DOCUMENT RESUME

ED 224 695 SE 039 734

TITLE	Identifying Environmental Education. Unit 2 of 6.
INSTITUTION	Pennsylvania State Dept. of Education, Harrisburg.
PUB DATE	[82]
NOTE	11p.; Units 3-6, in all likelihood, will not be completed.
PUB TYPE	Guides - Non-Classroom Use (055)
EDRS PRICE	MF01/PC01 Plus Postage.
DESCRIPTORS	*Cognitive Development; Cognitive Processes; *Curriculum Design; *Curriculum Development; *Developmental Stages; Educational Quality; Elementary Secondary Education; *Environmental Education; Moral Development; *Values
IDENTIFIERS	National Science Foundation; *Pennsylvania; Piagetian Theory

ABSTRACT

This is the second in a series of six units for administrators and teachers to serve the Environmental Goal, one of Pennsylvania's Twelve Goals of Quality Education. The environmental goal states that quality education should help every student acquire the knowledge and attitudes necessary to maintain the quality of life in a balanced environment. The objective of this unit is to learn about Piaget's developmental theory and its implications for designing environmental education curriculum. Topics discussed in the unit include: (1) nature of environmental education and its processes; (2) Piaget's developmental theory of learning; (3) transition between representational and formal thinking; (4) cognitive development, values, and environmental education; (5) list of values extracted from the philosophy of Ralph Barton Perry which provide guidance to facilitate transition to formal operations and to the learning of environmental education; and (6) implications of developmental theory for environmental education curriculum. A short unit test (with answers) is provided. (Author/JN)

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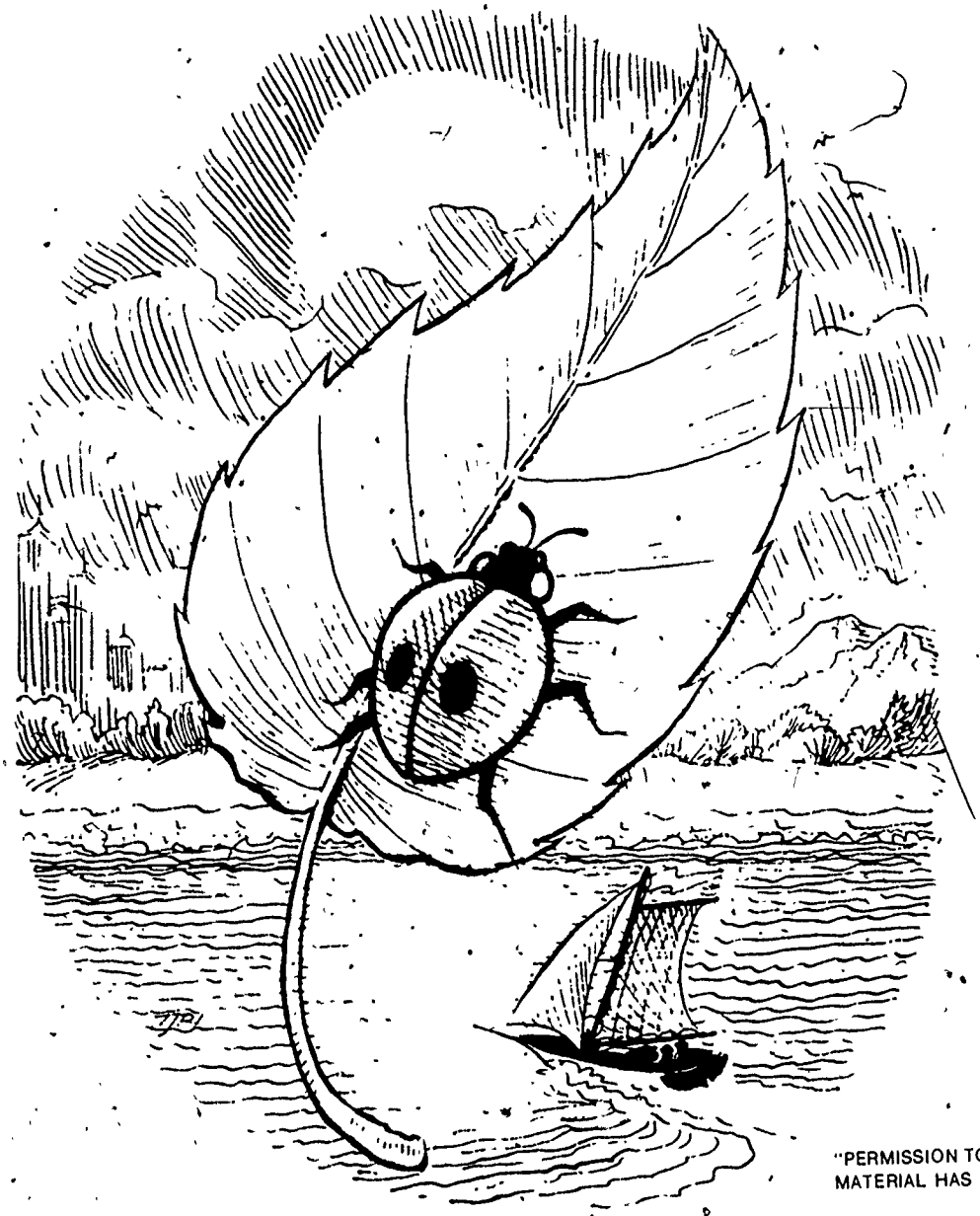
Identifying Environmental Education



