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AUTHOR Hosley, Edward Wendell
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ABSTRACT

In an attempt to compare two methods of instruction in environmental education, an instructional unit based on the balance of nature concept was developed according to a table of specifications which followed Bloom's Taxonomy of Educational Objectives: Cognitive Domain. Two versions of the instructional unit were prepared, one utilized a field or out-of-door approach and the second employed a three-screen slide tape presentation of the same concept. One hundred fifth grade students from Prince George's County (Maryland) Public Schools were selected at random and divided into four treatment groups of 25 each. Group 1 received no instruction, Group 2 received the slide presentation, Group 3 participated in the field approach, and Group four did both. A retention test was administered after the instructional unit was completed. It was found that: (1) students receiving the slide presentation scored as high as students participating in the field approach; (2) students receiving the slide presentation scored higher than students receiving no instruction; and (3) students receiving both instructional methods scored highest. (Author/TK)

A COMPARISON OF TWO METHODS OF INSTRUCTION IN ENVIRONMENTAL EDUCATION

by

Edward Wendell Hosley

Dissertation submitted to the Faculty of the Graduate School
of the University of Maryland in partial fulfillment
of the requirements for the degree of
Doctor of Philosophy
1974

APPROVAL SHEET

Title of Thesis: A Comparison of Two Methods of Instruction in Environmental Education

Name of Candidate: Edward Wendell Hosley
Doctor of Philosophy, 1974

Thesis and Abstract Approved: James Dudley
James Dudley, Ph. D.
Professor of Education
Department of Administration, Supervision, and Curriculum

Date Approved: 4/17/74

ABSTRACT

Title of Thesis: A COMPARISON OF TWO METHODS OF INSTRUCTION IN ENVIRONMENTAL EDUCATION

Edward Wendell Hosley, Doctor of Philosophy, 1974

Thesis directed by: James Dudley, Ph. D.
Professor of Education

In an attempt to compare two methods of instruction in environmental education, an instructional unit based on the balance of nature concept was developed according to a table of specifications which followed Bloom's Taxonomy of Educational Objectives: Cognitive Domain. Two versions of the instructional unit were prepared and judged for content adequacy by professionals in the field of environmental education. The first version utilized a field or out-of-doors method of instruction calling attention to physical evidences of plant and animal interaction which served as a basis for discussion of the balance of nature theme. The second version of the instructional unit employed a three screen slide tape (AMI) presentation of the same concept.

Three hypotheses were proposed for the study: (a.) Students receiving instruction in environmental concepts through AMI would score as high or equal to students who received instruction on the same concepts through field experiences on a retention test.

(b.) Students receiving instruction in environmental concepts through AMI would score significantly higher than students who received no instruction on a retention test. (c.) Students receiving instruction in environmental concepts through AMI would not score as high as students who received instruction through AMI plus field experiences on a retention test.

From a total population of four hundred fifth grade students participating in the Prince George's County (Maryland) Public Schools Environmental Education Program one hundred subjects were selected at random and assigned to four treatment groups of twenty five each. Group 1 served as a control group and received no treatment; group 2 received the AMI treatment; group 3, the field experience; and group 4 received the dual, AMI plus field experience, treatment.

A retention test was designed following the table of specifications (for content validity) and checked for reliability with two pilot groups judged to be representative by program staff members. The test was then administered to each experimental group following the appropriate treatment. Following an analysis of variance between and within treatment groups plus a postmortem comparison between the means using the Duncan Multiple Range Test, these results were obtained: (a.) Students who received instruction through AMI scored as high as students instructed by field methods. (b.) Students who received instruction through AMI scored higher than students who received no instruction. (c.) Students who received instruction through

AMI did not score as high as students who received the dual, AMI plus field experience.

Related observations included high interest evidenced by students in both treatments; more rapid responses by students in the field following the AMI program; and a much shorter learning time with the AMI treatment when compared to the field treatment.

VITA

Name: Edward Wendell Hosley

Permanent address: 12223 Wimbleton Street, Upper Marlboro, Maryland 20870

Degree and date to be conferred: Ph. D., 1974

Date of Birth: May 11, 1933

Place of Birth: New Gloucester, Maine

Secondary Education: Roosevelt High School, 1951

Collegiate Institutions attended	Dates	Degree	Date of Degree
The Citadel	1951-53	None	None
Georgetown University	1954-57	B. S.	1957
American University	1958-60	M. A.	1960
Maryland University	1960-74	Ph. D.	1974
University of North Carolina	Summer 1962	None	None
University of Wisconsin	Summer 1966	None	None

Major: Administration and Supervision

Positions held:

Elementary classroom teacher, Prince George's County, Maryland, 1957-1961.

Elementary school principal, Waldorf Elementary School, Charles County, Maryland, 1961-1963.

Elementary school principal, Kenilworth Elementary School, Prince George's County, Maryland, 1963-1968.

VITA Continued...

Positions held:

Fellow, Institute for Educational Research, University of Wisconsin, Summer, 1966.

Supervisor of Elementary Schools and Outdoor Education, Prince George's County, Maryland, 1968-1972.

Fellow, Program for Administrators in Curriculum Technology, University of Maryland, 1970.

Supervisor of Environmental Education, Prince George's County, Maryland, 1972--present.

DEDICATION

To the students of the

Prince George's County Public Schools.

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CHAPTER I

INTRODUCTION

Statement of the Problem

In seeking to fulfill the objectives of environmental or outdoor education traditional methods have asserted the superiority of "out-of-doors", field and residential, experiences over laboratory or classroom procedures. While this may seem obvious, laboratory or classroom techniques have not been evaluated against field experiences prior to the reaching of such conclusions. The problem of identifying the superior method or combination of methods was the subject of this study.

Purpose of the Study

The purpose of this study was to compare two methods of instruction in environmental education: (a.) laboratory (classroom) instruction using Audible Multi-Imagery (AMI), and (b.) field experiences—on site or "out-of-doors" instruction. In addition, a dual treatment of AMI plus field experiences was compared with these two methods and with a control group.

AMI was selected as the method of laboratory (classroom) instruction as there is evidence that it is an effective procedure in cognitive learning (Trohanis, 1972), and it is impressive and powerful as a motivating and stimulating medium in an era when classrooms are competing for student attention against the advanced media techniques of commercial television.

Significance of the Study

Environmental education programs have shown continuous growth during the past several years primarily as a reaction to the evidences of general environmental degradation and associated problems.

A survey conducted by the National Education Association and the National Park Service in 1970 (National Park Service, 1970) showed that of over 700 school systems surveyed the mean number of pupils and teachers participating in programs was in excess of 3000 per system. This indicates that no less than 2 million students and teachers were involved in the 700 districts surveyed in that year.

In Maryland, fourteen of the twenty-four school districts sponsor environmental education programs (Crocicchia, 1971) with two of the larger local systems, Montgomery and Prince George's Counties, supporting residential programs enrolling over 10,000 students each.

The mean capital outlay for the 700 school districts mentioned in the NEA study (above) was nearly $60,000 per system. This combined with a mean current operating expenditure in excess of $40,000 per district indicates that more than 7 million dollars was spent by the systems studied.

Both local systems, Prince George's and Montgomery Counties, have annual operating budgets in excess of $100,000 each for their residential programs and combined approved capital improvement programs of one and one-half million dollars.

To provide a residential experience for each student in Prince George's County at least twice during his school career as recommended by the Maryland State Department of Education nearly 25,000 students would have to be accommodated annually. A residential facility of sufficient proportions to support such a program would be expensive especially in an area where land values are high and nearly 25% of the land is currently under public ownership and thus off the tax rolls.

Thus it becomes obvious that environmental education programs command considerable involvement and expense especially in the development of residential facilities.

Alternatives other than the establishment of residential programs are open to study by school systems.

One question is the significance of the field or residential experience over the laboratory or classroom experience which was the subject of this study.

Methodology

Methods of conducting the investigation included the development of an area of concentration in environmental education at the elementary level, plant and animal communities. This curriculum was then applied by the researcher through AMI and a traditional field experience course outline to randomly selected fifth grade students in Prince George's County participating in the Environmental Education Program under conditions to effect concommitant treatment of all subjects. Curriculum materials were withheld from all subjects prior to program participation. A comparison was made of gains by respective groups (AMI, field, control, AMI plus field) on a retention test measuring ability in knowledge of environmental or ecological concepts.

Hypotheses

Three hypotheses tested in the study were:

(1) Students receiving instruction in environmental concepts through AMI will score as high or equal on a retention test to students who received instruction on the same concepts through field experiences.

(2) Students receiving instruction in environmental concepts through AMI will score significantly higher on a retention test than students who received no instruction.

(3) Students receiving instruction in environmental concepts through AMI will not score as high as students on a retention test who received AMI plus field experiences.

Limitations of the Study

(1) One limitation is imposed by a lack of definition. As noted in the review of the literature, one of the most apparent shortcomings of environmental programs is the lack of a universally accepted definition of environmental education. Outdoor education, recreational camping programs, and units in ecology are used synonymously and interchangeably with environmental

education in numerous cases. In this study, the definition reported by the Maryland State Department of Education has been adopted and follows in the Definition of Terms.

(2) A second limitation exists in sampling procedures. In an attempt to assure equal application of field experience methods to all subjects the author conducted each field experience. A possibility of inconsistency is present in a treatment of this type. Thus the internal validity threat of unequal treatment of subjects is not completely ruled out.

The time limitations imposed by the above procedure (i.e. personal involvement by the author with each treatment group) necessitated the utilization of a small population and a small number of treatment groups. This, according to some statisticians (Cox, 1958) has a tendency to inflate the observed F ratio and becomes an internal validity threat as interaction occurs between subjects within groups.

