus there is an option in dimension A that, if selected, would eliminate an option in dimension B.

On the other hand, there is no reason to suppose that a choice of color under dimension C would in any way affect the weight or mileage of the car. This is why there are two "no" answers in the row of Figure 3.2 labeled C.

The way the gathering of the information would take place is that the group would be asked to discuss and decide on the answer to the question for every possible ordered pair of dimensions. In our example, we would ask about (A,B), (A,C), (B,A), (B,C), (C,A) and (C,B), so that six questions would be asked of the group in order to construct Figure 3.2. With more elaborate options fields, more questions would be asked. These questions all must be considered in arriving at a design. This is because you have decided previously that every dimension must be addressed in order to arrive at a design.

Once such information is gathered, it is possible to group dimensions in a way that the group can be helped in arriving at a good sequence for making design choices that takes into account the constraints that you have identified.

In our example, we see that dimensions A and B are intimately related, and so we would want to consider these dimensions at about the same time in our options selection. On the other hand, we see that dimension C could be chosen either first or last, according to preference, because it has no effect on the other choices.

The skilled facilitator will know how to use this constraint information that you have supplied to help you decide in what order to address the dimensions for purposes of making selections. Specifically, whatever clusters of mutual constraint you have identified will be kept together as clusters, as you go through the next step.

SELECTING THE SEQUENCE OF DIMENSIONS

Now that you have studied and organized the constraints on the design, the next step is to select the sequence of dimensions in which you will make the choices of options.

Once again this process requires facilitation, and benefits considerably from the methods of collective inquiry described in Volume 4.

Let us pick up on our example from the previous section to show what would happen here.

In that example, there was a cluster consisting of dimensions A and B, such that a choice in either could eliminate one or more choices in the other. However dimension C did not constrain either of the other dimensions.

First you will be asked what your preference is in selecting within a cluster. In our example, you would be asked to decide whether you wanted to select the weight first or the mileage first. If you decided to pick the weight first, then you would automatically pick the mileage second, because the two dimensions are in a cluster.

Then you would be asked whether you wanted to choose the color before you deal with the weight and mileage, or whether you want to choose the weight and mileage before you choose the color. In this way, a sequence for addressing dimensions, such as (A, B, C) or (C, B, A), or (C, A, B) would be achieved. This would be the final step in preparing to choose options from the options field.

CONSTRUCTING AN OPTIONS PROFILE

The next step in doing the conceptual system design is to discuss each dimension, in the order previously selected, for the purpose of deciding which option or options under the dimension will be selected for the design. If the sequence (C,A,B) were previously chosen, for example, then the first choice would be made of the color of the car. The next choice would be made in the dimension of weight range. And the final choice would be made in the dimension of highway mileage.

Each time an option is selected, a line is drawn on the options field tying that option to the tie line. As mentioned earlier, this enables the group to keep a running record of prior choices, and provides for a final display of the entire set of choices. The completed picture, showing all dimensions, options, and selections tied to the tie line documents the outline of the design. The lines that are drawn on the options field are called the options profile.

When options have been selected in a given dimension, the group should refer to the constraints identified in a prior step, and use that information to see what options have been ruled out, if any, and draw a line through them before proceeding. This simplifies the continuing steps in constructing the options profile. Also it may cause the group to rethink their selection of options.

One must consider the thought that the credibility of decisions depends, in part, on the ability to explain why certain options were not selected. Indeed, a full explanation of why certain options were selected logically involves an explanation of why certain others were not selected.

Also it is important to realize that one reason for not selecting certain options for the system design can often be that those options are being handled by some other means. Thus the system being designed need not take on the responsibility for implementing those options.

When the options profile is finished, it becomes a vehicle for moving ahead with the design in greater detail, and for moving ahead with implementation plans.

It is good practice to let a completed options profile sit for a few days and then review the entire process by which it was constructed, including all of the reasoning that went into it. This may suggest the need for changes, or it may reinforce the thinking that produced it.

OVERLAYS

Notice that if an options profile has been completed for a RELS, it may be true that a great many options have been selected because of the relatively broad scope of a RELS. This establishes a broad scope, but it may be too broad for some purposes. For this reason, one can consider repeating the same process to develop one or more additional options profiles for parts of the RELS. For example, an options profile could be constructed for secondary education alone. Or an options profile could be constructed for non-formal EE, etc.

If several options profiles were constructed on transparencies, they could be laid over the options field in the form of overlays, and one could then see how the different parts of the RELS have joined to form a composite options profile for the RELS. This would be a way to show very quickly and easily with an overhead projector how the cooperating groups expect to join forces to deal with the total set of options for the RELS.

It seems highly advisable that if the RELS is thought of as being comprised of cooperating groups, and if an options profile is prepared by one of these groups, there should be observers present from the other groups. This would enable all the groups to gain the understanding needed to help see who is planning to do what in the RELS. Our concern here is not primarily with a tidy division of labor, although that is certainly helpful. Rather our concern is to develop and sustain a way for the separate groups to help each other in various ways. There is little point in having a RELS if it simply furnishes an umbrella for several independent groups to go their own ways, precluding the significant educational benefits of interaction.

WHAT HAPPENS NEXT?

After the options profile(s) have been developed, what happens next? Volume 3 is intended to assist with subsequent developments. In Volume 3 you will see source material related to developing a RELS based on a conceptual design of such a learning system.