Unit 2 of 6

Pennsylvania Department of Education 1981

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Unit 2

Implication of Developmental Theory for Designing Environmental Education Curriculum

Objective: The objective of this unit is to learn about Piaget's Developmental Theory and its implications for designing Environmental Education (EE) Curriculum.

Results: Upon completing this unit, you should become familiar with the following:

- The basic elements of Developmental Theory;
- The differences between Representational Operations and Formal Operations;
- The significance of Formal Operations in Environmental Education;
- The relationship between Cognitive Development and Moral Development and the role of values in Environmental Education;
- The instructional strategies to facilitate the transition from Representational Operations to Formal Operations;
- The implications of Developmental Theory for EE Curriculum design.

CONTENT OF THE UNIT

1. Environmental Education

Environmental Education (EE) as defined in Environmental Education Act of 1970 means "the educational process dealing with man's relationship to his natural and human surrounding, including the relation of population, pollution, resource allocation and depletion, conservation, transportation, technology, economics, and urban and rural planning to the total environment." The EE process is therefore interdisciplinary, problem-oriented, holistic, and integrative. The process should be designed to help the learners develop problem-solving capabilities by learning to organize diverse information pertaining to environmental issues under integrative and holistic principles.

The EE process includes the following learning elements:

- An ability to conceptualize issues in interdisciplinary terms in order to take into account the interrelations between economy, environment, resources and culture;
- An ability to integrate complex and diverse information for problem-solving;

. An active interaction with the surrounding physical and social environment in order to facilitate learning about the economiv, social and environmental problems;

. Particpatory mutual learning and social interaction according to shared societal values.

We shall examine below how Piaget's Developmental Theory offers an appropriate learning framework for effectively carrying the process of environmental education.

2. Developmental Theory of Learning

The Developmental Theory of Learning is concerned with how individuals unite discrete experiences into a general and holistic conception of the world. Piaget, who formulated the theory, argued that Cognitive Development of children proceeds through four successive periods.

1. The Sensorimotor Period--Birth to 18 months.

2. The Preoperational Period--18 Months to 7 years.

3. The Representational Period--7 years to 12 years.

4. The Formal Period--12 years and above.

The cognitive development through each period leads the individuals to conceptualize the world in more complex and more integrative manners.

Evidence suggests that the transition from period 1 to period 3 is more or less age-bound while the transition from period 3 to period 4 is not necessarily a matter of age but more of a result of learning. The age corresponding to each period merely indicates the readiness of the individuals to make this transition. The transition from Representational Period to Formal Period is the most important phase of cognitive development. This particular transition adds to the individuals capability of order and reordering empirical facts under abstract conceptual schemes.

At the Representational level, an individual views the world in terms of specific concrete images--the individual mentally represents real objects. He approaches facts as given, is able to manipulate them in a variety of ways, but unable to "hypothesize" objects. The thinking at this level is empirically based. For instance, thinking of the problems of urban environment, an individual at the Representational level is able to identify a number of empirical referents of urban life such as "urban sprawl," "lack of adequate spaces and parks," "racial and economic segregation," "low income housing shortage," "air and noise pollution," and so forth. The individual is able to interrelate these elements but does not not order these elements under some formal principles.

Formal thinking involves the ordering of empirical elements under some formal and abstract concepts. The formal concepts serve as higher order constructs within which factual

information is organized. By subsuming representational facts under formal concepts, an individual assigns a new meaning to the subject matter under study. For example, the individual approaching the problems of urban environment at a formal level identifies the relevant facts and orders them under certain formal principles such as resource "interdependence," "allocation of space," "mobility of patterns," etc. By employing such formal constructs, the individual finds an integrative rule for organizing the various elements of urban setting and for interpreting the problem.

