Environmental Education In the K-12 Span

By LeVON BALZER

A widely accepted definition of environmental education is not available at the present time, in spite of the extensive emphasis upon the environment and environmental education. In addition, various terms are being used with a wide range of meanings. To clarify discussion in this paper, a brief discussion of some of these terms follows.

Nature study. This complex and diverse movement was initiated at the turn of the century by Liberty Hyde Bailey and associates at Cornell University. A major purpose was to get children to know and love their environment by observing their surroundings. The beautiful, the curious, and the unusual were often emphasized more than the understanding of scientific principles. Actual content included such aspects as field work, soils, aesthetics, farm and city locations and landscapes, building construction, economics, and politics. In addition, form, making and modeling, work with numbers, colors, drawings, and music were activity areas emphasized. There was emphasis on the out-of-doors, field trips, and plant and animal identification, measurement, comparisons, and representation of results. There was much concentration on aesthetic, emotional, and moral values.

Conservation education. The efforts and achievements of conservation education will not be detailed here, but mention of some major areas of attention seems appropriate. Content aspects have traditionally included soil, water, air, plant and animal identification, wildlife, and forestry. Other areas that have often been included are human resources, agriculture, rocks and minerals, space, energy, and basic ecology, including succession. Techniques of field-trip organization, sampling, collecting, and recording have commonly been taught.

Many organizations have been actively involved in conservation education over the years. State departments of natural resources, county soil and water conservation districts, and various park boards and commissions are often involved at the state and local levels. Other organizations are National Wildlife Federation, Nature Conservancy, National Aeronautics and Space Administration, National Audubon Society, National Park Service, Sierra Club, Soil Conservation Service, Tennessee Valley Authority, U.S. Atomic Energy Commission, U.S. Department of Agriculture, U.S. Forest Service, state departments of education, state game and wildlife commissions, state departments of conservation, and the Ozark Society. Often, private industries make free or inexpensive educational materials available, but the educator should be aware that these materials are likely to represent and promote the particular view of conservation that is suitable to the industry involved. The same can also be said, of course, about the various interest groups and governmental agencies listed above.

Outdoor laboratories and outdoor education. A clear-cut distinction cannot be made between current usage of the terms conservation education and outdoor education. It is possible, however, to suggest a distinction on the basis of overall goals. Conservation education has often focused extensively on the many content topics listed above, while outdoor education has been seen as education executed under