CHAPTER 4

PROJECTS AND THE ENVIRONMENTAL EDUCATION ACT

Some of our readers will want to know how the RELS concept can be related to projects and to the Environmental Education Act of 1970, as amended. We expect that the following kinds of questions might be raised:

- How does the RELS idea relate to the EE Act?
- What kinds of projects does the EE Act specifically mention as being appropriate for funding under the Act?
- Suppose I wanted to interpret my own project idea as a RELS, or through the RELS idea. Can this Sourcebook help, and is this consistent with the EE Act?
- Does the RELS idea include all the kinds of projects mentioned in the EE Act, or only some kinds?

In this Chapter we will consider questions such as these, in the hopes that our comments will help make this Sourcebook more useful to those readers who have interests in projects that might be supported under the EE Act.

TYPES OF PROJECTS

While the Act does not require that projects be categorized in these types, the Act does specifically mention these types:

- Research projects [Sec. 353 (b) (1)]
- Pilot projects [Sec. 353 (b) (1)]
- Demonstration projects [Sec. 353 (b) (1)]
- Evaluation projects [Sec. 353 (b) (1)]

In addition to mentioning these types of projects, the Act also mentions a variety of activities that could be carried out under projects of these types (or as a mix of these types), including curriculum development, dissemination, community education, etc.

To simplify our presentation, we shall use the language of these types as representative of the EE Act, but will also consider combinations.

We present a structural image of the four types of projects in Figure 4.1.

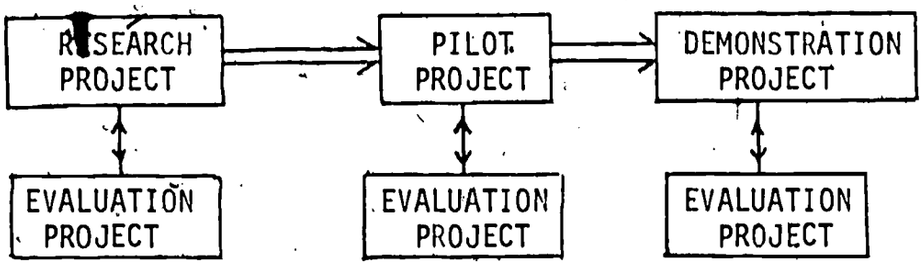


Figure 4.1

The horizontal broad arrows in Figure 4.1 represent a typical evolution that may be spread out over several years. A research project develops knowledge, methods, plans, system concepts, etc. Those that prove worthy of further action find their way into pilot projects aimed at assessing their merit in real situations. When pilot projects are judged to have particular merit, they may be followed by demonstration projects. The demonstration projects give an opportunity to reveal to many others what is going on in a particular local environment, and provide for the transfer of validated knowledge, methods, practices, etc.

The evaluation project has no life of its own, but attaches to the several types of projects. The vertical two-way arrows in Figure 4.1 represent this kind of attachment. Evaluation allows an opportunity both to improve the project activity and to help assess and convey the results of that activity to audiences beyond the project.

Figure 4.1 is highly simplified. A more realistic image of what might be expected to occur in practice would recognize that a pilot project typically draws on several research projects, as well as on accumulated experience. A demonstration project typically might be expected to draw on several pilot projects, as well as on accumulated experience.

Also, in Figure 4.1 we have not shown any source of support for these activities. But in practice there will be one or more agencies of institutions providing support. They will have evaluation requirements that may go beyond those that simply relate directly to the projects.

THE RELS AND THE PROJECT TYPES

Nothing in the EE Act requires that a project be limited to one of the four types shown in Figure 4.1. It is our belief that a RELS may contain elements of all four types of projects. In this respect a RELS may be a comprehensive project, in which some research, some pilot activity, some demonstration activity, and some evaluation activity go on in a coordinated way.

On the other hand, a RELS could equally well be considered to be either a pilot project or a demonstration project, with accompanying evaluation, depending on the particular circumstances in the region. It could still be a comprehensive project, even if limited to the pilot or demonstration type.

A comprehensive project acquires that status by virtue of the scope of its activity and potential consequences, rather than by virtue of being put into one or some combination of the types shown in Figure 4.1.

There is a tendency within the government to classify projects as service projects or demonstration projects.* In the former instance, the primary aim of the project is to deliver certain kinds of services to a target group (in environmental education, this would be the target group identified in a grant application, for example). The demonstration project, on the other hand, is much more concerned with showing persons outside the project geographical domain that certain practices are exemplary and deserve to be considered for adoption elsewhere.

One may notice, however, that such limitations as are placed on projects by such labels as these sometimes oversimplify what goes on. It is easy to imagine that a demonstration project would be a failure if it did not in some way provide services in an exemplary way. Likewise it is easy to imagine that considerable opportunity might be lost if a good service project did not have the opportunity to demonstrate its exemplary character.

* For a good discussion of demonstration projects, see John E. Dawson, "Why do Demonstration Projects?", Anthropology and Education Quarterly, 8(2), May, 1977, 95-105.

While the legislation and regulations often appear to constrain projects to fit into pre-selected categories, it is often true that such constraints are imagined rather than real. It is a pity if persons who have good ideas do not incorporate them into carefully planned grant applications, in the belief that the merit will be recognized.