(3) A third possibility for limitations may be found in the testing procedures. Students at the fifth grade level in a normal distribution reflect a wide range of abilities and reactions to verbal stimuli. Although there was a random sampling of homogenous groups, and the recognition test

was recorded, the possibility of vocabulary limitations by the subjects was not corrected by using visual stimuli as has been suggested by some authors (Trohanis, 1972).

Definition of Terms

AMI Audible Multiple Imagery means the simultaneous projection of two or more images coupled with a sound presentation. While slides, motion picture films, or transparencies may be used singly or in combinations, 2 x 2 slides are used exclusively in this investigation. Thus reference to AMI here means a three-screen presentation using 2 x 2 slides coupled with an audio tape.

Environmental Education. As cited in the review of the literature, there is little obvious agreement among users of the term as to the definition of environmental education. It is often used interchangeably with outdoor education and recreation, education out-of-doors, ecology, and environmental science. Although several definitions use essentially the same concept, the definition offered by the Maryland State Department of Education has been adopted in this study:

> An environmental education program is one that prepares people to make those decisions and to take those actions which create and maintain optimal relationships between man and the environment which sustains him.

Thus environmental education is interdisciplinary—calling upon the student to interact with several disciplines which deal with his environment—and the outdoor, recreational, and purely scientific areas are seen to be but a part of the total concept.

Field Experience. Opposed to a laboratory, classroom, or other simulated experience, it means the learning activity that takes place in the locale where the subject under study is located.

Organization of the Study

Chapter I described the problem area, purpose of the thesis, significance of the study, general methodology, research hypothesis, limitations, and definition of terms.

Chapter II covers a brief review of pertinent literature on environmental education and on AMI, and studies comparing instructional methodology.

Chapter III provides a description of the methodology for the field instructional program, the AMI instructional program, the evaluative instrument and the research procedures.

Chapter IV presents the findings of the investigation, while Chapter V offers a summary, conclusions and recommendations.

CHAPTER II

REVIEW OF THE LITERATURE

This chapter reviews the literature relating to the status of environmental education: historical aspects, problem of definition, and current trends and research on instructional methods. In addition, a short review on the literature relating to AMI will be offered.

Historical Background

Smith proposes that environmental or outdoor education has come about naturally as a result of man's associations with, and dependence upon nature (Smith, 1969):

> Using the outdoor setting for educational experiences has been a practice that has existed for centuries in different forms or patterns. Man's close relationship with his environment has continually provided an incentive for him to learn to understand, use, and live comfortably within his surroundings, and educators have historically provided for this in developing school programs.

Kirk has traced the origin of environmental or outdoor education back to a more definitive period. He cites the romantic naturalism associated with Jean J. Rousseau and

Heinrich Pestalozzi as the point of origin for environmental education. Rousseau, and later, Pestalozzi, urged teachers to permit students to live close to nature as education was "life" and not a process of preparing for life. (Kirk, 1968).

If romantic naturalism is to be accepted as the philosophical beginning of the outdoor education movement, it was another sixty years before the first resident camp was established in 1861 at Washington, Connecticut by Frederick W. Gunn. Although several others followed before the turn of the century, there is little evidence of any activity in outdoor education that could be classified as a movement until the 1920's and 30's (Freeberg and Taylor, 1961) when "the expression of concern for the child and society" prompted the founding of numerous fresh air farms and camps (Ebel, 1969).

Lloyd B. Sharp completed his doctoral dissertation in outdoor education (the first of its type) in 1930 at Teachers College and "he continued to be a leader in (the movement) up to the time of his death in 1963" (Ebel, 1969) establishing the Outdoor Education Association in 1951. He is the first to be associated with the concept of achieving educational objectives through camping experiences.

In 1955 the American Association for Health, Physical Education and Recreation, a division of the National Education Association, initiated "The Outdoor Education Project" under the leadership of Julian W. Smith who had emerged as an authority on outdoor education. This project, and Smith, have been associated with the concept that the technological revolution has necessitated attention to worthwhile use of leisure time and meaningful recreational activities in the out-of-doors.

During the 1960's considerable national attention was brought to bear on environmental problems and since then outdoor education programs have for the most part either changed their names to environmental education, or they have been absorbed by newly created divisions within school systems bearing that designation.

Definition of Environmental Education

In 1969-70 the National Education Association and the National Park Service conducted a study "to provide information about the current status of programs in the area of environmental education in the nation's public schools."

Among the most pertinent observations in the resulting report, Environmental Education in the Public Schools (National Park Service, 1970), are the following:

> At present there does not exist a well-established set of criteria for identifying and distinguishing environmental education programs, nor even, at times, a generally accepted terminology for describing the characteristics of environmental programs.

Further,

> Possibly the single most important general conclusion to be derived from the study is that there is no general type of environmental education program.

There are innumerable points of view regarding a definition of environmental education. Donald and William Hammerman in their book, Outdoor Education, A Book of Readings (Hammerman and Hammerman, 1968), present numerous writings wherein no less than twenty varying definitions are offered. As cited by the Department of Interior, Bureau of Outdoor Recreation (Department of Interior, 1968), there is no general agreement as to the coverage of the several names of programs in common use, but the broader interpretations may be summarized as follows:

> Environmental education deals comprehensively with both human resources and natural resources and their relation to each other—in other words, with the total environment. It adopts the meaning

of environment expressed in Webster's Dictionary of Synonyms. When used in reference to persons, environment suggests not only natural surroundings but social conditions, and implies their importance as factors in the physical, mental, and moral development of the species or the individual or as formative influences.

Environmental education aims to develop a citizenry with an understanding of the many complex problems in this broad field, and with the ability and the motivation to participate in their solution.

Conservation education obviously depends in its coverage on the definition of conservation, on which opinions and definitions differ widely. As one example, it has been described by Russel E. Train, president of The Conservation Foundation, as the rational use of the physical environment to promote the highest quality of living for mankind. Quality of living presumably includes both tangible and intangible values of all sorts, and rational use is determined by economic, social, cultural, and political considerations as well as by physical and biological considerations. So interpreted, conservation also deals with the total environment.

Outdoor education is a much broader term than conservation education or environmental education since it applies to all outdoor experiences that cut across the entire school curriculum. Outdoor education would be the larger, broader term that would include field natural sciences, ecology, and social sciences. Conservation education would have a somewhat narrower connotation. Clearly these views are based on a narrower conception of environmental education and conservation education than that indicated in the preceding paragraphs.

Resource education is a somewhat less common and perhaps less controversial term with similar, but to many with still broader, coverage.

In the absence of any generally accepted terminology, all four terms mean different things to different people. Broadly interpreted, however, they

> agree in implying concern with the interrelations between man and his environment. The differences lie largely in the emphasis placed on various aspects of these relations.

Compatible with the foregoing discussion of environmental education is the definition adopted by the Governor's Conference on Environmental Education for the State of Maryland.

> Preparing people to make those decisions and to take those actions which create and maintain optimal relationships between Man and the environment which sustains him.

It is this definition of environmental education that is used in this study.

Current Trends

1. INTERDISCIPLINARY APPROACH

The above definition implies a broad or interdisciplinary approach to environmental education. Some interdisciplinary approaches have recommended the inclusion of subject matter from foreign languages, industrial arts, mathematics, science, social studies. and humanities (Shoreline School District, 1966). The last three areas listed however, science, social studies, and humanities, appear to be the most frequently mentioned in various program descriptions as comprising an interdisplinary approach to environmental education. As explained by the subject area contributions listed in the report of the Multi-state Conference of Environmental Education (Maryland State Department of Education, 1971):

1. Science education programs must be presented so that they teach the processes necessary to perceive the components and structure of the physical and biological environments.

2. Science should teach students that the natural systems of the earth are ongoing, interrelated series of orderly phenomena.

3. The social sciences must provide the vehicle for, and analysis of, social interaction as a means to recognize and capitalize upon man's potential to improve his environment now and in the future.

4. Social science curricula must be restructured to allow for survey and in-depth study of different eco-cultural environments.

5. The arts and humanities must provide those learning experiences which involve the individual with the spatial, temporal, aesthetic, cultural, and spiritual concepts that deal with man's developing sense of order.

6. The arts and humanities should establish in the individual positive self-concepts as part of his relationship to the environment so that he might bring about constructive environmental change.

At this time, the Maryland State Department of Education, Environmental Education Project, is in the process of refining this interdisciplinary approach by employing teams of science, social studies, and arts and humanities teachers to write behavioral objectives and activities relating to the major themes: The Earth As An Environment, the Pursuit of Life, and Changes in the Eco-Culture System. (Maryland Environmental Education Curriculum Framework, 1973).

Although most states and school districts that have recently produced environmental education curricula (notably in Wisconsin, New Jersey, and the State of Washington) have incorporated an interdisciplinary approach, the implementation of these curricula can be accomplished only if either environmental education is viewed as a separate subject discipline, or if a broad-fields method is undertaken. Both procedures have long had opposition. The implementation of an additional course offering is greeted in most cases with arguments describing an already crowded curriculum. The latter, broad-fields approach, relies heavily on team or co-operative teaching which most often appears to depend entirely upon the interests of the participating instructors (Bogan, 1973).

In addition to the foregoing problems of definition and implementation of instruction in environmental education the question of increasing demand for facilities is to be considered.