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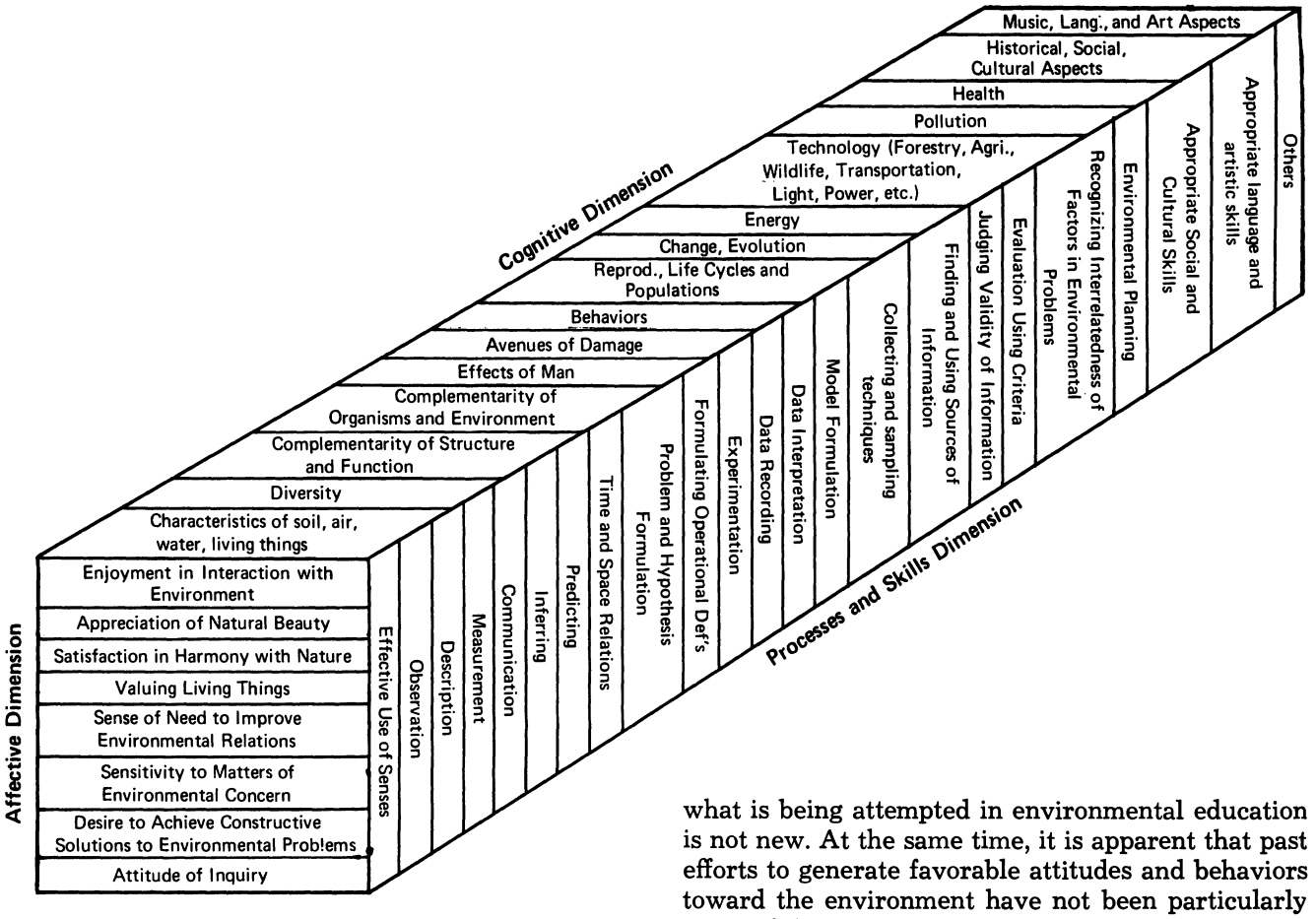
Fig. 1. Grid suggesting some major areas of objectives in environmental education.



the ideal conditions of the out-of-doors. Thus, the goal of outdoor education is to provide a learning climate (out-of-doors) which facilitates the achievement of various educational objectives. Accordingly, the literature of outdoor education often deals with such aspects as management of an outdoor laboratory, programming, and the planning of grounds and facilities.

The content to be achieved may be similar to that described above for conservation education, but it often includes also objectives in the areas of language arts, industrial arts, music and art, social studies, mathematics, health, and physical education. Various individual programs also suggest affective (value, appreciations, etc.) and inquiry objectives in addition to the content areas already suggested.

Outdoor recreation. Camping, hiking, and Scouting are other outdoor educational endeavors often emphasized. Achievements include working together, preparation of temporary shelters, food preparation, helping one another, sharing and taking responsibility, and physical conditioning. Various other content and affective objectives may be incorporated as well.

Environmental education. Obviously, much of what is being attempted in environmental education is not new. At the same time, it is apparent that past efforts to generate favorable attitudes and behaviors toward the environment have not been particularly successful. Americans pollute and destroy their environment with little or no evidence of reluctance.

The Need for Objectives

The major objectives of nature study, conservation education, outdoor education, and outdoor recreation are not readily disputed. They continue to be appropriate areas of concern. However, if environmental education is to become effective in changing behavior, objectives with behavioral foci will have to be developed. Curriculum development must then proceed in a manner compatible with these objectives, incorporating instructional strategies which develop behavioral changes. It appears, then, that environmental education must be an attempt to alter the behaviors of modern man by persuasion. There may be differences of opinion regarding the form this persuasion should take. Perhaps one individual will be persuaded on the basis of individual inquiry; perhaps another is persuaded on the basis of appreciations developed in contrasting environments. In any case, the individual is to be persuaded to behave in a manner less detrimental to, and more in harmony with, the environment than the past behaviors of modern man have been. We might expect these behaviors to be expressed in at least two forms: (i) behaviors implying concern about the effects of personal environmental destruc-

tion; and (ii) behaviors implying concern about the environmental destruction caused by others. Thus environmental education must be that which facilitates the achievement of such behaviors. As a science educator, I would say that such education should also be scientifically legitimate.