Thus in planning a RELS, for example, one might propose a judicious balance of research, pilot, and demonstration activities, justifying this balance in the light of the regional situation, and in terms of such matters as:

- What research needs to be done as the project proceeds to help assure success in some dimension(s)?
- What do we understand well enough that we can do a genuine pilot test to see whether success can be achieved?
- What do we need to do that has already been piloted, and found successful in the pilot test, that now deserves to be demonstrated?
- How can the evaluation that is needed be directed to the most fruitful parts of the activity, with due concern for helping the project people while providing necessary documentation to supporting agencies or institutions?

But the word judicious is crucial. This implies that there is a genuine need for such a balance and that there is sufficient managerial talent to be able to handle the varied aspects of the project. Where one or both of these conditions is not met, lesser aims should probably be considered.

A RELS AS A COMPREHENSIVE PILOT PROJECT

If one should undertake to design and develop a RELS as a comprehensive pilot project, it would be understood that the comprehensiveness would stem from a genuine joining of talent from formal and non-formal education, with the latter emphasizing regional environmental issues (tempered by the definitions of environmental education given in Volume 1 of this Sourcebook), and the former emphasizing ways to improve environmental learning in the formal system. The two groups would interact and provide mutual assistance.

Identification as a pilot project would be exemplified by the care with which what is done is documented and laid open to evaluation, giving consideration to the possibility that the pilot project might evolve into a demonstration project. In this case, one would find it essential to give a solid answer to the question: "What is found in this pilot project and in its evaluation that is worth demonstrating?"

A. RELS AS A COMPREHENSIVE DEMONSTRATION PROJECT

If one should undertake to design and develop a RELS as a comprehensive demonstration project, then it goes without saying that there must be some things to demonstrate that have given prior evidence of worth. Also the comprehensive features mentioned previously would be present.

It is especially worth noting that in conceptualizing a RELS as a demonstration project one could incorporate in a demonstration numerous results of pilot projects carried out at a variety of places. We have identified a variety of projects that were sponsored by OEE that appear suitable for consideration in regional settings. These are discussed in Volume 8 of our 4th Quarterly Report under the title "Regional Materials Analyses".

A few additional examples of possibilities are as follows:

- A demonstration project could be designed around a collection of prior grant results from OEE grants, by screening on criteria involving prior formal evaluation or on particular topics such as energy or land use. Reference can be made to Volume 1 of this Report, where results of past grants are listed.
- A demonstration project could be designed to show how the various methods of collective inquiry presented in Volume 4 can be used in both formal and non-formal education. Field tests with both formal and non-formal representation have indicated that these methods are quite useful, as indicated in Volume 4.

- o A demonstration project could be designed to show how the interpretive structural modeling process can be used on a broad scale in both formal and non-formal education as a means of learning about environmental interactions. This process has been pilot tested in the Chaminade-Julienne High School, Dayton, Ohio, and reported in USE OF INTERPRETIVE STRUCTURAL MODELING IN ENVIRONMENTAL STUDIES AT THE SENIOR HIGH LEVEL, UDR-TR-79-27, by Karen O. Crim, prepared under Grant G007700611 from the Office of Environmental Education.

While the classification of projects as research projects, pilot projects, demonstration projects and evaluation projects is well-founded, there may be times when it is desirable to consider combinations. We are particularly prone to suggest the combination of a pilot and demonstration project under certain circumstances. Suppose, for example, that virtually all the components of a proposed pilot project have been tested individually, but have never been brought together in a single project. Under these conditions, it would seem to offer economies of scale to conceive a project that was intended to be a pilot project, but which would also involve most of the elements of a demonstration project. With such a project, observers could determine ahead of time the history of development of components, and thus be in a position to comprehend the goals, development and activities of a pilot project as it unfolded. This would go a long way toward facilitating the problems of transfer of knowledge and experience to other locations in ways not readily achieved for complex projects.

It would be quite interesting to do a pilot project to see whether local people can design and develop a RELS along the lines described in this Sourcebook, and to see what local benefits and dysbenefits emerge in the process. But it would also be interesting to involve outside persons as observers, so that they could learn from the evolution of the pilot test and be in a position to proceed with a set of demonstrations elsewhere, should the results be sufficiently favorable.

The relative complexity of RELS design and development suggests that this would be a more economical way to conceive of such a project, rather than to follow the potentially more costly and less efficient serial sequence.

EVALUATING A RELS

From the previous discussions, it should be clear that evaluating a RELS can be very important. However it should also be clear that there is no formula that can be given for RELS evaluation. The way it will be evaluated will depend upon how it is conceived. If it is a combination of research, pilot, and demonstration activities, the evaluation will mirror that. If it is just a pilot project, the evaluation will mirror that. If it is a demonstration project, the evaluation will mirror that.

While evaluation itself is complex, and the state-of-the-art of evaluation as a scholarly endeavor is a matter of contention (see, for example, Volume 6 of this Sourcebook or the publication: Proceedings of the National Academy of Education, Vol. 3, 1976, pp. 81-107, a review by a Task Force of the Stanford Evaluation Consortium edited by Lee Ross and Lee J. Cronbach of the Handbook of Evaluation Research edited by Marcia Guttentag and Elmer L. Struening), we can simplify our discussion by saying that three primary reasons for evaluation come to mind: (a) if done during a project, to help the project staff do a good job, (b) to validate that certain materials, practices, processes, methods, etc., produced certain outcomes, (c) to provide funding agencies or institutions with a partial basis for deciding whether to allocate funds.

In our opinion, the most important ultimate evaluation in environmental education will be keyed to the definitions of environmental education given in Volume 1, and will show that it has been possible in practice to achieve what those definitions imply. This has certain implications for who will do this evaluation. It will be necessary to approach it in a multi-dimensional way, but one key dimension will be a good knowledge of the content base of the subject.

