A COMPARATIVE STUDY OF ENVIRONMENTAL EDUCATION COMPETENCIES OF THIRD GRADE STUDENTS AND THEIR TEACHERS

Dissertation for the Degree of Ph. D.

MICHIGAN STATE UNIVERSITY

VIRGINIA ANN JONES

1976

This is to certify that the

thesis entitled .

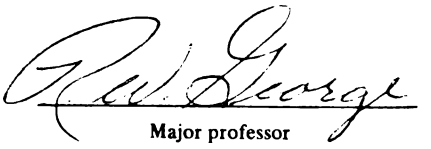
A Comparative Study of Environmental Education Competencies of Third Grade Students and Their Teachers

presented by

Virginia Ann Jones

has been accepted towards fulfillment of the requirements for

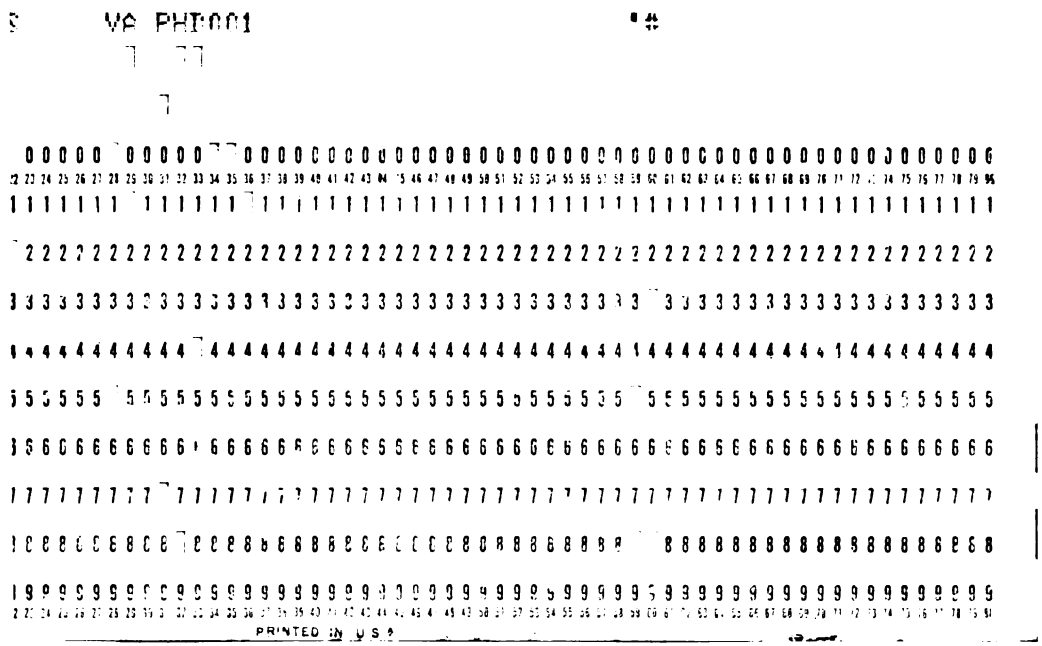
Ph.D. degree in Fisheries & Wildlife

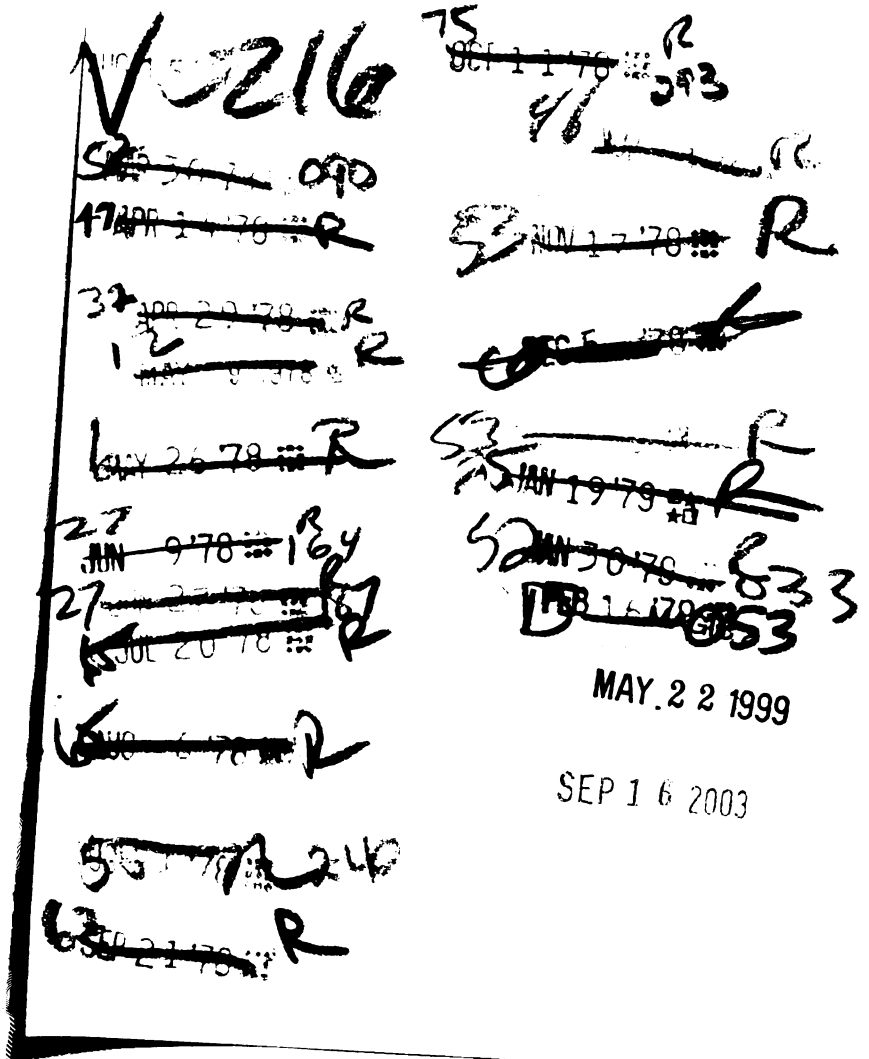


Major professor

Date July 21,1976

O-7639





MAY 2 2 1999

SEP 1 6 2003

ABSTRACT

A COMPARATIVE STUDY OF ENVIRONMENTAL EDUCATION COMPETENCIES OF THIRD GRADE STUDENTS AND THEIR TEACHERS

By

Virginia Ann Jones

The primary purpose of this study was to determine current levels of environmental education competency of third grade students and their teachers in relation to the Michigan Goals of Environmental Education. Also of interest was whether or not a relationship exists between knowledge about the environment and behavior regarding the environment and whether or not it is possible to assess the teachers' environmental education competency at minimal adult level and thereby to gain insights regarding the effects of these competencies on those of their students.

Four hundred and thirty-six third grade students were given an Environmental Education Competency Measure (E.E.C.M.) based on Michigan K-3 Minimal Performance Objectives. The cognitive component of the instrument was administered orally and the total number of correct responses constituted the C-score for each student. In addition, teachers were asked to observe specific environmental education behaviors of their students and then to rate each student in regard to the frequency of exhibited behavior

on a behavioral checklist. The scores derived from this checklist constituted the affective-behavioral (AB-score) component of the E.E.C.M. The total of AB and C-scores constituted the environmental education competency (E.E.C.).

The 20 teachers of the third grade classes used in the study were given an E.E.C.M. based on Michigan 7-9 Minimal Performance Objectives. The cognitive component was open-ended with the C-score determined by comparing the responses of the teachers with the responses of ten environmental education "experts." The AB component of the instrument involved self-reported responses regarding environmental behaviors. These responses were verified by an interview with the researcher who then evaluated each teacher on a behavioral checklist to determine their AB-score. The total of AB and C-scores again constituted the E.E.C.