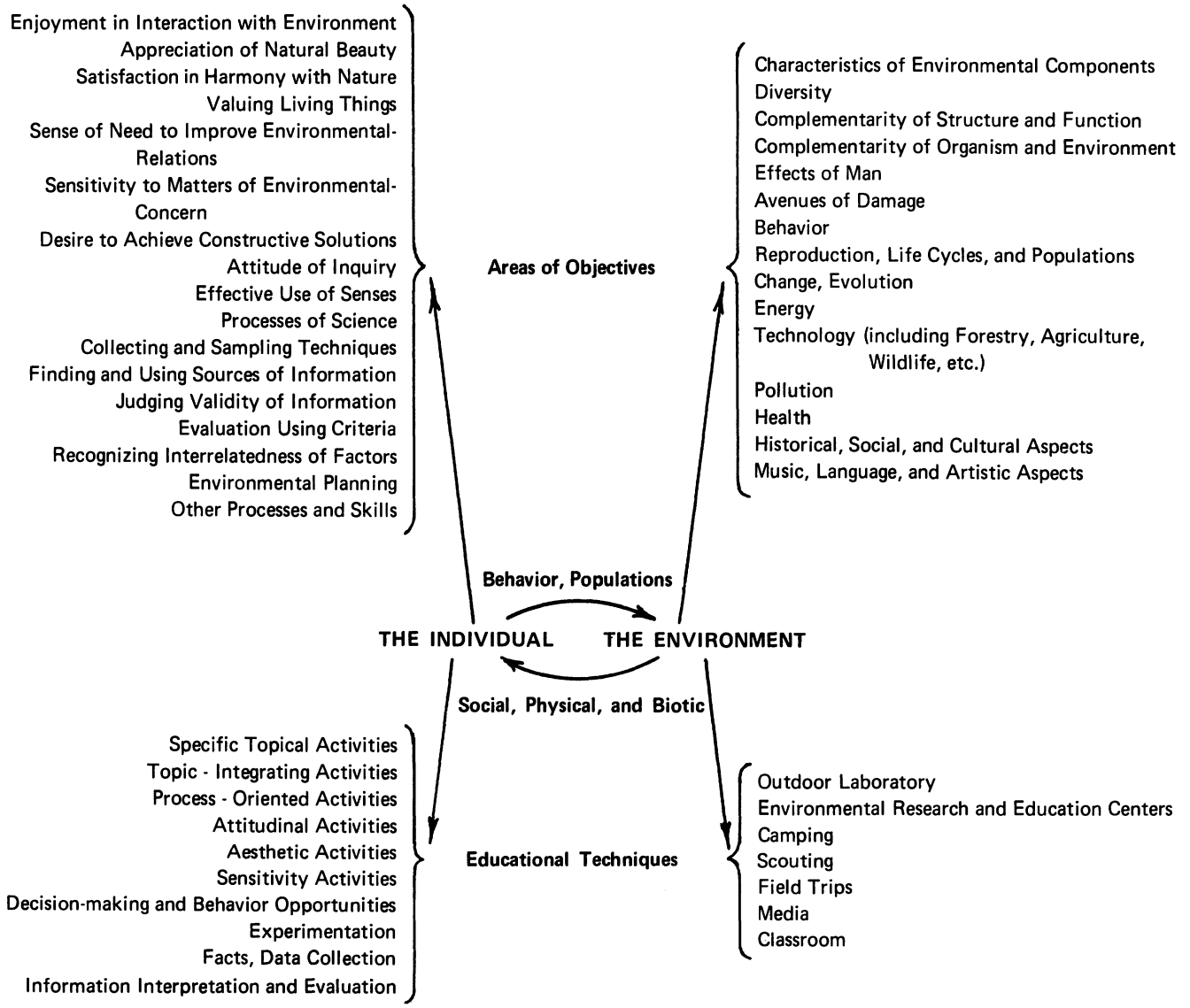
As those who have been involved in curriculum development can recognize, the specific behavioral objectives of environmental education will be very numerous. Behavior that is in harmony with the environment has many facets. Some of the areas of concern and behaviors are discussed in the next section.