2. FACIL..TIES

Although by definition environmental education can and should be taught in a variety of settings (Andrews, 1972), "the environment cannot be brought into the school building or the classroom without losing much of its character as environment" (National Park Service, 1970) and thus "the typical school system uses, in terms of median numbers, two sites of approximately 20 acres in the immediate school environs, one day-use environmental study center of approximately 77 acres 12 miles from the school district, and one site with resident facilities of approximately 200 acres 50 miles from the school district." Sixty-three percent of the school systems surveyed use resident sites with nearly 80% of them leased from state, church or private agencies (National Park Service, 1969).

A study by Crocicchia, (1971) of outdoor education programs in Maryland revealed that fourteen out of the twenty four school districts sponsored programs, and ten of the fourteen were designated as residential in nature. Of the latter, only four districts claimed ownership of residential facilities and three of the four leased facilities in addition to those under ownership. The most limiting factor to curriculum reported by the school districts, according to Crocicchia, was limitation of facilities.

This trend toward the inclusion of residential experiences in environmental education programs suggests that the many variables associated with physical facilities for this purpose, such as construction and operating expenses, should be included in the cost of environmental education.

Most of the literature in this area describes recommended facilities, and most recommendations include: one hundred acre and larger sites, sewer and water systems, dormitories, kitchen and dining facilities, infirmaries, administrative offices, large and small meeting rooms, and display and exhibit rooms. (National Commission on YMCA Camp Layouts, Buildings and Facilities, 1960; Michigan Department of Public Instruction 1951; Outdoor Education Association, 1961; National Audubon Society, 1965).

The National Park Service study (National Park Service, 1970) showed that in the residential sites surveyed better than fifty percent of the respondents had the facilities listed above, diminishing in frequency from dining halls (86.3%) to administrative offices (50.5%).

Construction costs obviously vary according to local factors and intended size of the facility, but the nature of the desired location of the project in a (usually) remote area dictates that water and waste disposal facilities as well as roads and service lanes are generally more costly than in typical school construction. Health department regulations may be more stringent than, or at least equal to, those imposed on other facilities. The Maryland Health Department, for example, requires that a specified number of lavatory facilities including showers must be provided on a per capita basis in all overnight programs. (Maryland State Department of Health, 1971).

Interpreting the data in the National Park Service study (National Park Service, 1970) a capital outlay cost of approximately $20 per pupil is derived. This was obtained by dividing the mean number of pupils participating in programs into the mean capital outlay budget for programs for the school year, 1969-70. The same procedure was used to obtain an annual operating expense of $15 per pupil. These costs are comparable to the limited data available in Maryland (Crocicchia, 1971), and especially in Prince George's County (Prince George's County Public Schools, Annual Operating Budget, 1971-73). Based on the foregoing, it is assumed that a per pupil cost of approximately $35 will be required to provide residential experiences in environmental education. Referring back to the goal of providing two residential experiences for each pupil during his K-12 career as proposed by the Maryland State Department of Education, this would necessitate an expenditure of approximately $700,000 annually for the 20,000 students in virtually any two grade levels in Prince George's County. This prompts an investigation into the relative merits of the residential experience—whether the gains made by students in the field experience outweigh those realized in the classroom or laboratory setting.

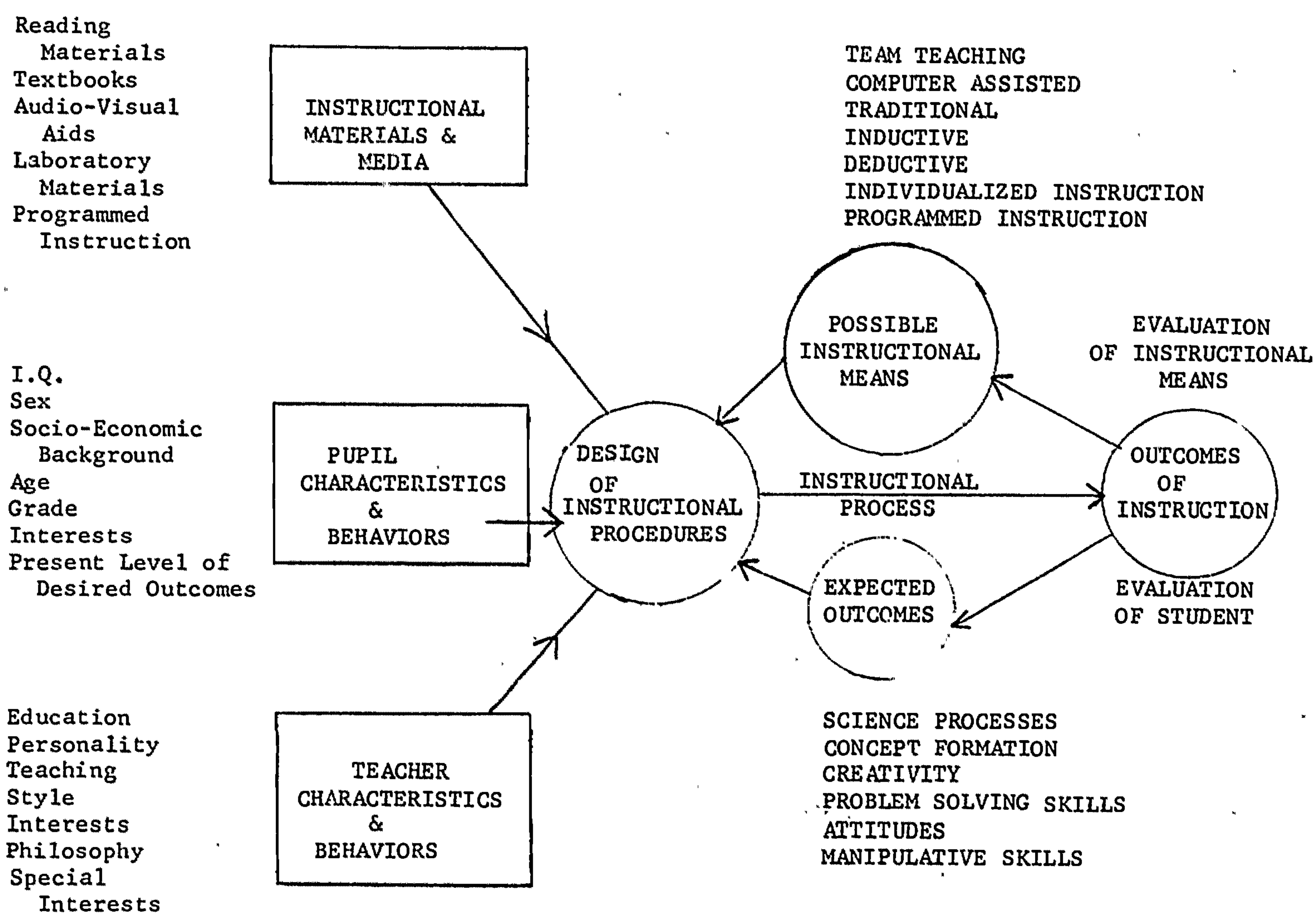
RESEARCH ON METHODS OF INSTRUCTION IN ENVIRONMENTAL EDUCATION

As might be suspected from the preceding review of the literature, the lack of definition of environmental education and the sporadic development of the "movement" is reflected in the research on the topic. Most studies have reported impressions, philosophies, and descriptions of existing or proposed programs. To put the few available studies into a comprehensive framework, an instructional model by Ramsey and Howe is offered in Table I. As explained by the authors (Ramsey and Howe, 1969):

> There are four major sets of variables which may affect the outcomes of instruction—the instructional materials and media used, pupil characteristics and behaviors, and the instructional means chosen. To know whether a particular instructional means (e.g. a problem solving method) does produce the change in behavior indicating the desired outcome, then all the other factors must be held constant or allowed for in the research design before one can be reasonably certain that it was the instruction and not some other variable which produced the change.

FIGURE I.

MODEL FOR ANALYZING INSTRUCTIONAL PROCEDURES (RAMSEY and HOWE)



Each of the three studies reported met the criteria described by the authors. The expected outcomes differed as one focused on science processes, the second on problem solving skills, and the third on attitudes.

Ritan and Koval (1971) used a pre-test, post-test design and the Processes of Science Test (POST) prepared by Biological Sciences Curriculum Study (BSCS) to measure gains in science processes of tenth grade biology students participating in field work studies. The mean gain of 4. 6 compared favorably with the average gain of 4. 3 points of 12, 062 students as a result of a full year of BSCS biology. Some 5, 363 students taught by conventional methods showed a mean gain of only 2. 6 points.

Harvey (1951) used thirty pairs of students matched on I. Q. scores and initial scores on the Scientific Attitudes Test (Calwell and Curtis, 1948) to measure the development of scientific attitudes. By using a split halves method she found a significant difference in the final scores between the members of the experimental group who had experienced field work and the members of the control group who had experienced regular classroom procedures on comparable material under the same teacher.

The third study dealt with problem solving skills. Bennett (1965) is a less clearly defined study used teacher made tests to compare a field method of instruction with a traditional classroom method. A limitation expressed by the author was that "the study was concerned with only a small highly specialized area of biology taught within a short period" (p. 458). The field method did not statistically prove to be better than the traditional classroom method but was just as good as the classroom method.

Literature on AMI

There is an abundance of literature on AMI which has been exhaustively reviewed by a number of authors including Allen and Cooney (1964), Perrin (1969), Brydon (1971), and Trohanis (1972).