The data were evaluated using a combination of item analysis, descriptive reports and parametric and non-parametric statistical procedures. Analysis of the data indicated that the behaviors identified by the minimal performance objectives are well within the capabilities of the subjects evaluated. Actual achievement in relation to Michigan's Minimal Performance Objectives for environmental education was, however, generally low. Further analysis of the data in relationship to individual objectives suggested specific concepts which appeared to be fully equilibrated by the subjects and others which were not yet clearly understood. When environmental education competencies were analyzed in terms of the five Michigan Goals of Environmental Education major differences were

found between the competency levels of the teachers compared to that of their students. Statistical analysis of correlations indicated a highly significant correlation (at the .001 level) between student C-scores and AB-scores but no significant relationship was found for the teachers tested. Further, no significant relationship was found between either the cognitive or affective-behavioral scores of teachers and the mean cognitive or affective-behavioral scores of their classes. However a significant correlation (at the .20 level) was found between the overall E.E.C. of teachers and the mean E.E.C. of their classes.

Analysis of the findings indicate that:

1). Overall E.E.C. levels of both third grade students and teachers were generally low in relation to the Michigan Goals of Environmental Education.

2). The affective-behavioral (AB) competencies of the third grade students were substantially lower than their cognitive competencies. The converse was true for the third grade teachers.

3). A highly significant correlation was found between the cognitive achievement of students and their affective behaviors as evaluated by their classroom teacher.

4). While there was no significant correlation between the isolated scores of teachers on either component of the instrument and the appropriate scores of their students, the overall environmental education competency of teachers did have a significant relationship to total student achievement.

The highly significant relationship between the environmental education knowledge and behaviors of third grade students and the influence noted between overall teacher environmental education competency and student achievement suggest that environmental education is a confluent approach to the educational process in which the final learning outcome may be greater than the sum of the parts.

The low environmental education achievement levels of both students and teachers demonstrated in this study point to the urgent need to make environmental education programs available at all educational levels. Inasmuch as the data collected represent baseline competency levels they could be utilized to identify individual performance objectives and related curricular areas in need of particular development. Instructional strategies to meet these needs could then be designed to improve the environmental education competencies of both students and teachers.

A COMPARATIVE STUDY OF ENVIRONMENTAL EDUCATION COMPETENCIES OF THIRD GRADE STUDENTS AND THEIR TEACHERS

By

Virginia Ann Jones

A DISSERTATION

Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of

DOCTOR OF PHILOSOPHY

Department of Fisheries and Wildlife

1976

Dedicated to

my parents,

Daniel D. and Ann M. Jones,

and to

The Sisters of St. Joseph of

Nazareth, Michigan

for their love, support, encouragement

and Faith.

ACKNOWLEDGEMENTS

I wish to express my sincere appreciation to Dr. Robert W. George, my committee chairman, and Drs. Eugene W. Roelofs, Gilbert W. Mouser and Milton Steinmueller my committee members, for their guidance, enthusiasm, time, interest and most of all the encouragement which was so freely given during the course of this study.

I am also indebted to Dr. Edward L. Smith of the Science and Mathematics Teaching Center for his assistance in interpretation of the item analysis and statistical data. Dr. N. Jean Enochs, also of the Science and Mathematics Teaching Center, provided both encouragement and technical assistance for which I am most grateful.

A special note of appreciation must go to the members of the Michigan Environmental Education Referent Committee for the many hours spent in the development of the minimal performance objectives utilized in this study and for their willingness to supply expert advice regarding environmental education content and process.

I am also grateful to the superintendents, principals, and staffs of the elementary schools who participated in this study for the many ways in which they assisted in the process of data collection.

A special thanks must go to Mrs. Frances Fenn, for her contributions which were above the call of duty in making the final product a quality one, to the eighth grade students from

St. Joseph School in St. Johns, Michigan, for their assistance in data transferral, and to the principal, teachers and third grade students of St. Therese School in Lansing for their assistance in revising the student assessment instrument.

Finally, I am grateful to Dr. John W. Brainerd of Springfield College, Springfield, Massachusetts, for the many ways in which he has contributed to my professional and personal development through the course of the years. His insight and dedication to the cause of environmental education are a constant source of inspiration.

TABLE OF CONTENTS

CHAPTER PAGE

LIST OF TABLES

LIST OF TABLES (Cont.)

LIST OF TABLES (Cont.)

LIST OF FIGURES

CHAPTER I

INTRODUCTION

Environmental quality is a major societal concern of Americans today. Within the past decade the average citizen has become increasingly aware of environmental concerns through a variety of mass media channels and educational programs. The activities of Earth Day, April 22, 1970, demonstrated the interest, concern, and commitment of nearly twenty million Americans (Swan 1975, p. 15). Subsequent Earth Day celebrations have also occurred. Yet this type of response alone has not been enough to bring about significant changes in basic values and life-styles necessary to improve the quality of our environment. There is a growing realization that:

> ...education has an important role to play now and in the coming years in helping people rationally solve some of the persistent problems associated with our natural and man-made environment. Education is the key to changing human attitudes, values and feelings, as well as behaviors--and doing so through intrinsic means (Michigan Department of Education, November 1973, p. 1).

Educational programs designed to achieve these ends are generally termed "environmental education."

GENERAL BACKGROUND INFORMATION

An Ecological View of Learning

Before considering the nature of environmental education I think it is necessary to examine three important conceptualizations of the manner in which the human organism is interrelated with his environment and hence the manner in which learning occurs. These fundamental views can be identified as nomothetic, idiographic and transactional.

The nomothetic view holds that knowledge and absolute values have their origins in the environment or have meaning apart from man himself. The human mind is conceived as tabla rosa (blank slate) upon which the social system inscribes its beliefs and values. Hence the environment is the most important component of the learning system. This view derives its theoretical support from behaviorism (especially the operant conditioning model of B. F. Skinner), from social learning theory and from psychoanalysis.

The idiographic or absolute relativistic view places its emphasis on the individual organism and holds that ALL values are relative. This approach derives theoretical support from existentialism and humanism and has been expressed in sensitivity training, gestalt therapy, situation ethics, and values clarification programs. The emphasis of these programs is on individual freedom and respect for the values of others while avoiding indoctrination and concentrating on the process by which values are determined.

Finally, the transactional view of learning as developed by Maslow, Piaget, Kohlberg and others holds that learning occurs through the interactions of the individual with the environment. Learning is not inherent in either the organism (idiographic view) or in the environment (nomothetic view) but in the process of interaction-that is, in the nature of the transactions that occur between the two.

Clifford Knapp states that

> Whenever people experience new things in their surroundings and delight in their discoveries; whenever people wonder about something they find and try to seek answers to questions; whenever people become concerned enough to do something to improve their surroundings; they are engaged in environmental education (1975, p. 209).

Central to Knapp's statement is the notion that man as an organism in some way interacts with the environment or real world and that learning or modification of behavior results from this interaction. This is a transactional or ecological view of the learning process which emphasizes the all-important principle that it is impossible to separate man from his environment. Thus the human organism constructs knowledge, values, attitudes and generates behaviors through a process of interaction with the environment.

Environmental education activities and programs based on this ecological model of the learning process are primarily concerned with the nature of the transactions or interactions

that take place between the individual and the environment. These transactions may be analyzed in light of the three domains of learning recognized by most educators: the cognitive, the affective, and the psychomotor. While the learning domains effectively identify the nature of the transactions occurring in the learning process, it is important to recognize that they are intimately interrelated in the actual dynamic of learning and that no learning activity can be viewed as relating exclusively to one domain.