In the absence of that kind of capability, we can expect that evaluations will still be useful. But until that kind of capability is achieved, we expect that most evaluations will be well-advised to give due concern to reporting needs of those funding agencies who, in the early stages of development of a field of study, operate mostly on faith, and desire to move more in the direction of fact.

INCLUSIVITY OF THE RELS

In our judgment, the RELS should not deliberately exclude activities mentioned in the EE Act. But realistically one cannot do everything in one project. Thus the RELS should embrace those other activities that it cannot focus on, but it should drive hard in selected areas. No recipe can be given for precisely what these selected areas should be, but certainly the definitions of environmental education given in Volume 1 and the options listed in the Options Field should help stimulate discussion in this respect.

The RELS idea is best seen as a means of focusing on key ideas and providing direction, rather than as a way of drawing a line as to what should be done and what should not be done to further environmental education.

APPENDIX

METHODS FOR THE FACILITATOR TO CONSIDER

APPENDIX

METHODS FOR THE FACILITATOR TO CONSIDER

As issues and educational themes become more complex, and as people demand participation in policymaking, decisionmaking, and issue resolution, it becomes increasingly clear that there is a strong need to distinguish certain roles.

Anyone who is a strong advocate of a certain position finds it almost impossible to be, at the same time, the leader of a group process involving a variety of positions.

Anyone who is highly knowledgeable about an issue, and who is in a position to contribute greatly to a discussion of an issue, finds it almost impossible to provide a discussion group with leadership and still contribute to the substance of the discussions.

When issues or themes are many-dimensional, and information is being generated from all directions, people become frustrated at the lack of organization of the information, and inability to make progress toward resolution of complex issues.

It becomes a very difficult and demanding job <u>just to help a group to be effective.</u> At the same time, if one can learn to facilitate the work of a group, so that the group does get a strong sense of <u>both</u> participation <u>and</u> achievement, the facilitator role can be very satisfying.

One of our findings is that there has been a very substantial improvement in the state-of-the-art of methods and methodology available for use by groups, and most of this has taken place since 1972. Persons who are not aware of these newer developments should become fully aware of them, if they desire to become more effective facilitators of group activity.

Some believe that the use of such methods will be the key to maintaining effective local, regional, and state responsibility and authority on matters that might otherwise never be suitably resolved.

Volume 4 treats these methods of collective inquiry, and offers examples and references. Persons who are experienced facilitators, but who are not aware of these methods are urged to become more familiar with them.

In this Appendix, it is intended to restrict our discussion only to the use of some of those methods as a way of facilitating a group activity aimed at developing a conceptual design for a Regional Environmental Learning System, using the general approach set forth in this Volume.

In the description given in Chapter 3, we avoided the use of technical language wherever possible, in the belief that the technical aspects should be the province of the facilitator. The group is the source of substantive knowledge and belief, but the methods and the facilitator who understands how to use these methods are the source of ways to help the group take maximum advantage of its collective knowledge and information resources.

THREE METHODS

We shall assume a knowledge on the part of the facilitator of three methods for helping groups. If the facilitator lacks this knowledge, reference to Volume 4 is recommended. The three methods that we assume familiarity with are: (a) Brainwriting (ideawriting), (b) Nominal Group Technique (NGT), and (c) Interpretive Structural Modeling (ISM). The first two are largely interchangeable in function, being designed to help groups generate ideas relevant to whatever issue is being considered. The third is intended to help groups organize their information.

STEPS IN CONCEPTUAL DESIGN

We discussed, in Chapter 3, several steps in conceptual design. We shall essentially repeat that discussion here, except with more elaboration and detail, including those technical matters that a good facilitator can be expected to comprehend and manage.

Step 1. Mission Statement

In this step, as in several others, a group will have a choice of three possibilities:

(a) Decide to use an already-available item without modification

(b) Modify an already-available item to suit local conditions

(c) Start from the beginning and develop the item

We have provided two mission statements for environmental education. One is in capsule form. The other is in the form of an intent structure. These have been arrived at after extensive study. Persons who undertake to start over will have, we believe, a rather difficult task ahead of them.

However it is possible to develop either a capsule mission statement or an intent structure at a local level. The capsule mission statement would not be subject to treatment via the methods we have mentioned.

If a group wishes to develop an intent structure, the facilitator should know that many groups have done this following a standard pattern. Either brainwriting or NGT is used to generate a set of objectives in written form. These are edited. Then the ISM process is used to structure the objectives.

These are some of the benefits:

(a) The group reaches a common understanding on what is to be achieved.

(b) The group documents that understanding.

(c) A sense of structure and relationship among objectives is achieved that helps people understand better how to go about achieving objectives

(d) If newcomers join a continuing effort, the documentation is available to help them catch up with the group.

(e) Observers have a way of seeing, on paper, where the group is headed, and comparing it with their own perceptions

Step 2. Options Generation

As an experienced facilitator, you will recognize the value of using idea generation methods to help the group be creative, and to help assure that everyone gets their ideas into the idea mill. The newer methods of idea generation have many advantages over the older methods. Brainwriting or NGT can be used to draw out most of the ideas of a group in a short time (less than an hour).

For conceptual design, the first kind of idea generation involves the generation of options. An option is something that is perceived as a possible choice that could be made later in order to arrive at a conceptual design of a system.