Reference is made to the study by Trohanis (1972) as it inspired the present investigation. He studied the theoretical factors associated with instructional AMI and concluded that:

> AMI seems to provide a vital basis for an external environment that can interact with a learner's inner, intervening variables. Usually the interplay between the external (AMI Program) and internal factors (needs, self-perceptions) brings about a change in the students' knowledge or disposition. Frequently, this change is ascribed to learning with retention as an index of measuring how well information is acquired (p. 20).
>
> Since AMI is an instructional medium, its existence and potential depend greatly upon perception. It appears that AMI can complement the perceptual needs of viewers who enjoy novelty and extract information from environments.
>
> AMI appears capable of doing many things to facilitate retention. It nurtures comparisons and provides motivation. The medium appears to capably entice and satisfy the large information demands of perceivers (p. 47).

Lombard (1969), Brydon (1971), and Trohanis (1972) conducted in depth studies on AMI in instructional settings. Lombard's study compared a three screen presentation with a single screen version of an 11th grade history lesson. Brydon did a similar study with adults. Both showed that information could be more effectively transmitted by AMI.

Trohanis compared the retention of 235 high school psychology students receiving AMI presentations with that of students instructed by conventional methods and found a significant difference favoring the AMI method.

In view of the simulation characteristics of AMI as described in the literature (Perrin, 1969 p. 60) and the conclusions reached by Trohanis, AMI appeared to be one of the most favorable classroom or laboratory methods of instruction to compare with field experiences.

This chapter on the review of the literature has shown that:

--Environmental education has had a loosely defined history spanning a period beginning with "life" studies to the recent reactions to environmental degradation.

--Consensus on a definition of environmental education is lacking, but one stressing a knowledge of man's environment and appropriate attitudes toward it is gaining acceptance.

--An interdisciplinary approach toward environmental education is one current trend. Another trend is the development of residential facilities at a significant cost for the purpose of providing field experiences.

--The few research studies on methods of instruction in environmental education have shown that students gain more through field experiences than by traditional classroom methods.

CHAPTER III

METHODOLOGY

Overview

The purpose of this study was to compare two methods of instruction in environmental education: (a.) laboratory (classroom) instruction using Audible Multi-Imagery (AMI), and (b.) field experiences—on site or "out-of-doors" instruction. In addition, a dual treatment of AMI plus field experiences was compared with these two methods and with a control group. The investigation was initiated with the development of an area of study in environmental education at the elementary level—plant and animal communities. This curriculum was then applied through AMI and a traditional field experience course outline to randomly selected fifth grade students in Prince George's County participating in the Environmental Education Program. This was done under conditions to effect concommitant treatment of all subjects. A comparison was made of gains by respective groups (AMI, field, control, AMI plus field) on a retention test measuring knowledge of environmental or ecological concepts.

This chapter describes the methodology employed in the investigation. The first section deals with the rationale and the objectives of the instructional unit (plant and animal communities) developed for the comparative study; section two offers a description of the field version of the instructional unit; and section three describes the AMI program. The research procedure is then discussed as is the evaluative instrument and the population used in the investigation.

Instructional Unit - Rationale and Objectives

As noted in Chapter I, the definition of environmental education adopted in this study describes a program that:

> - prepares people to make those decisions and to take those actions which create and maintain optimal relationships between man and the environment which sustains him.

Stapp (1973) states that in terms of a definition of this typ

> An appropriate role for school systems to assume in environmental education is to provide the opportunity for youth to explore their environment, sensorially, physically and intellectually.

The results of this activity will, according to Swan (1971), likely result in beliefs which:

> - are cognitions, the recognitions of simple pieces of information about almost anything. By themselves, beliefs have little relationship to behavior. Groups of

> beliefs, both cognitive and affective, may cluster toward a common objective and collectively produce attitudes which represent a behavioral predisposition toward that object. Groups of attitudes, in turn, cluster to form values which in turn produce behavior.

The function of any study unit or activity in environmental education, then, is to relate knowledge, to affect attitudes, and to encourage actions.

Probably the most fundamental principle offered in environmental education and related units is the concept of the balance of nature which is presented through sub-concepts such as: the web of life, food or energy cycles, biotic communities, and natural ecosystems. Generally stated, this concept stresses that every ecosystem has a basic pattern with four components. These are: (1) a physical environment that provides solar energy and the inorganic materials prerequisite for life; (2) primary energy converters that can transform solar energy and inorganic materials into food, (3) secondary energy converters that transform the energy of plant food into animal tissues and energy; and (4) decomposers that return essential ingredients to the physical environment. As stated by a noted environmental scientist, Hylander (1971):

> These four components make up the blueprint for every ecosystem, small or large, in any region from the arctic to the tropics.

That this ecosystem will maintain a self-sustaining equilibrium unless interfered with by man (or some other force) is the balance of nature so basic to all environmental principles.

The instructional unit devised to convey the balance of nature theme was entitled "Plant and Animal Communities" and focused on the concepts that:

(1.) Man is dependent upon plant life for shelter, fuel, tree products, and protection for himself and anim

(2.) Plants are a source of energy for all life.

(3.) There is a balance of nature in a plant community unless upset by man.

The instructional objectives for the unit stated in terms of behavioral outcomes in the cognitive domain were then outlined using Bloom's Taxonomy of Educational Objectives: Cognitive Domain (Bloom, 1956), Table 1.

TABLE 1 INSTRUCTIONAL OBJECTIVES FOR THE PLANT AND ANIMAL COMMUNITIES UNIT

Learning Outcome (by category) (Bloom, 1956)	Behavioral Outcome (At the end of this unit on Plant and Animal Communities the student will demonstrate that he:)
1.11 Knowledge of Terminology	Knows the common terms: herbivore, carnivore, decomposer
1.12 Knowledge of Specific Facts	Knows the important characteristics of the food cycle or energy chain
1.22 Knowledge of Trends and Sequences	Knows the most important cause of interruption in the energy cycle Knows the effect of woodland destruction on the balance of nature
1.23 Knowledge of Classifications and Categories	Knows the primary and secondary consumer classification Knows the classification of elements in the food chain.
1.25 Knowledge of Methodology	Knows methods of protecting the natural environment
1.31 Knowledge of Principles and Generalizations	Knows the principle of environmental protection Knows e principle of man's dependence on the natural environment
1.32 Knowledge of Theories and Structures	Knows the structure and organization of an energy cycle
2.20 Interpretation	Can explain the interrelationship between man and his environment
2.30 Extrapolation	Can predict the most probable effect of an action against a natural environment
3.00 Application	Can recognize evidences of plant and animal interactions in a natural environment
4.20 Analysis of Relationships	Can recognize unstated assumptions about environmental protection

Instructional Unit - Field Version

The general field instructional procedure was to utilize a forest layer board (a woodland scene painted on a 2' x 3' celotex board) and various animal cutouts which were placed on the board by students in those areas or layers where they felt the animals might exist. Students were then given game sheets, a simple collection of sixteen sketches of various animal and plant signs (tracks, seeds, nest, decomposers), Figure II, and encouraged to find as many as possible. The group returned to the forest layer board and related the game sheets to the original placement of animal cutouts. The interaction between the various components was then discussed. Students discussed the elements of the food cycle: sun, plants, herbivores, carnivores, and decomposers; and related to the concepts stressed (above). Students were asked to evaluate the potential effects of man's activities such as use of insecticide, clear cutting, trapping, or hunting on the natural area.

Dr. George Eley, College of Education, University of Maryland, assisted in evaluating the unit on a consulting basis. Two resource teachers in science and two resource teachers in environmental education employed by the Prince George's County Public Schools were asked to judge the unit in terms of the aforementioned objectives. All concurred that the methodology was appropriate.