The ecological or transactional view of learning just described has much potential for the development of future environmental education programs. Since it is based on fundamental ecological principles describing the manner in which organisms are related to each other and to their environment it affords opportunities for "modeling" these principles in actual learning programs.

Emergence of the Environmental Education Concept

In spite of the fact that environmental education and its forerunners, (nature study, conservation education and outdoor education) have been a part of curricular efforts since the early part of the twentieth century, "many perceive environmental education as a new movement. Many others perceive it as one or more old movements with a new name." (McInnis and Albrecht 1975, p. 3). Hence there is still a need to clarify what is meant by the term "environmental education".

Nature study or nature education had its beginnings in 1891 with the publication of Nature Study in the Common Schools by Wilbur Jackman. The focus of nature study is learning

through direct experiences and first hand observation facts and concepts about the natural world. Inquiry and discovery approaches to learning play a significant role in nature study programs. Nature study can be defined as:

> ...an area of study aimed at developing an understanding of and respect for the natural parts of our environment and cultivating in man the skills of accurate observation (Swan 1975, p. 9).

This movement was supported by the publication of the Cornell University Rural School Leaflets and the Handbook of Nature Study by Anna Comstock, and by the foundation of the American Nature Study Society which still publishes a periodical entitled Nature Study.

Conservation education originated in the 1930s and was initially intertwined with federal programs of human resource conservation, such as the Works Progress Administration (W.P.A.) and the Civilian Conservation Corps (C.C.C.) born out of the depression. The central focus of conservation education is the

> ...educational process of communicating an understanding of the characteristics, distribution, status, uses, problems and management policies of our basic natural resources. The emphasis has been on "stewardship" and the "wise-use" concept in relation to basic natural resources (Governor's Environmental Education Task Force 1973, p. 88).

Leadership for this movement came from many sources including governmental and private agencies and associations, soil and water conservation districts, wildlife federations and sportsmen's clubs. The Conservation Education Association is the

professional organization which seeks to promote and encourage conservation education activities and programs.

Outdoor education developed as an educational movement during the 1920s. The central concern of outdoor education is the approach to learning or the environment in which learning occurs.

> In effect, while conservation education is sometimes considered a substantive area of study, outdoor education is considered an educational approach or method (Swan 1975, p. 9).

Thus outdoor education involves the use of resources outside the classroom in order to obtain its educational objectives. The writings of John Dewey and William Kilpatrick provided a theoretical framework for outdoor education, and large scale, year round programs were soon established. Outstanding spokesmen for outdoor education included the late Julian Smith of Michigan State University and L. B. Sharp, Director of the Life Fresh Air Camps program.

Within the last decade the term "environmental education" has come to the fore, and in May 1968 a National Conference on Environmental Education was held in New Jersey. The Environmental Education Act of 1970 helped to bring the meaning of environmental education into focus and helped to define the parameters within which it operates. In accordance with this act (Public Law 91-516) the United States Office of Education defines environmental

education as:

> ...the educational process dealing with man's relationship with his natural and man-made surroundings, and including the relation of population, pollution, resource allocation and depletion, conservation, transportation, technology and urban and rural planning to the total human environment (U.S. Congress, 91st, October 1970:Environmental Education Act.)

Dr. George Lowe of the United States Office of Education, a sub-division of the Department of Health, Education and Welfare issued the following statement:

1. E.E. is NOT conservation education.
2. E.E. is NOT a subject - it is a process.
3. E.E. is multidisciplinary.
4. E.E. is community oriented.
5. E.E. is problem focused.
6. E.E. includes ALL components of society.
7. E.E. builds on past good - work.
8. E.E. is teacher-student oriented.
9. E.E. is both formal and non-formal.
10. E.E. could be an educational reform.

(January 4, 1972).

After indicating that there is no single, all-inclusive and adequate definition of environmental education, Noel McInnis, a prominent environmental educator, suggests the following as environmental education components:

1. Perceptual awareness.
2. Conceptual understanding of the natural environment.
3. Conceptual understanding of the man-made environment.
4. Values and values clarification.
5. Fostering creative abilities and attitudes.
6. Aesthetic discrimination.
7. Humanism.
8. Organizational skills and knowledge.
9. Decision-making (1975, p. 25).

It is apparent that the perspectives of different people regarding environmental education vary considerably. Some hold that environmental education should penetrate all aspects of the curriculum; indeed that environmental education is THE curriculum. Others see it as a discrete, unique component of the curriculum. Some see it as a way of teaching, or a process; others see it as content or a body of knowledge and skills to be taught.

In Michigan, the state legislature has defined environmental education as:

> ...teaching... of attitudes and skills involving the relationship between man and the quality of his cultural and biophysical environment...(included should be) understanding of ecology and man's activities within the context of the natural community... our environmental heritage; the intelligent use of natural resources; the effect on the environment of chemical contamination...preservation and enhancement of natural areas and recreation land for leisure time use; planning for wise land use; and the increased stress placed on the environment by growing technology and human populations... (State of Michigan Legislature, Senate Concurrent Resolution No. 69, June 1971).

This statement was summarized by the Governor's Environmental Education Task Force in its report, Michigan's Environmental Future

> Environmental education is the basic process leading toward the development of a citizenry that is aware of and concerned about the environment and its associated problems, and that has the knowledge, skill, motivation and commitment to work toward solutions to current and projected problems. (1973, p. 14).

It is this operational definition of environmental education that will be employed in subsequent discussions.

Environmental Education in Michigan

In early 1970 a Task Force on Goals of Michigan Education consisting of educators, students, and other citizens was established by the State Board of Education. The result of the work of this group was the publication of a report entitled The Common Goals of Michigan Education in September 1971. Goal 11 under the section on student learning addressed itself to education for a quality environment

> Michigan education must develop within each individual the knowledge and respect necessary for the appreciation, maintenance, protection, and improvement of the physical environment. (Michigan Department of Education, 1971, p. 7).

In response to suggestions from various citizen's groups and governmental agencies, Governor Milliken appointed a broadly-based Environmental Education Task Force in mid-1971. This group sponsored a series of geographically distributed public meetings to obtain ideas and concerns regarding a state master plan for environmental education to be developed by the Task Force. Funds for the development of the master plan were received through a grant from the United States Office of Education, of the Department of Health, Education and Welfare. In the first edition of the report of this group entitled Michigan's Environmental Future: A Master Plan for Environmental Education (1972) the following goals

for environmental education were established:

> to develop in people an awareness, understanding, and concern for the environment with its associated problems--natural, manmade social, political and economic--and knowledge, skill, commitment and motivation to work toward solutions to these and projected problems. (Governor's Environmental Education Task Force reprinted by Michigan Department of Education, November 1973, p. 3).

An Environmental Education Guidelines Committee was established by the Department of Education in accordance with Senate Concurrent Resolution No. 69 (1971) to develop guidelines to assist local school districts in designing educational strategies to meet these goals. This committee suggested that these goals may be achieved by helping individuals:

> 1. to realize and appreciate that man is an inseparable part of a life support system, and that whatever he does alters the inter-relationships within the system;
> 2. to obtain a basic awareness and understanding of the environment with its associated problems and to learn ways they can be effectively solved;
> 3. to recognize and clarify their values concerning the environment;
> 4. to develop a personal responsibility for environmental protection and enhancement;
> 5. to develop the motivation to work toward the prevention of and solutions to environmental problems.
>
> (Michigan Department of Education, November 1973, p. 3).