It is usually true that if a group tries to generate ideas to fit within a structure of some kind, this inhibits the work of the group a great deal. Therefore we urge that the group be asked to generate options, but not to try to imagine that they are in any preconceived set of categories. Categorization will usually be needed, but it can come later after the options themselves have been generated.

Step 3. Categorization of Options

The ISM process can be used to help a group arrive at a categorization of options. If the group has access to a time-shared computer through a terminal and a telephone line, this will be very helpful, but some facilitators have learned to carry out the ISM process without the computer. We don't recommend this, except for a very skillful individual.

The relationship to be used in structuring is "is in the same category as". If the group structures the options using this relationship, and makes modest amendments to the final result, you should find that all the options can be placed in meaningful categories without too much trouble.

You will notice that we have given a set of options and have placed them in categories. We will mention this again in more detail shortly.

Step 4. Identification of Design Dimensions

Good facilitators understand that a point may come in the work of a group where some steps must be taken that are necessary to get results, even if some damage is done to the participation.

It may turn out that the number of categories found in Step 3 is quite large, and that the amount of work facing the group to deal with all these categories is horrendous. Even if this is not true, it may be that some of the categories are not useful.

In this Step 4, the group is asked to decide whether each category should be retained or not. The test to be used is whether the group feels that it is necessary to make a choice of options in that particular category in order to be able to arrive at a conceptual design of a system.

If the group believes that a category is essential, then we say that category is a dimension of the system to be designed.

Now it may turn out that all categories will be judged to be dimensions. If this is so, it simply means that the facilitator and the group have their work cut out for them.

Just as it is not right to keep categories in that are not necessary, so it is not right to take them out if they are necessary.

You can see, by reference to Figure 3.1 that we have identified ten dimensions for the design of a RELS, and that we have shown 46 options arrayed under the ten dimensions.

Step 5. Construction of Options Field

The construction of the options field is just a drafting or typing job. Figure 3.1 shows how a completed options field looks. The options are grouped under their designated categories, and the categories are the ones that have been identified as dimensions.

The bullets in front of the options are available as ways to tie selected options to the "tie line", a step that will be discussed later.

Step 6. Describing the Options and Dimensions

While not strictly necessary for the working group, it seems highly advisable for purposes of educating others about the work of the group to make up a written description of the options and dimensions, so as to consolidate the results of the work so far.

Step 7. Developing the Restrictions Structure

One of the problems that the group will recognize, knowing that they will be asked to decide which options should be selected for the conceptual design, is that there must be a way of deciding in what order the choices will be made.

The way in which an order can be specified is simply to specify which dimension will be used to make the first choice, which dimension to make the second choice, and so on.

Without such an understanding, the group would probably flounder. One of the difficulties is that the group cannot readily distinguish (without help) between built-in constraints and the exercise of free choice.

Our solution to this is to deal with the built-in constraints first.

The way this is done is to ask the group to structure the dimensions using the ISM process. This will be done, as usual, in a group discussion mode, and the options field will be in front of everyone as a visual aid to the discussion.

The typical question is:

> "Is there some option in dimension X, which, if chosen, would eliminate some option in dimension Y?"

This prototype question allows the ISM process to be used to develop a restrictions structure on the dimensions.

The restrictions structure may have several disconnected parts. Some of the parts may contain cycles. We will use the restrictions structure as a given, and as a partial initial structure, to be modified further by group preference in arriving at a sequence of consideration of dimensions.

Step 8. Developing a Composite Precedence Structure

If there are any cycles in the restrictions structure, each is dealt with separately. Each of them can be structured into a linear sequence using the typical question:

> "Do you prefer to make a choice in dimension X before making a choice in dimension Y?"

After each cycle is structured this way, the partial sequence should be displayed before the group on a blackboard or other large display. The group then is asked to decide on an order for working with each part of the resulting structure. (Of course if there is only one part, there is nothing left to decide.) We are assuming that the group prefers to deal first with those dimensions that are most highly restrictive, since this will simplify their succeeding work. In any case such a choice is not constraining, because iteration is almost always needed anyway.

Again the ISM process can be used (with the bordering algorithm), but it may well not be necessary to use the computer. If there are just three or four parts, the facilitator can probably get the group to develop the rest of the composite precedence structure by asking a few questions.

When this step is complete, the group will have a linear hierarchy containing as many levels as there are dimensions in the options field. This will show how the group intends to sequence their decision making as they begin to choose options.

Step 9. Choosing from the First Dimension

Next the group is asked to choose one option (or more than one, a composite option) from the first dimension. It is possible to use ISM for this purpose, with a relationship like "is preferred to", but it may not be necessary unless the number of options is rather large, such as ten or more.

As soon as the group has decided on the option(s), the appropriate bullet is tied to the tie line in full view of the group.

Step 10. Ruling Out Option(s)

Next the group is asked to identify any options in other dimensions that have been ruled out by the choices made in the first dimension. If there are any, lines are drawn through these options on the options profile, to indicate that the group need no longer deal with these options, since they have ruled them out by their own choice.

The group can take advantage of their prior work with the restrictions structure. If that structure is displayed for the group, it reminds them of the restrictions that they had identified earlier, and helps with the ruling out of options.

Step 11. Repetition

Next, Steps 9 and 10 are repeated until all of the dimensions have been addressed in sequence. When this is done, we say that the group has drafted an options profile.

Step 12. Checking and Amending

The next step is for the group to review the work they have done and see whether they are dissatisfied with anything that they have produced. If so, amendments can be made at this point.