A transition from the Representational Thinking to Formal Thinking contributes significantly to the process of environmental education. Formal Operations enable the learners to process, organize, and integrate complex and diverse information under holistic principles.

3. Transition between Representational and Formal Thinking

The dynamics behind the transition are less understood. However, Piaget specifies certain conditions of the learning settings which facilitate the transition. These conditions include:

. Exposure to surrounding environment;

. Social interaction;

. Encouragement by the teachers.

The learner's exposure to the environment outside the classroom and their interaction with social, economic, and environmental conditions helps them to experience contradictions, to identify unfamiliar situations, and to motivate them in exploring alternative explanations.

Social interaction within a peer group, both in formal and informal educational settings, helps to increase the complexity of the learners' representational systems and encourage them to search collectively for formal principles to integrate diverse information. Social interaction further helps in acquiring new concepts and in the social validation of individuals' concepts.

Participation and encouragement by the teachers to think in abstract and formal terms provides reinforcement to the learners and contributes to the development of Formal Thinking.

4. Cognitive Development, Values, and Environmental Education

Cognitive Development implies an ability to make a transition between Representational and Formal Thinking. The process of Cognitive Development greatly facilitates the learning process of Environmental Education by enabling the learners to process, organize, and integrate complex and diverse information.

The educational process is general, and the Cognitive Development process in particular, takes place within a set of values vis-a-vis the societal context of learning, social interaction, and the content and process of knowledge. The learning of Formal Operations and Cognitive Skills when carried out in the context of broader societal values contributes to the individual moral development. Thus, the individual moral development parallels Cognitive Development if an individual learns to carry Formal Operations in the context of socially agreed upon values.

Kohlberg, who extended Piaget's theory by relating Cognitive Development to Moral Development, argues that the transition from Representational Period to Formal Period opens the possibility for the individuals to apply values in carrying Formal Operations. Individual Moral Development is as important a factor in innovative learning as Cognitive Development. Kohlberg, however, does not specify a consistent set of values that could be applied in the process of facilitating the transition to Formal Operations and to the overall individual Cognitive Development. It appears that the educational process including the individual Cognitive and Moral Development should be guided by a philosophy of values that connects education methods and practices to the society in which education takes place.

The philosophy of Ralph Barton Perry, as analyzed and summarized by Steinberg,* provides an appropriate value-framework for educational process. The following set of values extracted from Perry's philosophy provide guidance to facilitate the transition to Formal Operations and to the learning of Environmental Education.

CLASSIFICATION OF PERRY VALUES

A. Context-Related

V-1 Democratic political system

B. Relational

V-2 Individual interests are related to the interests of others

C. People-Related

V-3 Presumption of capacity of each individual to contribute to building a superior society

V-4 Presumption that people are the architects of order

D. Content-Related

V-5 Knowledge of the cultural inheritence

*I. S. Steinberg, Ralph Barton Perry on Education for Democracy, the Ohio State University/University Press, Columbus. 1970.

V-6 Preparation for participation in the contemporary world

V-7 Preparation to contribute to future civilization

V-8 Realistic understanding of the environment

V-9 Self-comprehension of one's own values and priorities, both as they are and as they ought to be

E. Process-Related

V-10 Free inquiry

V-11 Learning how to learn

V-12 Testing one's priorities against those of others

V-13 Structuring a benevolent society

V-14 Reasonableness, demonstrated by generating and testing rationale for decision making

V-15 Factual knowledge, when available, takes precedence over hope and taste

V-16 Agreement on how decisions will be reached

Piaget has specified exposure to the surrounding environment, social interaction among the peer group including the interaction between students and teachers, and a flexible structure of learning as some of the conditions to facilitate the transition to Formal Operations. The classification of Perry Values vis-a-vis the societal context, social interaction and the content and process of knowledge appear to support Piaget's conditions for the transition and to contribute to the Cognitive and Moral Development of learners.

5. Implications of Developmental Theory for EE Curriculum Design

Developmental Theory has several major implications for designing EE curriculum.

- A major objective of EE Curriculum should be to enhance the learners' ability in making a transition from Representational to Formal level of thinking thereby enabling them to conceptualize problems in integrative and formal terms. An EE curriculum should include both Representational and Content-oriented materials as well as Formal and Process-oriented materials. The Representational materials should be made gradually complex. The learners should be introduced to the process and organize the content-oriented materials.