The five broad sub-goals listed above were utilized to develop minimal performance objectives by the Department of Education's ad hoc committee for the Development of Basic Environmental Education Objectives. This group began work in the fall of 1973 and has developed several drafts of objectives in

accordance with the State Accountability Model (Appendix I). In September 1975 the ad hoc committee was dissolved and the Michigan Environmental Education Referent Committee (M.E.E.R.C.) was established as a permanent committee of the Department of Education. This group will revise and finalize the existing minimal performance objectives, develop suitable test items, and assist in needs assessment, delivery system analysis and evaluation as well as make recommendations for curriculum development.

DEFINITIONS AND TERMINOLOGY

In this study the following definitions are being used

Cognitive domain refers to the mental activities or operations involved in knowing an object. It includes what an individual learns as well as the intellectual process involved in learning. Cognitive skills include recall and recognition (knowledge), comprehension, application, analysis and evaluation (Krathwohl,Bloom and Masia, 1964, p. 49).

Affective domain refers to the emotional aspects of experience and learning. The emphasis is on feeling or tone, emotion, and degree of acceptance or rejection, and finds expression as interests, attitudes, appreciations and values (Kratwohl, et al, 1964, p. 7).

Behavior is an observable or overt action which may be either verbal or nonverbal.

Entry level is the existing knowledge, skills, attitudes and values the learner brings to the educational situation.

Terminal level is the level of knowledge, skills, attitudes and values desired/achieved as the outcome of instruction and stated in the performance objective.

Performance objective is

> ...a statement which describes the individual or individuals who will be behaving (Audience), the behavior to be exhibited (Behavior), the object or objects of the behavior,... the technique to be used for measuring behavior (Condition), and the criterion for success (Degree). (Governor's Environmental Education Task Force, 1973, p. 89).

Environmental Education Competency (E.E.C.) will be defined as the degree or level of success achieved in attaining the Michigan Goals of Environmental Education as measured by ability to demonstrate behaviors specified by Michigan Environmental Education minimal performance objectives.

Environmental Education Competency Measure (E.E.C.M.) is the instrument used to assess E.E.C. It consists of two components: a cognitive component or C-score plus an affective-behavioral component or AB-score.

Definitions of additional terms such as "appreciation", "awareness", "commitment", "concern", "environmental problem", "environmental solution", "environmental quality", "pollution", "understand", and "value" are in accordance with those contained in the glossary of Michigan's Environmental Future, 1973, the state Master Plan for Environmental Education.

NEED FOR THE STUDY

In America today all are exposed to some form of environmental education whether they realize it or not. Television programs and commercials, bumper stickers, cartoons, comic books, textbooks, newspapers, magazines, and novels all contain messages about the environment and its quality. Many even express values and attitudes about the manner in which environmental problems should be solved. Because environmental problems are a salient concern for our society today, everyone is learning something about the environment through some type of formal or informal educational technique or program. But what exactly are people learning and how are they learning it? What environmental knowledge, attitudes and values do they need in order to make intelligent decisions regarding personal behavior and public policy?

Questions such as these were considered by the Governor's Environmental Education Task Force when developing the state master plan for environmental education. This committee and the Department of Education's Guidelines Committee formulated the basic goals and sub-goals for environmental education for the state and thus answered for Michigan the question "What is important to us?" The next important question to be asked is "Where are we now, and where do we want to go?" The first half of this question ("Where are we now?") points to the need for pilot studies to determine baseline data regarding the current levels of environmental education achievement possessed by various groups and individuals within the state. The second half of the question ("Where do we want to go?") is currently

being addressed by the Michigan Environmental Education Referent Committee involved in the development of minimal performance objectives. It will be impossible to consider questions such as "How shall we get there?" (delivery system analysis and curriculum development) and "How shall we know when we have arrived at our destination?" (evaluation) until sufficient data have been collected to provide adequate answers to the first basic question, namely, "Where are we now?" Hence at the moment the collection of baseline data regarding current levels of environmental education achievement in Michigan in terms of assessment of existing entry levels of both cognitive and affective behaviors is an important research need and a top priority item.

Recent research indicated that teachers, students, and administrators have perceived a need for and expressed interest in determining the knowledge and attitudes as well as the background (training/experience) needed by teachers to produce successful environmental education programs and curricula. Instruments to evaluate cognitive and affective achievement must be designed and tested to meet this need (Hilgerson, Hilburn, Wiley, Blosser, et al 1971.

This study addresses itself to these needs by developing and testing such evaluation instruments and by assessing current levels of student and teacher achievement in both cognitive and affective domains in relation to the Goals of Michigan Environmental Education.

PURPOSE OF THE STUDY

The primary purpose of this study was to determine current levels of environmental education competency (E.E.C.) of third grade students and their teachers in relation to the Michigan Goals of Environmental Education. Since these goals are directed at both cognitive skills and affective behaviors, success in meeting the resulting minimal performance objectives will be determined by individual achievement levels in both of these learning domains. Although psychomotor skills contribute to learning, current Michigan goals do not address this aspect of the learning process and therefore are not considered in this study.

Also of interest in this study was whether or not a relationship exists between knowledge about the environment and behavior regarding the environment. Is there a relationship between what third grade students know about the environment and what they do about it? Similarly, is there a relationship between what third grade teachers know about the environment and what they do about it?

In the past numerous studies have attempted to correlate teachers' environmental knowledge/attitudes/behaviors with student environmental knowledge/attitudes/behaviors. This study was also interested in whether or not it is possible to assess the teacher's E.E.C. at minimal adult level and thereby to gain insights regarding the effects of these competencies on those of their students.

Therefore the purpose of this study was threefold:

1. To determine current levels of environmental education competency of third grade students and their teachers through assessment of entry behaviors.

2. To determine if a relationship exists between competence in the cognitive (knowledge about the environment) and the affective (behaviors regarding the environment) domains.

3. To determine if a relationship exists between a teacher's E.E.C. and that of his/her students.

SIGNIFICANCE OF THE STUDY

Since little is currently known about the entry levels of students regarding environmental education knowledge and behaviors, it is difficult to establish meaningful minimal terminal performance. This study seeks to assess what the entry level of third grade students is regarding E.E.C. and thus serves as a pilot project for the field-testing of stated environmental education objectives. Such a field-testing is necessary

> ...to determine whether the behaviors cited by the objectives are attainable by students in a school setting as a result of planned instructional strategies...
> ...(for) determining the appropriateness of the objectives for the age group specified...
> ...(for) identifying some indicators of the relevance of the objectives in relationship to commonly agreed upon goals...
> (Michigan Department of Education, July 1973, p. 1).

The information made available as a result of this study would make it possible to reexamine existing minimal performance objectives in terms of the criteria just stated in order to make necessary modifications. In addition, the determination of this type of baseline data is essential to the development of educational programs that are relevant to student needs and abilities. As soon as information is

available concerning existing entry levels and the desired outcomes of environmental education instruction have been determined, we can examine the important issue of what delivery systems can be best utilized to obtain our goals.

Among the top priorities in environmental education today is the development of meaningful in-service teacher education programs. In order to do this, existing entry levels must be assessed and relevant terminal performances specified. Meaningful teacher education programs must be based on knowledge of entry levels of both the teachers and their students. This study seeks to provide useful data in this regard.

OVERVIEW OF THE DISSERTATION

In Chapter II the literature is reviewed to provide an understanding of the theoretical relationships of knowledge, beliefs, attitudes, values and behaviors in the learning process; to explore the role of performance objectives and criterion-referenced measurement in evaluation; and to provide an understanding derived from empirical studies of possible relationships between teacher traits and student performances. A brief description of the developmental learning theories by Piaget and Kohlberg is also provided.

In Chapter III the procedures used in the study are described. Hypotheses are formulated and assumptions and limitations stated. A description of the instruments used in assessing E.E.C. as well as scoring and evaluation procedures are given. Information describing statistical and data processing procedures is also given.