Areas of Objectives

In fig. 1 are shown some of the major areas of interest to the biology educator, in which behavioral objectives might be specified in environmental education. The activities and experiences of environmental education would constitute the volume of the grid and a given experience (visualized as being *within* the box) would normally have components in each of the three dimensions. In some cases, attitudes might be more heavily emphasized and in other cases one of the other dimensions might receive more attention. Such an encompassing view of objectives is appropriate if people learn individually and are persuaded individually through a variety of means.

A complete discussion of the grid is not possible here, but several features should be noted. Several of the unifying themes of BSCS (see E. Klinckman, ed., 1970: *Biology Teachers' Handbook,* 2nd ed., John Wiley & Sons, New York) appear to be particularly appropriate in environmental education and have been incorporated in the cognitive dimension. Second, various applications of our scientific knowledge must be incorporated if values concerning the environment are to be addressed, so technology is included in the cognitive dimension. Third,

Fig. 2. Preliminary scheme of major relationships involved in environmental education.



if we have the kind of faith in scientific inquiry that we usually claim to have, inquiry should be a major method used. Thus, various processes of science have been incorporated, including those of the process approach (see A. Livermore, 1964: "The process approach of the AAAS Commission on Science Education," *Journal of Research in Science Teaching* 11: 271-282).

Certainly the grid of fig. 1 should not be seen as complete or final. The major emphasis here is on science, with various other curriculum areas only mentioned. As our understanding of environmental education develops, additions, deletions, or other modifications will be necessary. The point is that if the major behavioral outcomes described in the previous section are to be realized, decisions will need to be made regarding emphasis upon at least these three dimensions in the educational experience. Furthermore, activities considered should be analyzed to ascertain their strengths in these dimensions and to avoid a curriculum heavily imbalanced with respect to the dimensions.

Fig. 2 is an attempt to illustrate some of the major relationships of environmental education. At the center of the scheme are the individual and the environment, which interact as indicated. Associated with the individual are numerous areas of objectives within which behavioral examples can be specified. Also associated with the individual are the various types of activities in which he will be participating, thus gaining experience in the performance of the types of behaviors being specified. Associated with the environment are various areas of information with which the student will have experiences and in which cognitive behavioral objectives may be specified. Also associated with the environment are examples of educational techniques in terms of environmental setting. Specific behavioral objectives may also require behaviors integrating these two groups of objectives. The experiences themselves occur in an integrated manner.

Illustrative Behavioral Objectives

To illustrate, let us consider some specific examples.

1. For the primary grades, let us consider the following behavioral objective: "The child will respond enthusiastically and provide reasonable answers when asked what he enjoyed about the walk he and his classmates took through the woods."

2. For the intermediate grades, let us consider the following behavioral objective: "The child will spontaneously or voluntarily suggest the need to improve a situation, based upon his interpretation of data provided."

Behavioral objective #1 may deal with enjoyment in interaction with the environment, appreciation of natural beauty, or valuing living things (fig. 1). In any case, the affective dimension (attitudes) (#1) is represented. Though other concepts or knowledge might also be represented, the child will usually provide or imply characteristics of such features as soil, air, water, or living things, thus representing the cognitive dimension (knowledge, concepts). Typically, at least the processes of observation and description are represented in the achievement of this objective. To repeat for emphasis: the above does not suggest that all specific behavioral objectives will have equal components in all three dimensions of the grid (fig. 1); indeed, this would be unnecessarily difficult to accomplish. However, broad goals and specific objectives should be developed and implemented with an awareness and deliberate evaluative decision regarding all three dimensions in the curriculum.

The attitudes and processes described above are examples from the areas of objectives that describe the individual (fig. 2), and the information about the environment stated or implied by the individual partially describes the environment. (The behavior itself also partially describes the individual, of course, but the information conveyed pertains more directly to the environment than the individual in this case. The attitudes and processes conveyed, on the other hand, pertain more directly to the individual than the environment.) Quite likely the teacher would consider the activity to have an attitudinal, aesthetic, and sensitivity orientation, though it could be a combination of others as well. Facility-wise and environment-wise, it is a field trip, although it may also be taking place in an outdoor laboratory or other specifically designated facility.