- The sequencing of instructional presentations should move from Representational to Formal. The transition to Formal level is greatly assisted by the application of collective inquiry techniques such as Interpretive Structural Modeling (ISM) and Nominal Group Technique (NGT) which involve group interaction and decision-making. The collective inquiry techniques

enable the students and the teachers to share their knowledge with each other and engage in mutual learning. A number of other process-oriented techniques such as input-output analysis, feedback analysis, trend exploration, goal clarification, options analysis, etc. also help develop formal and decision-making skills.

The structure of the curriculum and the instructional strategies should be closely guided by Perry Values. The Perry Values relating to social interaction, content, and process of knowledge help to establish a conductive environment for developing formal and decision-making skills which specifically contribute to the environmental process and to a democratic educational process in general.

UNIT 5 .

UNIT TEST

1. What are the major assumptions of Development Theory of learning?

2. Describe the stages of Cognitive Development according to Development Theory. Why is the transition from Representational to Formal stage the most important part of Cognitive Development?

3. What are the basic distinctions between Representational and Formal thinking? Give an example.

4. What forms of learning conditions facilitate the transition from Representational to Formal Thinking?

5. How do Perry Values facilitate the process of Environmental Education?

6. Why do collective inquiry techniques such as Interpretive Structural Modeling (ISM) help the transition from Representational to Formal level of thinking?

7. What are the necessary elements of the Environmental Education process?

8. What is the significance of Developmental Theory for the teaching of Environmental Education?

9. What are the implictions of Developmental Theory for designing Environmental Education Curriculum?

UNIT 5

ANSWERS TO UNIT TEST

1. Developmental Theory assumes that learning is a function of uniting discrete pieces of information into a general and holistic conception of the world. The learners' ability to unite discrete experiences increases as they make a transition from Representational thinking to Formal Thinking.

2. Piaget described four stages of human Cognitive Development: the Sensorimotor stage, the Preoperational stage, the Representational stage, and the Formal stage. The development from one stage to the others is successive and age-related. The transition from Representational to Formal stage is the most important part of Cognitive Development because the ability to make this transition enables the learners to integrate complex information under Formal and Abstract concepts.

3. The Representational thinking is defined as thinking in terms of observable empirical facts. At the Representational level, the individual mentally represents real objects. The individual treats facts as given and fits them into his basic cognitive structure. He is unable to manipulate and restructure the facts with the help of hypothetical and formal concepts. The Formal thinking is characterized by an individual's ability to apply formal concepts to collect and organize facts. The individual does not approach the meaning of the facts as given but identifies them, selects them, and organizes them according to some integrative and holistic principles. For example, thinking of energy problems, a Representational thinker may view the problem in terms of such factors as the "energy prices," "patterns of energy consumption," "sources of energy supply," "energy-related environmental pollution," "foreign dependence on oil". and so forth. The individual may even be able to interrelate some of these empirical elements. At the Formal level, the individual will approach the empirical elements of the energy problem under a conceptual model or a formal scheme. He may select formal concepts such as "interdependence," "balance," "equity," and organize the Representational elements to interpret the energy problem.

4. An opportunity to actively interact with the surrounding environment social interaction among the learners and the teachers, and the teacher's encouragement to apply Formal reasoning facilitates the transition to a Formal level.

5. Perry has specified the democratic values relating to the educational process. The classification of Perry Values regarding the overall societal context of learning, social interaction, and the content and process of knowledge applied to learning process contribute to the Moral and Cognitive Development of individuals. The Cognitive and Moral Development contributes to the process of Environmental Education by enhancing the learners' capabilities to seek, process and organize complex information toward solving environmental problems according to domocratic values.

6. Collective inquiry techniques such as ISM are designed to enable mutual learning by encouraging group interaction and abstract thinking and therefore contribute to the transition to Formal Thinking.

7. The necessary element of Environmental Education include:

   a. An active interaction with surrounding environment;
   b. An ability to conceptualize issues in broader terms and generalize from one domain of knowledge to anotner;
   c. An ability to interrelate complex and diverse information under Formal principles.

8. Developmental Theory offers an appropriate learning framework for EE because of its emphasis on Formal Thinking and on integrating Formal and Informal learning. It focuses on learning strategies that combine interaction with environmental surroundings, collective learning process, and Formal thinking which greatly contribute to the EE process.

9. According to Developmental Theory, the EE Curriculum should include:

   a. A combination of Representational and Formal materials;
   b. Process-oriented material such as ISM to assist in the transition from Representation to Formal level, and;
   c. A learning structure that facilitates group interaction and is based on Perry Values.

   Representational materials that are introduced first should be later combined with Process-oriented materials to enable the transition from Representational to Formal level. The application of Formal thinking combined with Perry Values in conceptualizing and solving problems should be encouraged.