Chapter IV consists of the presentation, analysis and interpretation of data. The E.E.C.M. instruments are analyzed and descriptive and statistical data are presented and interpreted in relation to the formulated hypotheses and to achievement of specified objectives.

In Chapter V the data related to each of the hypotheses are examined and conclusions drawn. Data describing current levels of E.E.C. in Michigan in relation to Michigan Environmental Education goals are also examined and conclusions regarding educational implications and implications for future research are presented.

CHAPTER II

REVIEW OF THE LITERATURE

Literature regarding the theoretical relationships of the components of cognitive and affective domains is reviewed in this chapter in order to provide a basis for interpretation of empirical studies seeking to explore those relationships. Descriptive literature related to demonstrated levels of environmental education achievement in these domains is also cited.

A theoretical basis for the utilization of performance objectives in environmental education assessment is provided through a review of the literature relating to performance objectives and criterion-referenced measurements in the educational process.

Research exploring possible relationships between teacher traits and student performances is also reviewed to examine possible correlations between the cognitive and/or affective-behavioral scores of teachers and the cognitive and/or affective-behavioral scores of their students.

Finally a brief discussion of the developmental learning theories of Piaget and Kohlberg is presented to provide a conceptual framework for the interpretation of descriptive data.

The Cognitive and Affective Domains in Learning

Attitudes and Behavior

An attitude may be defined as a person's favorable or unfavorable orientation toward a group of objects or events--the evaluative dimension of human response (Knapp, 1972). Insko and Schopler (1967) and Wicker (1969) support Knapp's definition by referring to attitudes in terms of evaluative feelings in regard to particular objects. Rokeach (1968) suggests that attitudes represent an organization of interrelated beliefs that are focused on a specific situation. Finally, Watson (1966) describes attitudes as predispositions to act in a certain manner toward any given stimulus; thus attitudes can be considered constructs which can be inferred from behavior.

Behavior, as previously defined, is an observable or overt action which may be either verbal or nonverbal. The ramifications of this definition are extremely significant in the application of the term "behavior" in the development of behavioral or performance objectives to be discussed later in this chapter.

Often a three-step flow process from knowledge acquisition to attitudinal change and behavioral modification is assumed. This assumption is based on psychological balance, consistency or dissonance theories. These theories suggest that as a person receives more information on a topic, he begins to behave in accordance with that information. If there is inconsistency (dissonance) between the attitudes he holds and the knowledge he has obtained, the individual will change his behavior to bring it into closer harmony

with his attitudes. As Swanson (1972) points out, the actual relationship among the members of this triad are probably not as simple nor as consistent as previously assumed. This may in part be related to the fact that although attitudes are classified as belonging to the affective domain, they also have a cognitive component. Alternative theories to dissonance or consistency theory suggest that behavior may change before attitude change and that attitudes are more resistant to change. (Swanson, 1972, p. 364).

Numerous empirical studies have been conducted to investigate the relationships of attitudes and behaviors. Wicker (1969) indicated that research prior to 1969 suggested that it is considerably more probable that attitudes will be unrelated or only slightly related to overt behaviors than that attitudes will be closely related to actions. Seed (1970) found that young adults have strong public attitudes against littering but that their private attitudes and actions tend to be dissonant with their public littering attitudes. This is supported by the findings of Bart (1972) in a study of Minnesota graduate students in which attitudes relating to personal behaviors formed a linear hierarchy and were to a great extent independent of other attitudes which related to more public behavior. From this he concludes that anti-environmental attitudes associated with personal behavior are the most difficult to change.

According to Sheth (1974) more recent studies indicate that when attitude scores are calculated on the basis of

multidimensional measures there is a significant relationship to behavior or behavioral intention. This is supported by the results of Evans' (1974) study which was successful in fostering changes in littering and/or pollution behaviors as a result of programs focused upon attitudinal change. Further, the observed behavioral changes were explicable by cognitive consistency theory. Perkes (1973) points to a lack of understanding of just how attitudes and behaviors are related and how both are influenced by knowledge. Nevertheless, research suggests that although the relationship between attitudes and behavior is by no means linear or direct; the linkage is still predictable and manageable (Fishbein, 1967,).

Relationships of Cognitive and Affective Domains

Educators have long suspected that close relationships exist between components of the cognitive and affective domains and have conducted numerous inquiries into the nature of these relationships. Models describing possible relationships have been suggested by Eiss and Harbeck (1969) and Kimball (1974). The Eiss and Harbeck model emphasizes the complexity of interrelationships among the cognitive, affective and psychomotor domains and the resulting synthesis (output) in the form of overt behavior (Figure 1 adapted from page 4).

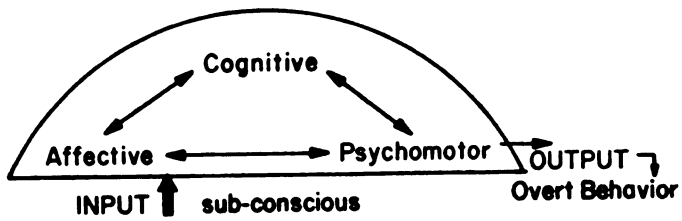


Figure 1. Eiss and Harbeck Model

Kimball (1974) developed a model utilizing Piaget's stages of cognitive development and related them to affective maturity (Fig. 2 - adapted from page 1).

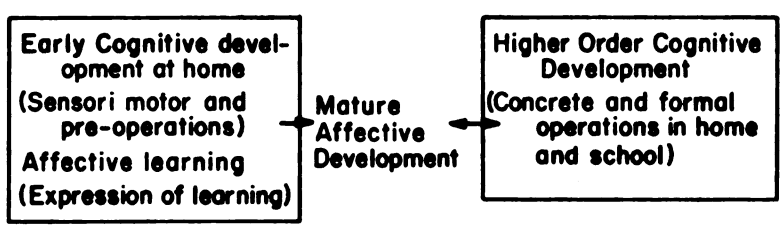


Figure 2. Kimball Model

This model suggests that cognitive development at higher levels is dependent upon affective development and maturity. Kimball's model is supported by Gordon's (1970) research which indicated a close relationship between affect and cognition in the development of object performance in infants and in the development of symbolism and language in the young child. Gordon concludes

> At all ages.. cognitive organization, development and change are inspired and fed by a search for meaning which is affective (p. 44).

Piaget and Inhelder (1969) indicate that all behavior patterns, no matter how intellectual, involve affective motivational factors; hence cognitive and affective aspects of learning are inseparable and irreducible.

In 1950, Sherman studied the attitudes of elementary school teachers in training and the extent to which conservation information was related to the possession of these attitudes. He found that common factors seem to be operating to influence both conservation information and attitude attainment. In 1966 George found that conservation attitude changes were associated with interest, motivation and exposure to conservation knowledge.

Solid (1971) studied the relationship of attitude toward conservation to knowledge about conservation in a group of junior high school students. The results of this study indicate a direct relationship or positive correlation between conservation knowledge and attitudes. Cohen's (1973) study of the relationship between the environmental information and environmental attitudes of high school students supports Solid's conclusions. Furthermore, the group which exhibited the higher information level was also more willing to express their attitudes. In a study of 1881 sixth grade students in North Carolina, Hounshell and Liggett (1973) found a high positive correlation between individual knowledge about the environment and attitudes toward the environment. Kimball (1974) found a high positive correlation between measures of thinking and feeling in Americans and in the citizens of other

countries. Moger's (1975) study of more than 200 high school seniors found a correlation of .38 between affective (environmental attitudes) and cognitive (environmental knowledge) test scores. This correlation was significant at the .001 level. Also the correlation between cognitive test scores and student grade point average (GPA) was .58; significant at the .01 level. However, no corresponding significant correlation between environmental attitudes and GPA was indicated by the results of this study.