Step 13. Documenting

After the group is satisfied that it has an acceptable options profile, it is worth documenting much of the thinking that went into this production. If resources are available, a report that explains the activity, the thinking, and the results should provide a useful communication and education tool.

SUMMARY FLOW CHARTS

Summary flow charts that highlight the foregoing are provided in Figures A-1, A-2, and A-3.

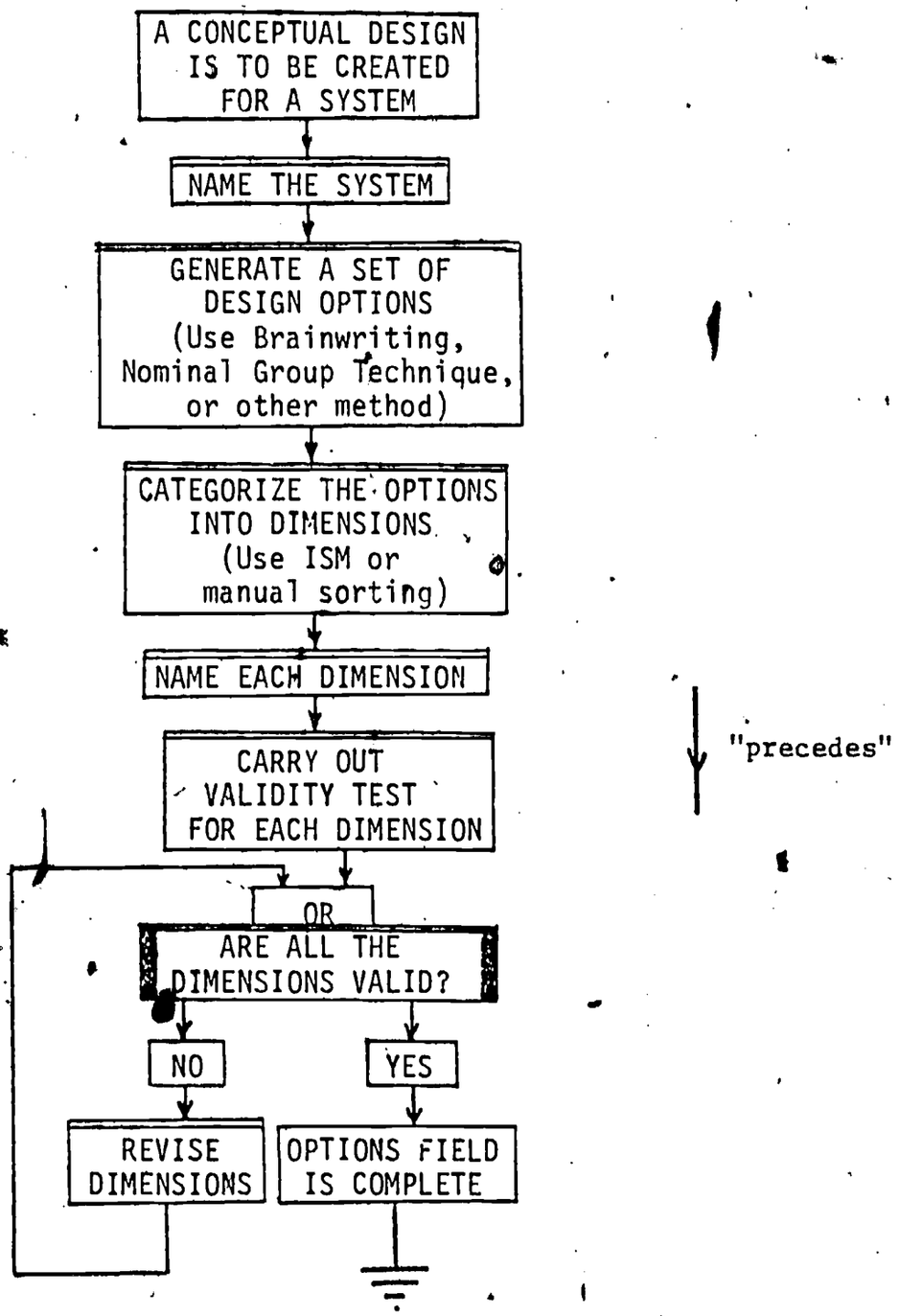


Figure A-1 FORMING ALGORITHM (a procedure for forming the Options Field)