GAME SHEET USED IN THE INSTRUCTIONAL
UNIT - FIELD VERSION

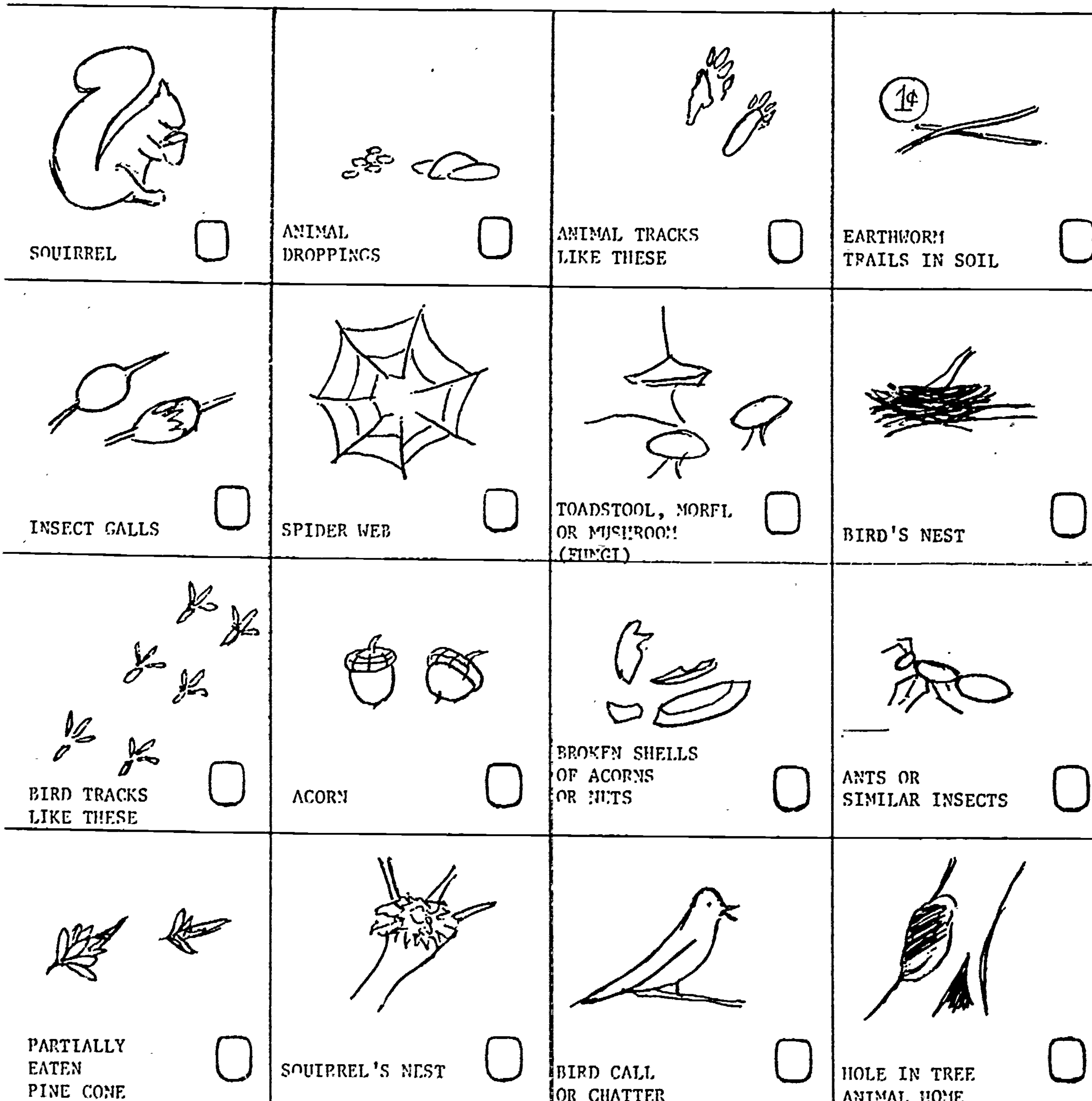


FIGURE II.

Instructional Unit - AMI Program

As noted in the definition of terms, AMI means the simultaneous projection of two or more images coupled with a sound presentation. In this study AMI means a three-screen presentation using 2 x 2 slides coupled with an audio tape. The AMI presentation was developed employing techniques described by Perrin (1969) and Trohanis (1972).

The basic rationale and objectives described in the instructional unit structured on the concepts of man's dependency upon plant life and the balance of nature (listed previously) were utilized in the AMI program. Slides and an accompanying tape were produced which depicted: (1) numerous examples of the elements and interactions in the energy or food cycle: sun, plants, herbivores, carnivores, and decomposers; (2) examples of various animal signs and plants photographed locally that were incorporated in the food cycle; and (3) evidence of man's disruption of the balance of nature: erosion, forest fires, water pollution, and strip mining. The layout and script for the production is included in Appendix A.

The number of references (by imagery and by narration) used in the AMI presentation to the learning outcomes specified by the instructional unit are presented in Table 2.

TABLE 2 NUMBER OF REFERENCES USED IN THE AMI PRESENTATION ON PLANT AND ANIMAL COMMUNITIES TO LEARNING OUTCOMES SPECIFIED BY THE INSTRUCTIONAL UNIT

Learning Outcome (by category) (Bloom 1956)	Behavioral Outcome	Number Of References
1.11 Knowledge of Terminology	herbivore, carnivore, decomposer	8
1.12 Knowledge of Specific Facts	characteristics of food cycle or energy chain	4
1.22 Knowledge of Trends and Sequences	causes of interruption in energy cycle	7
	effect of woodland destruction on balance of nature	2
1.23 Knowledge of Classifications and Categories	primary and secondary consumer classifications	6
	classification of elements in the food chain	5
1.25 Knowledge of Methodology	methods of protecting the natural environment	6
1.31 Knowledge of Principles and Generalizations	principle of environmental protection	4
	man's dependence on natural environment	12
1.32 Knowledge of Theories and Structures	structure and organization of energy cycle	8
2.20 Interpretation	interrelationship between man and environment	10
2.30 Extrapolation	effect of an action against natural environment	10
3.00 Application	recognizes evidences of plant and animal interactions	8
4.20 Analysis of Relationships	recognizes unstated assumptions about environmental protection	

Evaluative Measure

In order to test the general hypothesis that there was a difference between the achievement of students instructed in environmental concepts through AMI and those instructed through field experiences, it was necessary to construct a test designed to measure achievement of the learning outcomes specified in the instructional unit.

The first area of concern in constructing the achievement test was content validity or, how well the test would measure the subject matter content and learning outcomes covered during the instructional period. According to Gronlund (1968):

> We can build a test which has high content validity by (1) identifying the subject-matter topics and behavioral outcomes to be measured, (2) building a table of specifications which specifies the sample items to be used, and (3) constructing a test which closely fits the table of specifications. These procedures provide the best means we have for ensuring the measurement of a representative sample of both the subject-matter content and the behavioral outcomes under consideration--in short, for ensuring high content validity.

To meet these conditions of content-validity, a table of specifications, Table 3, using the learning outcomes listed in the instructional unit (Table 1) was constructed and followed in designing the achievement test.

The second area of concern in constructing and evaluating the achievement test was reliability, or how consistent the test scores would be from one measurement to another. In order to measure this variable, the test was administered to two pilot groups of students under similar conditions as intended in the experiment. The pilot groups were each composed of thirty fifth graders participating in the Prince George's County Public Schools Environmental Education Program. In the judgement of staff members they were felt to be representative or typical groups of students. One pilot group received the field experience prior to testing, and the second pilot group received the AMI treatment prior to testing. An item analysis was conducted upon completion of the pilot testing in order to evaluate the effectiveness of the test items. A summation of the item analyses is presented in Appendix C. The difficulty (too easy or too hard) indices were within the second and third quartile ranges (that is, between 25 percent and 75 percent of the students responded correctly). The discrimination (how well each item discriminated between high and low scorers) indices all showed positive discriminating power. The difficulty and discriminating indices were held to be acceptable (Gronlund, 1968).

The reliability coefficient for the retention test was then determined by the Kuder-Richardson Formula 21 using the pilot groups as subjects. Reliability was found to be .69 which was held to be acceptable (Diederich, 1964).

A copy of the retention test is presented in Appendix B.

TABLE 3 - TABLE OF SPECIFICATIONS FOR THE RETENTION TEST DESIGNED TO MEASURE ACHIEVEMENT OF ENVIRONMENTAL CONCEPTS

CONTENT / OUTCOMES by category (Bloom, 1956)	DEPENDENCY UPON PLANTS (Item No.)	PLANTS & ENERGY (Item No.)	BALANCE OF NATURE (Item No.)	TOTAL OF ITEMS
1.11 Knowledge of terms			1, 2	2
1.12 Knowledge of specific facts			3	1
1.22 Knowledge of trends and sequences		4	5	2
1.23 Knowledge of classifications and categories		7, 9	6, 8	4
1.25 Knowledge of methodology			10, 11	2
1.31 Knowledge of principles and generalizations	13		12	2
1.32 Knowledge of theories and structures		14		1
2.20 Interpretation		15		1
2.30 Extrapolation	16			1
3.00 Application	17, 18, 19			3
4.20 Analysis of relationships			20	1
TOTAL OF ITEMS	5	5	10	20

Research Design

A posttest-only control group design (R O, R X O), (Design 6, Campbell and Stanley, 1963) was utilized for two reasons. First, this design calls for a research procedure that does not employ a pretest and thus avoids a situation where a pretest would, according to Campbell and Stanley, be "awkward" (p. 26). This judgement was based on the desire to conduct residential environmental education programs under conditions where students feel apart from ordinary classroom procedures (i.e. paper and pencil tests) that is, participating in entirely new experiences. Secondly, the posttest-only control group design avoids sensitization by a pretest, or a reactive validity threat (Lumsdaine, 1967). This would appear to be an area of concern for the reasons given above--the unique environment of the camping program where recall of pretest items would be favored.

Four groups of subjects were required to test the hypotheses:

Group I would serve as a control group and receive no instruction prior to testing.

R O

Group II would be identified as the AMI group and receive that presentation prior to testing.

R X_1 O_1

Group III would be identified as the field experience group and receive that treatment prior to testing.

R X_2 O_2

Group IV would receive both methods of instruction prior to testing.

$$R \quad X_1 + X_2 \quad O_3$$

This design would then allow the following null hypothesis to be tested:

$$Ho: O = O_1 = O_2 = O_3$$

Selection of Subjects

Four fifth grade groups of one hundred students each participating in the Prince George's County Public Schools Environmental Education Program were used in the experiment. Students in each of the four groups were assigned numbers and a table of random numbers was used to select twenty five students from each group.

To test the normalcy of the population sample, Cognitive Abilities Test scores were obtained from the Prince George's County Public Schools Office of Testing and Research and averaged for the one hundred subjects. The results were virtually identical with national norms, Table 4, so normalcy of the population of subjects was accepted.

TABLE 4. COGNITIVE ABILITIES TEST SCORES OF SUBJECTS COMPARED TO NATIONAL NORMS

(Quartile Scores)	Q.	Mdn.	Q_3
Cognitive Abilities	25	52	77
National Norms	25	50	75

Treatment

Group I served as a control group and received no instruction prior to testing.

Group II was identified as the AMI group and received that presentation prior to testing.

Group III participated in the field experience before taking the retention test.

Group IV received both methods of instruction prior to testing.

Consistency in the testing procedure was maintained by using a recorded tape along with the printed test.

Summary

Since traditional methods of environmental education had asserted the superiority of field experiences over classroom procedures, and since the latter had not been evaluated against field experiences in achieving the objectives of environmental education, it was decided to compare these two methods of instruction in view of the increasing costs associated with field and residential programs. AMI was selected as the classroom technique because of its previous success and its highly motivating quality.