The results of some research investigations, however, have suggested an inverse relationship between knowledge and the development of specific environmental attitudes (Tichenor, Donahue, Olien and Bowers 1971, Krathwohl, et al., 1964, Hilgerson et al., 1971). Thus Krathwohl, et al. conclude that the correlation between these two domains is too low to effectively predict one type of response from the other. Although the existing relationship between the cognitive and affective domains is not yet fully understood, Brown (1971) affirms that it is still apparent to most educators that all intellectual learning involves some affect and all affect is based upon intellectual involvement of some type.

Status of Environmental Knowledge and Attitudes

Several studies have attempted to determine the amount of specific or general environmental education knowledge/attitudes held by various segments of our society. In 1969 Swan found that despite the high concern expressed for air pollution by high school students, the subjects knew relatively little about air pollution

or local control efforts. Similarly a 1969 questionnaire distributed to fourth through sixth grade students by Towler and Swan (1972) indicated a high degree of awareness of environmental problems but little knowledge about factors which affect the environment or how they affect it or the degree to which they, as individuals, are personally related to the problem. The high level of awareness demonstrated by these studies corresponds to the high level of awareness of environmental problems in the United States reported by the May 1970 Gallup Poll according to Doran, Guerinin and Sarnowski (1974), 51% of the respondents to the poll indicated environmental problems are one of the three most important issues facing American society today.

In spite of this high level of awareness, research continues to indicate low levels of understanding of factors relating to environmental problems. Towler and Swan (1972) in a study of elementary school children found that elementary children generally lack an understanding of cause and effect relationships regarding environmental problems such as pollution (a phenomenon in accordance with the stages of cognitive development suggested by Piaget). They also found that a sample of teachers represented by members in the Michigan Environmental Education Association did a little better than the students in terms of environmental knowledge; but there were still large gaps in their overall understanding. Based on a review of the research prior to 1972, Roth and Helgeson (1972) conclude that the ability to identify or recognize environmental problems

does not necessarily imply knowledge or understanding of the problems presented. The results of an extensive study of 10,264 tenth and twelfth grade students in 22 states conducted by Bohl (1974) indicates that while American youth have a positive attitude toward environmental management, they are oriented toward regional problems and related knowledge areas and they seem to have little knowledge about how to change things in order to improve the quality of the environment.

A major hypothesis regarding reasons for this generally low level of environmental education knowledge concerns the lack of educational background on the part of most teachers in terms of environmental education. This is supported by research conducted by Ferrier (1972) who studied 131 elementary school teachers and found that 56% of the teachers (59% of primary teachers) felt that environmental education was a vague term. In spite of this only 14% felt that they were uncertain as to how environmental education relates to their classroom. Ninety-four percent felt that environmental education should be integrated into all areas of the curriculum but more than 50% indicated that they did not have enough background and training to do this effectively.

The lack of information regarding levels of existing environmental education knowledge in relation to broader environmental education goals is indicated by Towler and Swan (1972). They suggest, for example, that the first step toward meeting

Michigan's environmental education goals is to describe the base on which we can build--to determine the status of student's knowledge and attitudes about the environment.

Environmental Education Assessment

Within the last decade all curriculum areas, including environmental education, have been influenced by the growing national movement for accountability in education. In California the Stull Bill of 1971 required that teacher appraisal systems be created that would establish standards and techniques for assessing student progress in each curriculum area (including environmental education) and assessing teacher competencies in these areas (Passineau, 1975). In Michigan, a State Accountability Model (Appendix I) has been formulated and minimal performance objectives have been or are being developed in all subject matter areas.

Passineau (1975) suggests that assessment, however, should not be considered as synonomous with evaluation, since the process used to measure and describe a particular phenomenon is called "assessment", while "evaluation" implies the imposition of a judgment regarding the worth of a phenomenon.

Assessment in Cognitive and Affective Domains

Assessment in the cognitive domain constitutes a major aspect of every educational program and numerous means (including multiple-choice, fill-in, matching and essay type questions) exist to measure acquisition and retention of cognitive skills. Cognitive learning objectives abound which are formulated by the individual

classroom teacher, the local school district and the state departments of education. Cook (1975) reports that the Federal Interagency Committee on Education (FICA) proposed a series of cognitive learning objectives in environmental education for the high school level. (FICA did not, however, suggest any affective environmental education objectives).

Assessment and evaluation in the affective domain is much more difficult, and therefore there has been a tendency to minimize affective measurement efforts. However, since many of our environmental problems are actually closely related to human behavior (Swan 1969), worthy environmental education objectives and assessment must eventually deal with behavioral change (Perkes, 1973). Ames (1971) points out that in the final analysis, the success of environmental education will be determined in terms of its ability to change the behavior of society.

Clearly stated learning objectives in the affective domain are prerequisite to any assessment effort. The purpose of formulating objectives is to identify the specific outcomes of learning that are desired as a result of any given learning experience or program. Eiss and Harbeck (1969) indicate that at present the state of our knowledge about the affective domain may not be sufficient to suggest behaviors that invariably will serve as indicators of achievement of any particular affective objective. Affective assessment today consists of the identification of certain overt student behaviors that will be accepted as evidence that the objective has been achieved.

Few affective assessment instruments developed specifically for environmental education currently exist (Passineau, 1975). Bennett (1973) developed a series of guidelines for formulating environmental education objectives in all learning domains and reviewed existing environmental education assessment instruments. Passineau (1975) concludes that in order to assess the outcomes of environmental education a variety of measures are needed from formal test items to attitude scales, unobtrusive measures, and informal teacher observation.

Since classroom behaviors are directly relevant to curriculum goals, observational data can be used for assessing success in meeting these goals (Love, 1974). In fact

> ...a qualitative score... might well be given for the achievement of behavioral goals in the affective domain, if the score is used as an indication of the success of the school in achieving its goals and of teachers in carrying out the instructional program (Eiss and Harbeck, 1963, p. 26).

Although observational techniques (checklists, ratings, and narratives) are frequently used to assess learning outcomes, there are numerous factors which may influence their effectiveness. For example, the selection of behaviors to observe reflects the theoretical biases of those constructing the assessment instrument. In addition, their reliability may be affected by lack of precision in defining the behavior, the degree of complexity utilized to record behaviors, the order (high or low) of inferences required to classify the behaviors, and the demand for simultaneous observation of too

many variables (Good, 1963). Observer biases may also influence the observational process (Knafle, 1972). This raises the question as to whether the teacher's perception of student academic performance may be influenced by student behavior or vica versa. Brandt (1973) found that individual observers may also exhibit tendencies to either distribute their ratings along a given scale or to cluster ratings about a median value.

Several empirical studies have been conducted to investigate the utility of observational techniques in the classroom setting. Love (1974) found that the classroom behavior patterns of teachers and children were relatively stable across days. Contrary evidence is provided by a study conducted by Elmore and Beggs (1972) in which elementary teachers were asked to rate students on items describing specific observable classroom behaviors in two separate sessions with a two-week interval between ratings. The results of their study indicate that teachers were not stable in rating pupil behavior over this period of time.

In spite of the limitations and difficulties associated with behavioral observation techniques such measures are still most useful in the assessment of affective learning outcomes. Trexler (1963) found that the observational method seemed--to have a higher degree of validity for ascertaining conservation behavior than introspective techniques. Cronbach (1949) indicates that observations by partial observers can be accepted as valid if they can be made reliable. Reliability is enhanced when direct observations are made over reasonably long periods of time (too lengthy a time period

tends to have a negative effect), when the extent of the sampling is sufficiently large, and when the individuals being observed are consistent in their performance (Cronbach, 1949, Trexler, 1963).