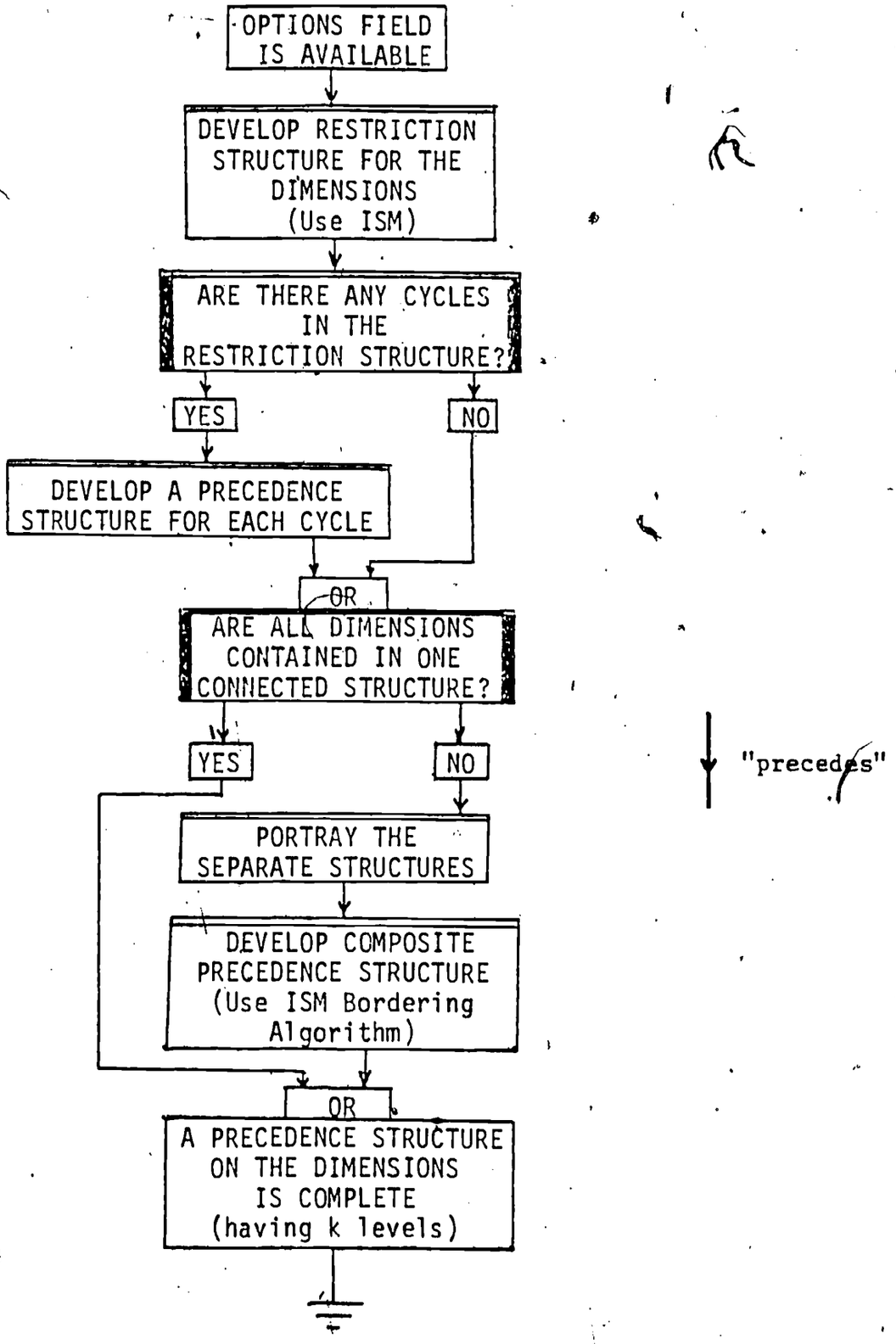


Figure A-2. SEQUENCING ALGORITHM (procedure for deciding in what order to look at the dimensions, in selecting options)