It should be apparent in the example provided that there is an environmental influence upon the child through the social, physical, or biotic context that is provided. It is also clear that achievement of this specific objective is consistent with our overall goal of persuading the student to behave in a manner less detrimental to the environment, though the two are certainly not synonymous. This transfer of behaviors will continue to be very difficult and much will continue to depend upon teacher strategies and behaviors. A bit more will be said about this later.

In the second behavioral objective provided above, the child provides evidence that he senses the need to improve environmental relations (fig. 1) and perhaps implies achievement of other areas of affective objectives. The knowledge or concepts reflected depend upon the nature of the data, of course, but population, pollution, effects of man, and "major applications" would all be fertile areas. Some of the processes likely involved would be inferring, predicting, problem-formulating, and, especially, interpretation of data. Attitudes, processes, and information can be related to the child and the environment (fig. 2) in much the same manner as in example #1. The activity would probably be topical and focus on information interpretation and evaluation (fig. 2). As described here, the activity could take place in the classroom.

Organization of Content and Learning Experiences

A major goal of environmental education has been presented, and various subsumed areas of objectives within three dimensions have been suggested. The bases of these selections include such considerations as goals, student interest, and appropriateness, validity, and significance of content. Similarly, the organization of content and learning experiences must incorporate considerations such as child development, interest, logical structure of disciplines, the nature of learning, attitude development, facilities, social context, and teacher preparation. In actual curriculum development, such considerations are highly numerous and detailed. Furthermore, since curriculum development is a continuous process, content and organization will undergo more or less continuous change. Let us not be distracted here by the current hypothesis, however, that children should determine their own learning experiences. The potentiality for these experiences must still be provided at least in part through the curriculum; hence, a certain degree of structure and organization is needed for planning.

In the primary grades, consideration such as the following appear to be defensible:

Basic skills and processes of science (use of senses, measurement, etc.)
Characteristics of soil, air, water, organisms (observation, description)
Diversity (from obs., classif.)
Life Cycles (change, time relations)
Population (numbers, time)
Change (obs., inference, time relations)
Homes and habitats, needs
Gardening, foods
Weather, seasons
Behavior
Effects of man (obs., inf., likes, dislikes)
Avenues of damage (obs., inferences)
Pollution
Health
Enjoyment in interaction with environs
Valuing living things
Appreciation of natural beauty

Obviously, the above list is neither complete nor adequate. However, it should provide an overview of the kinds of areas in which specific behavioral objectives should be developed for the primary grades.

In the intermediate grades, the areas listed for the primary grades should be reinforced and deepened. Beyond these, the following areas of objectives should be emphasized:

Integrated processes of science (experimentation, model formulation, etc.)
Collecting and sampling techniques
Finding and using sources of information
Energy (light, heat, temperature, etc.)
Local changes, historical considerations
Complementarity of structure and function
Food webs (organism and environment)
Environmental factors and living things
Communities
Agriculture, food production, and simplicity
Forestry
Wildlife conservation
Satisfaction in harmony with nature
Attitude of inquiry
Sense of need to improve environmental relations

In the middle schools and junior high schools, many of the previously mentioned areas should again receive additional attention. The following additional areas or more specific examples within areas of objectives should be incorporated at the middle school level:

More complex instances using integrated processes of science
Greater independence in finding and using sources of information
Environmental changes, succession
Interaction
Ecosystems
Decision-making (local issues, committees, interest groups, etc.)
Health and medical considerations
Local cultural and social studies (special speakers, etc.)
Sensitivity to matters of environmental concern

In the high schools, much of the attention of environmental education must be given to experiences that will provide increased sophistication in the areas already listed for the previous levels. In addition, considerable emphasis should be given to such areas as the following:

Evaluation using criteria
Judging validity of information
Recognizing interrelatedness of factors in environmental problems
Environmental planning
Desire to achieve constructive solutions to environmental problems

The areas of objectives as organized for the various school levels obviously should not be taken as mutually exclusive or strictly sequential. Evaluation as a skill will be taught before the high school, but it should be emphasized at the secondary level. Hence, the content of environmental education should not be seen as strictly sequenced, but an overall pattern does emerge. Needless to say, future experience may indicate a need for extensive modifications.