The instructional unit developed to serve as a basis for comparison was structured on the balance of nature concept and specified ten learning outcomes according to Bloom's Taxonomy of Educational

Objectives: Cognitive Domain.

These specifications were followed in the construction of the field versions of the instructional unit which was judged by five individuals involved with this subject area.

The AMI unit was also constructed using the table of specifications and the number of references by imagery and by narration was compared to the learning outcomes.

The criterion for the experiment was the achievement of students on a retention test developed according to the table of specifications and checked for reliability and validity by a pilot group of students. A posttest-only control group design was selected as the research design and one hundred subjects, selected at random from a population of four hundred students participating in an environmental education program, were divided equally into four groups: control, AMI only, field experience only, and AMI plus field experience. Each group was tested after its respective treatment.

Chapter IV reports the study findings.

CHAPTER IV

FINDINGS

Overview

This chapter describes the findings from the experimentation) comparing AMI, field, and AMI plus field methods of instruction with a control group on the retention of environmental concepts.

Major Findings

As mentioned in Chapter I, the three hypotheses tested in this study were:

(1.) Students receiving instruction in environmental concepts through AMI will score as high or equal to students who received instruction on the same concepts through field experiences on a retention test.

(2.) Students receiving instruction in environmental concepts through AMI will score significantly higher than students who received no instruction on a retention test.

(3.) Students receiving instruction in environmental concepts through AMI will not score as high as students who received AMI plus field experiences on a retention test.

The research procedure described in Chapter III called for the establishment of three randomly assigned experimental groups, each one representing a method of instruction or a combination of methods, plus a control group.

Thus, Group I served as a control group; Group II was the AMI group; Group III, the field group; and Group IV the combination, or AMI plus field experience group. The null hypothesis to be tested was:

$$Ho: \; O = O_1 = O_2 = O_3$$

O represented the mean score on the retention test for the control group.

O_1 represented the mean score on the retention test for the AMI group.

O_2 represented the mean score on the retention test for the field experience group.

O_3 represented the mean score on the retention test for the AMI plus field experience group.

The scores for the twenty five subjects in each group and the mean s., res for each group are presented in Table 5.

To test the significance of difference among the means or, in other words, to test the null hypothesis, an analysis of variance was employed. Population variances were held to be homogeneous as a nonsignificant result of 1.87 was obtained on the Fmax test.

Table 6 displays the analysis of variance for the test score means of the four groups. Since the obtained F ratio was higher than the value of F needed for significance, the null hypothesis was rejected.

TABLE 5. MEAN SCORES ON A RETENTION TEST DESIGNED TO MEASURE ABILITY IN THE COGNITIVE DOMAIN OF ENVIRONMENTAL CONCEPTS

	GROUP I (Control)	GROUP II (AMI)	GROUP III (Field)	GROUP IV (AMI & Field)	
N =	25	25	25	25	
1.	13	18	18	19	
2.	13	18	18	19	
3.	13	17	17	18	
4.	13	17	17	18	
5.	13	16	17	18	
6.	13	16	17	18	
7.	12	15	16	18	
8.	12	15	16	18	
9.	11	14	15	17	
10.	11	14	15	17	
11.	11	14	15	17	
12.	11	14	15	17	
13.	11	14	14	17	
14.	11	13	14	17	
15.	11	13	14	15	
16.	11	13	14	15	
17.	11	13	14	15	
18.	10	13	13	15	
19.	10	13	13	15	
20.	9	12	13	15	
21.	9	12	13	15	
22.	7	12	13	13	
23.	7	12	12	10	
24.	6	11	12	8	
25.	6	11	12	8	
ΣX =	265	350	367	392	
$\overline{X}$ =	10.6	14.0	14.7	15.7	$\overline{X}_T$ = 13.74

TABLE 6. ANALYSIS OF VARIANCE AMONG THE MEAN SCORES ON A RETENTION TEST DESIGNED TO MEASURE ABILITY IN THE COGNITIVE DOMAIN OF ENVIRONMENTAL CONCEPTS

SOURCE	df	SS	MS	F	F Critical (.05 level)
Between	3	364.3	121.4	22.2	2.7
Within	96	524.9	5.47		
Total	99	889.2			

TABLE 7. DUNCAN MULTIPLE RANGE TEST APPLIED TO MEAN SCORES ON A RETENTION TEST DESIGNED TO MEASURE ABILITY IN THE COGNITIVE DOMAIN OF ENVIRONMENTAL CONCEPTS

	$\overline{X}$	Shortest Significant Range	Pairwise Contrasts					
			4-1	3-1	2-1	4-3	4-2	3-2
Group I (Control)	10.6							
		1.37 (one rank position)			3.4			
Group II (AMI)	14.0			4.1				.7
		1.44 (two rank positions)						
Group III (Field)	14.7							
		1.48 (three rank positions)	5.1			1.0	1.7	
Group IV (AMI & Field)	15.7							

According to Dayton (1970):

> In the event that the null hypothesis $T_1 = T_2 = \ldots = T_p$ is rejected in a completely randomized design, the experimenter must continue his analysis of the data in order to isolate specific inequalities among the treatment affects. Whenever more than two treatment levels are involved, rejection of the null hypothesis suggest only that there are some inequalities among the p treatment effects. The location and direction of these inequalities must be found by further analysis.

Therefore, in order to test specific contrasts among the sample means, a postmortem comparison, the Duncan Multiple Range Test was made on the test data. The results of this test are presented in Table 7. The criterion for judging pairwise contrasts between means was that they exceed the computed shortest significant range. As indicated, the pairwise contrasts 4-1, 3-1, 2-1, and 4-2 were significant; but the others, 4-3 and 3-2 were not.

Discussion of the Findings

Hypothesis 1 stated that students receiving instruction in environmental concepts through AMI would score as high or equal to students who r eived instruction on the same concepts through field experiences on a retention test. The null to be tested was thus, Ho: $O_1 = O_2$ where O_1 represented the mean score on the retention test for the AMI group, and O_2 represented the mean score on the same test for the field experience group. Of the one hundred students involved in the investigation, twenty five received the AMI treatment, and twenty five received the field experience treatment. The difference between the means of the two groups on the retention test was .7 (Table 5). Although the analysis of variance (Table 6) indicated that there were significant differences among the means, the Duncan pairwise contrast called for a difference that would exceed the shortest significant range of 1.37 (Table 7). Since the difference between the means was below the shortest significant range, the null hypothesis was "accepted".

Hypothesis 2 stated that students receiving instruction in environmental concepts through AMI would score significantly higher than students who received no instruction on a retention test. The null to be tested was thus, Ho: $O = O_1$ where O represented the mean score on the retention test for the control group, and O_1 represented the mean score on the retention test for the AMI group. Twenty five students served as the control group and received no treatment and twenty five students received the AMI treatment. The difference between the means of the two groups on the retention test was 3.4 (Table 5). The analysis of variance (Table 6) indicated that the difference among the means was significant, and the Duncan pairwise contrast which called for a difference greater than the shortest significant range of 1.37 was exceeded. Therefore, the null hypothesis was rejected.

Hypothesis 3 stated that students receiving instruction in environmental concepts through AMI would not score as high as students who received

AMI plus field experiences on a retention test. Thus the null to be tested was Ho: $O_1 = O_3$, where O_1 represented the mean score on the retention test for the AMI group, and O_3 represented the mean score on the retention test for the AMI plus field experience group. The difference between the means of the two groups on the retention test was 1.7 (Table 5). Since the analysis of variance (Table 6) indicated that the difference among the means was significant, and since the Duncan pairwise contrast which called for a difference greater than the shortest significant range was exceeded, the null hypothesis was rejected.

Related Observations

Three related observations were made by the researcher and although they are not represented by statistical data, they are of importance to the study. These observations were: student interest, transfer of learning, and relative learning times.

The first observation was based on apparent student interest as reflected by span of attention and solicited as well as unsolicited comments. It was observed in working with students that there was a high rate of interest in both the AMI and the field presentations. No students were observed looking away from the screens during the AMI program and there were many open remarks made about the scenes depicting environmental degradation. The viewing was usually followed by applause.

The second observation dealt with an obvious transfer of training when the AMI program preceded the field experience. The researcher was able to use the visual presentations as cues to existing field conditions on numerous occasions by having students recall scenes from the slide program that depicted the concept being taught in the field.

The final related observation was based on relative learning times. The field experience program consumed nearly two hours while the AMI presentation lasted less than twenty minutes. The test results for the two groups were comparable, however.

Summary

From a random sample of one hundred students participating in the Prince George's County Public Schools Environmental Education Program three groups were identified for treatment in methods of teaching environmental concepts. One group received an AMI presentation, one received a field version, the third was exposed to a dual treatment, (AMI plus field experience), and a fourth group served as a control sample. A retention test designed to measure achievement of environmental education concepts was administered to all four groups.

Three hypotheses were tested in the experiment. The first hypothesis stated that the results on the retention test would be equal between the AMI and the field experience group. The test-results showed a slightly higher mean score for the field group, but although there was a significant difference among the means as shown by an analysis of variance, a postmortem pairwise contrast favored the hypothesis that there was no difference in the effects of the two treatments.

The second hypothesis stated that the results of the retention test would favor the AMI treatment group over the control group. The test results were significant according to the analysis of variance and the pairwise contrast so the hypothesis was accepted.

The third hypothesis was concerned with a comparison between the AMI treatment and the dual treatment of AMI plus field experience. It stated that the dual treatment would be more effective in teaching environmental concepts than AMI alone. Results of the retention test were significantly in favor of the dual treatment.