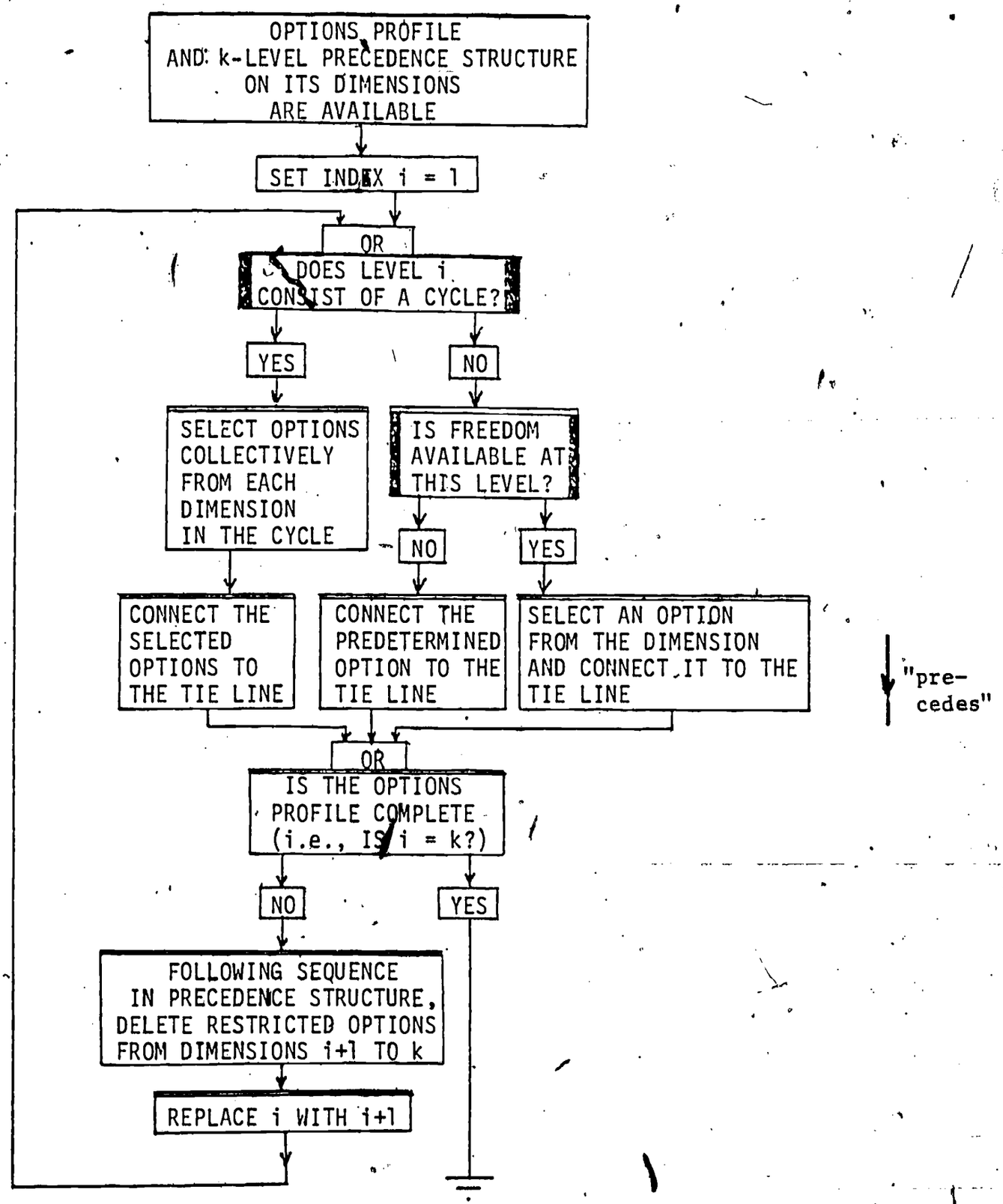


Figure A-3 CONSTRUCTION ALGORITHM (procedure for constructing the Options Profile)

THE LAW OF REQUISITE VARIETY

If, in addition to being a facilitator, you are a systems-oriented individual, you may be familiar with the Law of Requisite Variety. This Law, formulated by the late Professor Ashby, states, in essence, that if an issue or system or problem has a certain number, say N, dimensions, then you must, if you wish to resolve that issue or design that system or solve that problem, create a resolution or design or solution that, itself, has N dimensions.

The dimensionality of the remedy must match the dimensionality of the disease.

In presenting this rather involved methodology for the conceptual design of a RELS, we are primarily motivated by the belief that there is no substitute for thorough, high quality, conceptual effort in ameliorating the problems that face our society today. We see nothing unique about environmental education, from this perspective. It is a field that offers as much of a challenge as many of the more publicized problems.

We believe that some of the factors stressed in the Environmental Education Act, such as economics, population, etc., could sensibly be addressed through the use of the methodology we have set forth for the design of a RELS.

While we understand the reasons that systematic methods often are not used either to analyze, to design, or to communicate, we also understand that the consequences are often severe, and they damage our sense of what is right.

It is our conviction that skillful facilitators can help to develop a new sense of responsibility, and a new respect for the use of knowledge at the same time as they are helping people to be more effective in working toward goals to which they are already committed.

Distribution

Copy No.	
1 - 6	Mr. Walter Bogan, Director Office of Environmental Education 400 Maryland Ave. S. W. FOB #6, Room 2025 Washington, D. C. 20202
7 - 8	Mr. George Coates Office of Environmental Education 400 Maryland Avenue S. W. FOB #6, Room 2025 Washington, D. C. 20202
9	Dr. Alexander Christakis University of Virginia Engineering Science and Systems Department Room 234 A & M Building
10	Bro. Raymond Fitz Office of the President University of Dayton Dayton, Ohio 45469
11	Dr. H. Grant Goodell Department of Environmental Sciences Clark Hall University of Virginia
12	Dr. R. W. House Box 6188, Station B School of Engineering Vanderbilt University Nashville, Tennessee 37235
13	Dr. Robert Waller Department of Business University of Northern Iowa Cedar Falls, Iowa 50613
14	Office of Sponsored Programs Madison Hall University of Virginia
15 - 24	J. N. Warfield Department of Electrical Engineering University of Virginia

Distribution (cont.)

25 - 26 MS E. H. Pancake
Science/Technology Information Center
Clark Hall
University of Virginia

27 RLES files

28 Professor Robert Stake
CIRCE
College of Education
University of Illinois
Urbana, IL 61801

29 Dr. Tom Hastings
CIRCE
College of Education
University of Illinois
Urbana, IL 61801

30 Dr. Bela Banathy
Far West Laboratory
1855 Folsom Street
San Francisco, CA 94103

UNIVERSITY OF VIRGINIA

School of Engineering and Applied Science

The University of Virginia's School of Engineering and Applied Science has an undergraduate enrollment of approximately 1,300 students with a graduate enrollment of approximately 500. There are 125 faculty members, a majority of whom conduct research in addition to teaching.

Research is an integral part of the educational program and interests parallel academic specialties. These range from the classical engineering departments of Chemical, Civil, Electrical, and Mechanical and Aerospace to departments of Biomedical Engineering, Engineering Science and Systems, Materials Science, Nuclear Engineering and Engineering Physics, and Applied Mathematics and Computer Science. In addition to these departments, there are interdepartmental groups in the areas of Automatic Controls and Applied Mechanics. All departments offer the doctorate; the Biomedical and Materials Science Departments grant only graduate degrees.

The School of Engineering and Applied Science is an integral part of the University (approximately 1,530 full-time faculty with a total enrollment of about 16,000 full-time students), which also has professional schools of Architecture, Law, Medicine, Commerce, and Business Administration. In addition, the College of Arts and Sciences houses departments of Mathematics, Physics, Chemistry and others relevant to the engineering research program. This University community provides opportunities for interdisciplinary work in pursuit of the basic goals of education, research, and public service.