A few words should be said about the complexity and messy appearance of the environmental-education curriculum. First, we should attempt synthesis and simplifications of this proposal. Second, we should be prepared to accept that environmental-education-curriculum development that is specific enough to facilitate implementation may be highly complex. The problems of the environment and environmental education are highly complex and pervasive. This writer is impressed that the task before us in environmental education may well be the most important and the most difficult one we have ever faced. **(To next page)**

Comments Concerning Implementation

Environmental education should not be "tacked on" or added to the existing K-12 curriculum. My suggestions for environmental education in this paper are strongly science- (especially biology-) oriented, but simply increasing the science content is not the solution either. The entire curriculum must be infused by the activities that facilitate improving man's relation to the environment.

Irwin Slesnick, in a paper presented at the 1970 convention of NABT, illustrated a mechanism for accomplishing such infusion in the area of population education by bringing together various areas of the curriculum (such as art, social studies, health, science, etc.) on a grid. Space does not permit detailed treatment of this mechanism here, but this process must be carried out in environmental education. When the potential contributions of all these areas toward the ultimate behavioral goals of environmental education are worked out, we will be moving toward the total curriculum of environmental education in the K-12 span. In the process, we may even evolve some major themes around which our objectives can be more simply structured.

Water Pollution . . . from p. 213

to attend. At the close of the summer the 71 schools reached in the various programs (55 in summer 1970) were placed in the cluster groupings for coordination, and the learning guide of activities was published in draft form. Funding for the establishment of training programs within the clusters around the United States is being sought for programs in the coming summer. The Tilton program has been encouraged to take up other concerns, such as urban problems, using the same problem-solving involvement of students and the same cooperation of teachers and students in writing curricula.

Fully aware of the environmental crisis, the need for environmental education, the value of the stimulating educational approach achieved at Tilton School, and the rapid growth of the Tilton program, the participants left Tilton with a pile of preliminary documents for testing in their schools. In a very real sense, these teachers *were* the Tilton program. Plans for information exchanges, newsletters, and school visitations were on everyone's tongue—all keyed toward the June 1971 publication goal. All were reluctant to leave, for they had been actively involved in a learning process that was enjoyable to themselves and useful to the community.

On a subject as diverse as that of water pollution, one could never produce an inclusive document. And the guide should be left incomplete for another reason. Said one student, "If we answer all the main questions, we've closed the door for the teacher or student who might want to develop a new activity of his own."

DEVELOPMENTAL ECOLOGY

"Developmental ecology" is the name proposed to describe a new area of basic research by University of Wisconsin zoology professor Robert Auerbach.

Addressing the National Biological Congress in Detroit, Auerbach described developmental ecology as the study of the relationship between environmental factors and developmental processes.

"While in the past scientists have performed research on the effects of specific agents, such as x-rays or thalidomide or hallucinogens, and examined such things as death of embryos or cleft palate or absence of limbs, it is essential that scientists now attempt to assess the impact of the total environment on such developmental processes. Not only on the formation of the embryo, but aging, development of behavior, immunity, and the ability to repair damaged tissues and heal wounds," Auerbach said.

What is the total environment? Auerbach explained that there is accumulating evidence of effects of light cycles, of sound and ultrasound, of radio waves and radiation, of oxygen levels, pollutants, hormones, and food additives, of general nutrition—of the environment as a whole—on the developing cells and systems of the body.

"Therefore," he held, "total assessment is mandatory. Obviously, we do not escape the environment, but we can examine alternatives for what that environment should consist of. And developing systems, be they embryos or blood-forming tissues, growing bones or aging skin, are extremely sensitive to their environment.

"As long as we cannot assess the sum total of environmental influences on development," he said, "decisions about drug safety, nutrition, radiation, and the myriad of other environmental modifiers will continue to be based on piecemeal, unilateral decisions, like banning this additive or eliminating that hormonal treatment."

Of Learning and Living

This poem was written by John Breukelman in 1943, and the italicized portion is engraved on a bronze plaque in the new Breukelman Hall on the campus of Kansas State Teachers College, Emporia.

TO A STUDENT

As it cannot be told
That anyone has sold
  Unless someone has bought,
So if you do not learn
Of living when you turn
  To me I have not taught.
You must choose the way,
The things you do and say,
  Whenever you respond
For I can do no more
Than set ajar a door
  Into a room beyond.