Three related observations were made by the researcher without the support of data: (1) Student interest was high during the AMI and field experience treatments; (2) concepts presented in the AMI program facilitated the presentation of related concepts during the field experience for the dual treatment group; and (3) the AMI treatment required twenty minutes as opposed to the two hour field experience.

Chapter V presents the summary, conclusions and recommendations of the thesis.

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

This study was concerned with a comparison of two methods of instruction in environmental education. The purpose was to determine which would be more effective in teaching environmental concepts: (a.) laboratory (classroom) instruction using Audible Multi-Imagery (AMI), or (b.) field experiences—on site or "out of door" instruction. In addition, a dual treatment of AMI plus field experiences was compared with these two methods and with a control group.

In this chapter, a summary of the study is presented followed by conclusions based on the data and recommendations for further research.

Summary

In an attempt to compare two methods of instruction in environmental education, an instructional unit based on the balance of nature concept was developed according to a table of specifications which followed

Bloom's Taxonomy of Educational Objectives: Cognitive Domain.

From a total population of four hundred students participating in the Prince George's County Public Schools Environmental Education Program, one hundred pupils were selected using a table of random numbers and assigned to four treatment groups of twenty five each. Group 1 received no treatment; group 2 received the AMI treatment; group 3, the field experience; and group 4 received the dual, AMI plus field experience, treatment. The AMI and the field versions of the instructional unit followed the table of specifications and were judged for adequacy by a panel of professionals in the field of environmental education.

A retention test was designed following the table of specifications and checked for reliability with two pilot groups. The test was then administered to each experimental group following the appropriate treatment. This was a posttest-only control group research design.

The three hypotheses tested and the results of the testing were:

(1) Students receiving instruction in environmental concepts through AMI would score as high or equal to students who received instruction on the same concepts through field experiences on a retention test. This hypothesis was accepted after a postmortem comparison between the means was made using the Duncan Multiple Range Test.

(2) Students receiving instruction in environmental concepts through AMI would score significantly higher than students who received no instruction on a retention test. This hypothesis was accepted after an analysis of variance among the means and the pairwise contrast tests showed significant difference in favor of the AMI treatment.

(3) Students receiving instruction in environmental concepts through AMI would not score as high as students who received instruction through AMI plus field experiences of a retention test. Test data resulted in the acceptance of this hypothesis.

Related and untested observations suggested that other factors associated with the study included a high interest level on the part of students in the experimental AMI group and the experimental field experience group. Also in the AMI plus field experience situation the students exposure to the AMI program prior to the field experience resulted in quicker student responses in the field. Finally, there were different learning times of two hours versus twenty minutes respectively for the field and the AMI experiences.

Conclusions

This study showed that AMI as a laboratory or classroom method of instruction is as effective as a field experience in conveying selected concepts of environmental education. This does not corroborate the studies of Ritan and Koval, Harvey, and Bennett reported in the review of the literature which compared field methods with usual classroom procedures. Thus, AMI is held to possess certain qualities which make it more effective than traditional classroom techniques. This supports the studies of Lombard, Brydon, and Trohanis.

This study also showed that AMI combined with field experiences is more effective than AMI only in teaching certain environmental education concepts. It is held that AMI through its highly stimulating and motivating approach provides realistic transition from traditional settings to unfamiliar environments. Thus realistic colorful visual images or clues offered in large projections help to speed identification with field environments as opposed to highly verbal and traditionally illustrated means.

Finally the difference in learning times observed in this study confirms previous reports by Brydon and Trohanis of shorter learning time gained through AMI.

Recommendations

Based on the data and conclusions of this study several recommendations can be made.

First of all consideration should be given to the utilization of AMI presentations in critical areas of instruction especially those situations where repetition is costly or difficult. For example, as noted in the foregoing field experiences are relatively limited for the total population of students thus putting importance on maximum gain during the experience. When realistic visuals attending to the concepts being stressed are incorporated in instruction prior to the field experience students grasp the concepts more readily.

A systematic research program for a school district involving defined objectives for field experiences and their achievement with and without AMI presentations beginning in the early grades would be worthwhile. For example, the transition between classroom and home environments and the purposes of field trips for young children is open to investigation. As noted, AMI allows the producer to use realistic and multiple stimuli and control the areas of attention for the audience. Simulations in this type of information retrieval are worthy of further study.

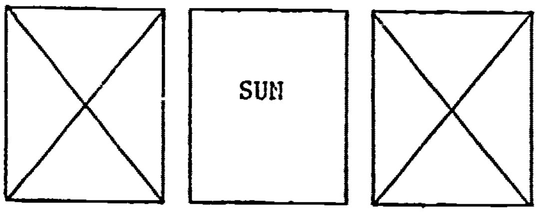
An area that offers extensive research possibilities is related to instructional efficiencies. If shorter learning times are to be gained through AMI as indicated, then this factor should be contrasted with relative production costs. Included in this area should be a study of the types of instructional units that will require little revision over extended time periods as opposed to those subject to frequent change. Another area to be researched is the optimum number of AMI programs that may be used with students before general disinterest sets in.

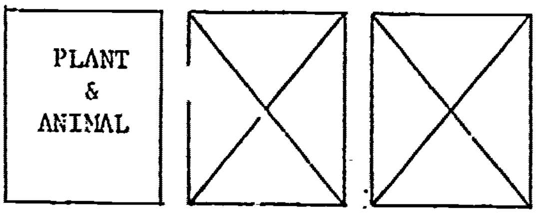
For the purposes associated with environmental education programs, this study has shown that an AMI presentation is as effective as a field experience, and when both methods are combined other gains will be realized. It is, therefore, recommended that this combination method should be expanded.

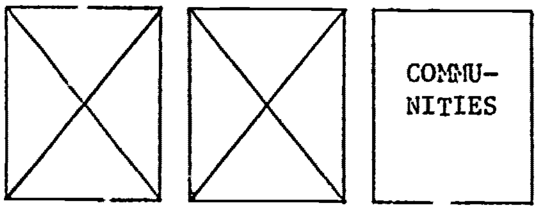
APPENDICES

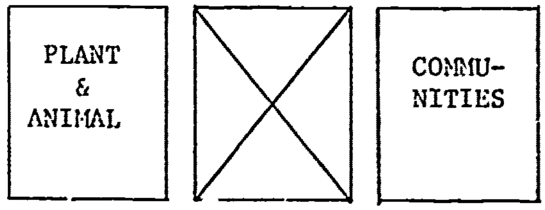
APPENDIX A

LAYOUT AND SCRIPT OF AMI PRESENTATION

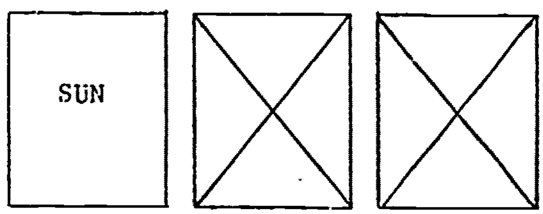
(1) 

(2 

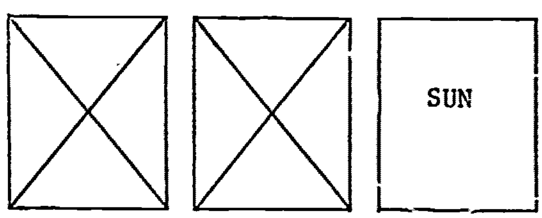
(3) 

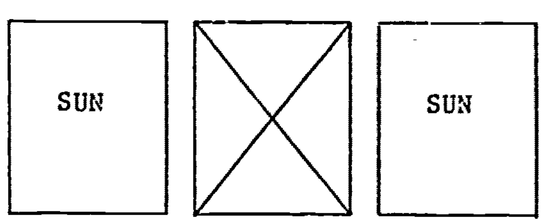
(4) 

Plant & animal communities

(5) 

All energy comes
from the sun

(6) 

(7) 

being captured by the
leaves of plants

(8)		TREES		which cannot live without it
(9)	INSECTS	INSECTS	INSECTS	Insects eat the leaves
(10)	BEE		LEAF-HOPPER	and other parts of plants
(11)	BUTTER-FLY	BUTTER-FLIES	MANTIS & BUTTER-FLY	other insects eat the plant eaters

(12)		APHIDS & LADYBIRD BEETLES		
(13)		SPIDER		other animals eat them
(14)	SPIDER & GRASS-HOPPER	INSECT IN WEB	SPIDER & GRASS-HOPPER	
(15)		SPIDER & FLY		

(16) WOOD-PECKERS

(17) BIRD FEEDING

(18) GROUND-HOG | HAWK & PREY — other animals depend upon animals for food

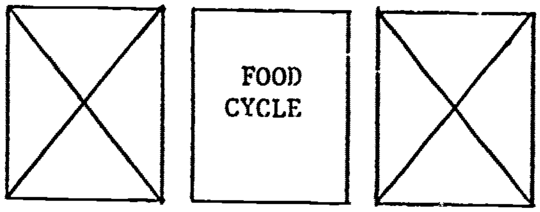
(19) FOX & PREY | FOXES & PREY

(20)		MOOSE		
(21)	WOLF		WOLF	
(22)		WOLVES & PREY	WOLF & PREY	
(23)	DEER IN STREAM	DEER	BUZZARD & DEER	Some animals eat dead animals

(24)		FISH & PREY		Notice how many animals depend upon fish
(25)	SPIDER & FISH	BIRDS & FISH	BIRD & FISH	
(26)		ALLIGATOR & FISH		
(27)	FISHER-MAN		FISH NETTED	

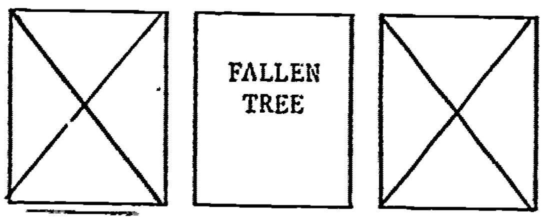
(28)	CATTLE	HERBIVORE (TITLE)		Animals that eat plants are called HERBIVORES
(29)	LION & ZEBRA	CARNIVORE (TITLE)	LION & BUFFALO	animals that eat other animals are called CARNIVORES
(30)	LION & CUB	EAGLE	POLAR BEAR	an animal that has no natural enemies is called a TOP CARNIVORE
(31)	WHALE SKELETON	TURTLE SKELETON	CATTLE SKELETON	When he dies his remains decay and go back into the soil to help the roots of plants grow. This whole process is called a <u>food or energy cycle</u>.