Other affective instruments include the attitude inventory and self-reports. In 1950 Sherman suggested that an attitude inventory could be a feasible device for use with elementary teachers and that environmental attitudes could be inferred from responses to specific behavioral situations in regard to conservation problems. Upon completion of a review of the related literature, Roth and Helgeson (1972) conclude that statements of behavior with respect to conservation concerns do not satisfactorily predict observed behavior consistent with such statements. This is supported by Trexler's (1963) study of elementary school children in urban classrooms. Trexler investigated the relationship between children's testimonies and their observed behavior regarding conservation actions. He also explored the relationship between the children's testimonies and their I.Q., sex, academic achievement and the type of housing in which they lived. The results of this study showed a correlation of .03 between what children testified they did and what they were observed doing. This correlation is certainly not strong enough to suggest that self-report testimony of children can be relied upon to predict their conservation behaviors. None of the personal factors tested seemed to have an effect on the consistency of response.

Although affective assessment is difficult and at present far from precise, desired environmental education outcomes are

such that avoidance of assessment in this domain would result in serious omissions in the total environmental education endeavor. Perhaps one solution to the difficulties suggested above is the combined and concurrent use of more than one affective assessment instrument to ascertain the status of affective environmental education goals and outcomes. Since all environmental education programs should have as a prime consideration the modification of environmentally-related behaviors, any instrument that helps teachers appraise the student's behaviors toward the environment should be most helpful for both assessment and evaluation.

Norm-Referenced versus Criterion-Referenced Evaluation

The current dispute regarding the relative merits of norm-referenced (NR) and criterion-referenced (CR or mastery) evaluation procedures has implications for environmental education assessment and evaluation. This topic is particularly germane in Michigan because of the development of environmental education minimal performance objectives by committees of the Department of Education. In NR-testing, a student's score is assessed by relating it to the test results achieved by other students in the same or similar group. Thus, the critical property of NR-evaluation is the comparison to others for the establishment of an evaluative judgment (Yelon, 1976). In CR-testing, a student is expected to be capable of performing specific tasks in order to achieve the terminal objectives. His performance on these tasks can be interpreted without reference to the performance of other students. Thus, CR-measuring instruments are constructed to yield measures which can be directly interpreted

in terms of specified performances standards (Stanley and Hopkins, 1972).

The mastery or CR-test (CRT) is sometimes termed "content-meaningful" and is given to identify those students who have or have not acquired basal competencies. When a CRT is administered, the student is asked to perform the stated behavior as evidence that a particular objective has been attained. Hence CRT-items are directly derived from the instructional objectives of a learning program while NR-tests (NRT) are often constructed from more general objectives which may have greater significance to society but which may or may not be directly related to a particular learning program (Passineau, 1975).

NR-evaluation assesses individuals by comparing their performances with the performance of a normative group. The distribution of scores of such a group generates a normal or bell-shaped curve. Thus in NR-measurement the scale is anchored in the middle of a distribution of scores and represents average performance for a particular group while in CR-measurement the scale is anchored at the extremes with a score at the top of the scale indicating complete or perfect mastery of some particular performance (Ebel, 1971). Bloom (1968) suggests that the normal curve is intended to describe the outcome of random processes and, since education is a purposeful activity, the distribution of scores obtained upon the completion of instructional activities should be skewed toward the higher scores if instruction is effective.

A model developed by Carroll (1963) to explain the results of the research he conducted indicates that if students are normally distributed with regard to aptitude for a particular subject and all are presented with identical instruction, then achievement measured at the completion of study of the subject will be normally distributed. In this situation, the correlation between aptitude and achievement was found to be relatively high (.70 +). Conversely, if students are normally distributed with respect to aptitude but the quality and type of instruction and time allowed for learning are adapted to the characteristics and needs of each learner, then the majority of students will achieve subject mastery. In this situation, the correlation between aptitude and achievement should approximate zero. Glaser (1968) and Atkinson (1967) found that most students, in both standardized and self-paced learning systems can attain a given level of achievement, but some will attain it sooner than others. These studies indicate that 95% of the students tested can learn a subject to a high level of mastery if given sufficient time and appropriate assistance.

The best NR-examinations are those in which items which lack discrimination (those in which everyone answers in a similar manner) are deleted because they do not help differentiate students on the basis of the characteristics being evaluated. Since individual differences are of no concern in criterion-referenced testing, the best CRT-items might be answered similarly by all students if a particular objective has been achieved.

Block (1971) suggests that CR-measurements are absolute in the sense that they can be interpreted in relation to a fixed performance standard or criterion and do not require consideration of other measurements for interpretation.

> They indicate what the student has or has not learned because they are taken on a fully representative sample of skills (content and behaviors) drawn from those he was expected to learn (Block, p. 289).

If pupil learning success is to be promoted, evidence regarding what the student has learned at each stage must be available. Given this information, steps may then be taken to ensure that each student masters required performances before moving on to the next level of related performances.

Establishment of specified performance levels which will be acceptable indications of mastery is somewhat arbitrary but rests upon the following assumptions:

1. The attainment of some performance level in a particular instruction sequence will produce greater learning outcomes than non-attainment at some level.

2. Attainment of the selected level will produce approximately the same outcomes as would attainment at other possible levels (Block, 1971, p. 183).

Ebel (1971) suggests the following as limitations of CR-measurements:

1. They do not provide all the information we need to know regarding achievement.

2. They are difficult to obtain on a reliable basis.

3. They are necessary for only a small proportion of important educational achievements.

Other researchers suggest that the above limitations are equally applicable to NR-measurement. Harsh (1974) indicated that even for NR-testing, evaluation of the performance of another individual requires making judgments based upon a limited sample of possible and/or observed behavior. NRT-items sample some content from some categories of learning materials in some of the available formats. CRT-items provide exact replication of content, format and application that were used in the original lesson. Block (1971) suggests that findings to date indicate

> ...that pre-specified instruction objectives provide a key to maximally effective classroom instruction when put into operation in the form of criterion-referenced measurements for use in a feedback correction system (p. 294).

In spite of the numerous differences between NR and CR measurement previously described, there is still great variability in classification of measurement devices as CRT or NRT instruments by different researchers. Perhaps this indicates that although NRT and CRT instruments are concerned with different referent norms, they are still not totally exclusive of each other. Combined calculations may thus allow more comprehensive and meaningful assessment and evaluation of learning outcomes.

Performance/Behavioral Objectives in Education

Although there is a technical distinction between the term "performance objective" and the term "behavioral objective", many

researchers use these terms more or less synonymously. Both (1974) defines a behavioral objective as an operational statement of behaviors (verbal or nonverbal overt actions) which students will be expected to demonstrate at the completion of a learning unit.

Application of Mager's (1962) three criteria for behavioral objectives tends to increase the specificity of the behavioral statements to such a degree that behavioral objectives tend to become transformed into performance objectives. According to Mager, all behavioral objectives must contain statements which identify specific action(s), designate the conditions under which the student will be expected to perform the action, and specify the criteria of acceptable performance. A performance objective contains four essential components: a statement regarding the Audience for whom the objective is written, identification of the specific observable Behavioral action required as the terminal behavior, designation of the Conditions of performance and the Degree or criteria of acceptable performance. Hence for all practical purposes these two terms may be viewed as descriptions of basically the same philosophical and empirical approach to formulation of educational objectives.