(32)



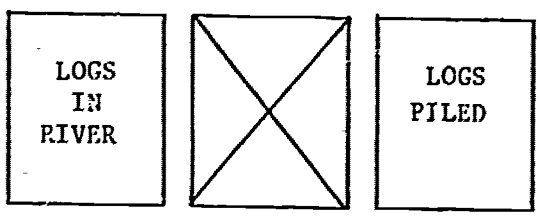
This cycle or chain will continue unless man interferes with it.

(33)



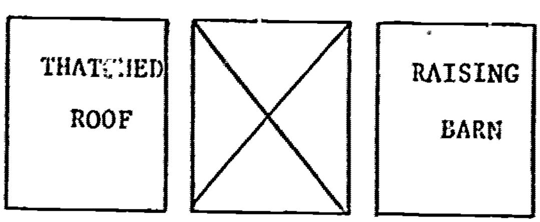
Men and animals also depend upon

(34)



plant life for:

(35)



shelter

(36)	FIRE PLACE	FIRE LAY	FIRE PLACE	fuel
(37)		BOAT		
(38)		FRUIT		food and
(39)		RUBBER TREES		other products

(40)		CATS IN TREE		and protection
(41)	FOREST	FOREST LAYERS (TITLES)	FOREST	you may see around and about a woodland signs of plants and animals which are part of the energy or food cycles. These signs may be in the top layer of trees or CANOPY; in the next layer or UNDERSTORY; in the BRUSH layer or on the bottom layer the FOREST FLOOR.
(42)		SQUIRREL EATING		you may see a squirrel eating
(43)		RABBIT DROPPINGS		or animal droppings

(44)	T R A C	K S I N	M U D	if you study the mud around streams you should see some animal tracks
(45)	E A R T H	W O R M	T R A I L S	and earthworm trails
(46)	GALLS		CEDAR GALL	Galls result from insects laying their eggs under the bark or in the leaves.
(47)		SPIDER WEB		s ,rely you will spot a spider's web

(48) MUSHROOM — or a mushroom which acts as a decomposer

(49) SHELLS — where some squirrel's or chipmunks had a meal on acorns or nuts

(50) PINE CONE — or a partially eaten pine cone

(51) SQUIRRELS NEST — a squirrels nest is easy to spot when the leaves are not too thick in the CANOPY

(52) HOLE IN GROUND

and there are other homes in the ground

(53) ROBIN ON NEST

This home can nearly always be found.

(54) MICE IN GRAIN

Remember the food cycle or energy chain will stay in balance unless something interferes with it. If man destroys some of the carnivores some of the hunted may be able to live unchecked and do a lot of damage.

(55) FOREST FIRE | FOREST FIRE

If man destroys the woodlands by fire he eliminates food, shelter, and protection for animals.

(56)	BULL-DOZING	SHEEP	STRIP-MINING
(57)	STOCK YARDS	MUDDY ROAD	AGRI-CULTURE
(58)		CARS	
(59)		CAR IN STREAM	

(60)	R E	F I N E	R I E S

(61)		POLLUTED STREAM	

(62)	DEAD FISH		DEAD FISH

(63)	P O L	L U T E D S	T R E A M S

(64)		CROP DUSTING		Improper use of insecticides, pesticides, or herbicides can cause the poisons to spread through the food chain and damage all the members.
(65)	GEESE	WASHINGTON MONUMENT	GEESE	Man can respect his environment for his own enjoyment or benefit.
(66)		DOLLS & TRASH		or end up on the mountain of trash he has created.

APPENDIX B

TEST TO MEASURE RETENTION OF ENVIRONMENTAL CONCEPTS

(1.) What term means the same as CARNIVORE?

A. plant-eater
B. playland
C. meat-eater
D. garbage

(2.) Which statement best defines the term TOP CARNIVORE?

A. a plant that eats animals
B. an animal that has no natural enemies
C. the best carnival in town
D. an animal that lives on mountain tops

(3.) What is the most important characteristic (feature) of the food cycle?

A. it can stay in balance by itself unless tampered with
B. it can be purchased at any Sears & Roebuck
C. it can be stopped and started again at any time
D. it can survive without sunlight

(4.) What is the most important cause of interruptions in the energy cycle?

A. Interference by sunlight
B. Interference by animals
C. Interference by weather
D. Interference by man

(5.) What will be the effect of destroying a woodland?

A. It will provide more homes
B. It will interrupt the balance of nature
C. It will create more noise
D. It will prevent forest fires

(6.) What are the major classifications of animals?

A. Herbivores and carnivores
B. Dogs and cats
C. Hoofed and non-hoofed
D. Prey and predators

(7.) What is a characteristic of all plants?

A. They all lose their leaves in winter
B. They all get their energy from the sun
C. They all provide lumber for homes
D. They all must be watered each day

(8.) How would you classify a spider web?

A. As part of a food chain
B. As a trap for fish
C. As a thing to knock down
D. As a nuisance in your garden

(9.) Which one of the following is an example of an energy chain:

A. sun-plant-animal-plant
B. sun-water-animal-plant
C. plant-sun-animal-plant
D. water-sun-plant-water

(10.) What method is used for studying animal life?

A. Burning down the trees and seeing what is left
B. Setting traps
C. Looking for animal signs
D. Waiting until winter when the leaves are gone

(11.) What is the best way to protect the environment?

A. Feed the squirrels
B. Try not to go into the woods
C. Put birds' nest in your backyard
D. Try not to interrupt the balance of nature

(12.) Which statement best expresses the principle of environmental protection:

A. Man must prevent all woodlands from being used
B. Man must keep all animals from eating each other
C. Man must keep bugs away from plants
D. Man must not interfere with the balance of nature

(13.) Which one of the following best illustrates the principle of man's dependency upon plants?

A. Plants are a source of energy for all life
B. Plants are a source of building materials
C. Plants provide homes for animals
D. Plants are often beautiful to look at

(14.) Which one of the following best describes the structure and organization of the food cycle?

A. Animals that eat plants or animals and return to the soil by decaying

B. Animals that eat plants or animals are never hunted by man
C. Animals that ride bicycles
D. Plants that are grown for human use

(15.) The statement that "there is a balance of nature in a plant community unless upset by man" means that:

A. No plants will die unless killed by man
B. No animals will die unless killed by man
C. Plants and animals will die but man will upset their replacement
D. All plants and animals will live together without competing or fighting

(16.) If a woodland is destroyed, a nearby farmer may notice an increase in insect pests. Why?

A. Insects will be driven out of the woods
B. Birds that live in trees may not hunt the insects
C. Trees help to control insects by shading them
D. None of the above is true

Indicate which of the following animal signs might be seen in a woodland by circling.

(17.) T F Animal droppings

(18.) T F Sharks teeth

(19.) T F Bird tracks

(20.) A conservation club recently took a stand against the construction of an airport in a marshland. Which one of the following assumptions was the club making?

A. Birds can fly faster than planes
B. Birds like to nest in planes
C. A plane crash would likely kill many animals
D. Animal homes would be destroyed in the building of the airport

APPENDIX C

ITEM ANALYSIS OF TEST TO MEASURE RETENTION OF ENVIRONMENTAL CONCEPTS

	Dif.	Dis.
1. A B *C D 2 0 6 0 4 0 3 1	.56	.38
2. A *B C D 1 7 0 0 1 5 0 2	.75	.25
3. *A B C D 8 0 0 0 1 0 0 7	.56	.87
4. A B C *D 0 0 0 8 1 2 2 3	.69	.62
5. A *B C D 1 7 0 0 2 1 1 4	.44	.38
6. *A B C D 5 1 1 1 2 1 1 4	.44	.38
7. A *B C D 0 7 0 1 1 4 2 1	.68	.38
8. *A B C D 6 0 0 1 3 1 2 2	.56	.38
9. *A B C D 3 0 2 3 1 1 3 3	.25	.25
10. A B *C D 0 0 8 0 0 2 4 2	.75	.50
11. A B C *D 0 0 0 8 1 1 1 5	.71	.38
12. A B C *D 0 0 0 8 1 1 2 4	.75	.50
13. *A B C D 3 1 1 1 1 1 4 2	.38	.50
14. *A B C D 7 0 0 0 1 2 0 5	.56	.87
15. A B *C D 0 1 7 0	.56	.62
16. A *B C D 0 5 0 3 4 0 2 2	.31	.62

Item					Dif.	Dis.
17.	A*	B			.75	.50
	8	0				
	4	1				
18.	A	B*			.68	.38
	1	7				
	4	4				
19.	A*	B			.62	.50
	7	1				
	3	4				
20.	A	B	C	D*	.38	.50
	0	0	3	5		
	1	0	6	1		

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