Proponents of behavioral objectives include Briggs (1970), Kibler, Barker and Cegala 1970), Geis (1972), Mager (1962), Cogswell (1966), Churchman (1968), DeCecco (1968), Brooks and Friedrich (1973), Vargas (1972), Gagne (1967), Glaser (1967), Kurtz (1965), Lindvall (1964), Popham (1969), Tyler (1950), and Walbesser (1963). They suggest that there are four major advantages to

formulating objectives in behavioral terms.

1. Use of behavioral objectives more clearly communicates educational goals. Gagne (1972) indicates that behavioral objectives have a major role in clearly communicating educational goals to all involved in the learning process. In an extensive review of the literature related to behavioral objectives Booth (1974) reports that this hypothesis is supported by the work of Kibler, Barker and Cegala (1970), Briggs (1970), and Harless (1971). Gagne (1972) suggests that clearly communicating expectations to the learner regarding terminal behaviors serves to provide direction to the learning process by assisting the learner to reject extraneous or irrelevant stimuli and by serving a reinforcement function since the learner is thus able to determine which behaviors are "correct". Popham (1969) found that the use of behavioral objectives provided students with a direction and goal for their studies. Brooks and Friedrich (1973) suggest that behavioral objectives help direct the attention of students and Harless (1971) found that behavioral objectives tend to inform the student as to what has been achieved and what yet remains to be mastered.

2. Use of behavioral objectives facilitates curriculum design. Research conducted by Brooks and Friedrich (1973), Mager (1962), and Kibler, et al. (1970) suggests that using behavioral objectives assists the teacher to organize materials and design appropriate instructional strategies to obtain their educational objectives.

3. The use of behavioral objectives improves the teaching-learning process. Harless (1971), Mager and Pipe (1970) and Geiss (1966) suggest that the use of behavioral objectives tends to reduce instructional problems.

4. The use of behavioral objectives facilitates evaluation procedures. Little research has been cited to support this claim.

The effects of the use of behavioral objectives upon both students and teachers have been studied by numerous researchers. Booth (1974) and Walbesser and Eisenberg (1972) provide extensive summaries of this research and report the following results for each research question studied.

1. Does the use of behavioral objectives have a significant effect upon student achievement? Blaney and McKie (1969), Engle (1968), Tieman (1968), Piatt (1969), Maier (1930), McNeil (1967), Dalis (1970), Lawrence (1970) all indicate a significantly positive influence of the use of behavioral objectives. Bryant (1972) found that training teachers to use behavioral objectives had a significant effect on the cognitive achievement of black inner city children. Boardman (170), Bishop (1969) and Weinberg (1970) indicate no significant influence. Since these studies manipulated a wide range of variables including different student populations, different subject matter areas and different degrees of specificity of objectives, Walbesser and Eisenberg (1972) conclude that the literature offers a cautious support for this hypothesis.

2. Does the use of behavioral objectives have a significant effect upon the efficiency of knowledge acquisition and retention? Mager and McCann (1961) found that students who were aware of behavioral objectives were able to progress through instructional units in less time than those who were not. Walbesser (1970) found that the rate of acquisition and resistance to forgetting could be altered by informing learners of instructional objectives. Since a wide range of variables were manipulated in the various studies, research results thus offer only cautious support for the hypothesis that knowledge of behavioral objectives increases the rate of acquisition of learning and retards forgetting.

3. Does the use of behavioral objectives have a significant effect upon student attitudes toward instruction? Tieman (1968) found that students had a more favorable attitude toward presentation of lessons when specific objectives were used in contrast to general (non-behavioral) objectives. Research conducted by Rowan (1971) supports Tieman's results. Piatt (1969) found that students presented with behavioral objectives had a more positive attitude toward the instructor than those who were not given any instructional objectives.

A few research studies have investigated the opinion of teachers regarding behavioral objectives and their use. An ERIC report prepared by Cook and Neville (1971) examined the literature

in this regard and explored the question "Do teachers act differently on being given statements of objectives which are more specific?" Ammons (1962) found that teachers were unable to distinguish between behavioral and general objectives and this conclusion is supported by Baker (1969). Frey (1973) surveyed 406 elementary, middle and secondary school teachers and found that there was a high level of familiarity with behavioral objectives and a high degree of involvement in writing them but indecisiveness in regard to opinions of the influence of behavioral objectives on pupil performance. In spite of this, the majority of teachers surveyed indicated that behavioral objectives were useful in the educational process.

Booth (1974) concludes that the research fails to substantiate or disprove that behavioral objectives enhance the teaching-learning process (Jenkins and Deno, 1971) because research conducted to date has manipulated too many variables and utilized too many experimental designs to permit definitive conclusions.

Walbesser and Eisenberg (1972) and Booth (1974) list the following as opponents of behavioral objectives: Atkin (1968), Eisner (1967), Ebel (1970), Aronstine (1972), May (1964), MacDonald (1966), Raths (1971). These individuals caution that behavioral objectives should not be relied upon too heavily (Strain, 1970). Arnstine (1964), Atkin (1963), and MacDonald (1966) express the following concerns:

1. Behavioral objectives are too restrictive and hinder innovation.

2. Behavioral objectives can not be developed for all or even most of the important goals of education.

3. Writing behavioral objectives requires a great deal of time and is therefore unrealistic and impractical. Eisner (1969) indicates that teachers simply are not using them in instructional programs.

4. Use of behavioral objectives may result in failure to understand and appreciate the learning process.

Passineau (1975) suggests that the criticism that behavioral objectives do not foster the entire realm of educational potential including creativity and decision-making is based upon the realization that it is easier to formulate behavioral objectives for lower levels of cognitive learning than for higher levels or for the affective domain. He also indicates that the theory, however, should apply equally well to these levels of learning. Eisner (1967) points to the inability of behavioral objectives to articulate all outcomes of a process as dynamic and complex as education but Passineau replies that this simply means that when one is dealing with complex areas, certain important outcomes will develop without being specified as objectives in advance.

Student-Teacher Interactions in Learning

Numerous studies in the past have attempted to correlate teachers' knowledge, attitudes and/or behaviors with the knowledge, attitudes and/or behaviors of their students. The findings of some of these research projects will be discussed in subsequent paragraphs.

Teacher Knowledge and Student Achievement

Although there is a general expectation that increased teacher knowledge will be manifested in gains in pupil achievement, recent

research in this area does not provide overwhelmingly favorable evidence in this regard. Phillips (1973) found no significant relationship between student achievement in arithmetic and the arithmetic achievement of the most recent teacher. Ekstrom (1974) studied the cognitive characteristics of elementary teachers, their teaching behavior and the academic success of their pupils. Teachers were measured in terms of their knowledge of the subject being taught, their knowledge of teaching and their verbal, numerical, reasoning and memory aptitudes. Ekstrom concluded that the relationship between teacher knowledge in a content area and pupil achievement in that same area may not necessarily be positive. Rouse (1968) found a slightly negative correlation between the amount of college mathematics studied by elementary school teachers and the arithmetic achievement of their pupils. These studies suggest that numerous factors may be operating to influence the process of transferral of a teacher's knowledge to his or her students' ergo a direct relationship between a teacher's cognitive competencies and the achievement of his/her students can not *a priori* be assumed.

Teacher-Student Attitudes

The general assumption that teacher attitudes have a significant role in student learning is not clearly supported by research (Stern, 1963). Peskin (1964) in a study of seventh grade teachers and students in New York City, found no significant relationship between teacher attitude and student attitude nor between teacher attitude and student achievement. Glass (1970)

studied 525 high school students and their teachers to determine what effect teacher attitude toward biology had on student attitudes toward biology. The relationship between these two variables as determined by the Wilcoxon matched-pairs signed ranks test was significant at the .05 level. In addition, it was found that student attitudes could be significantly changed to be more congruent with that of their teacher. The conclusion suggested by this study is that students in general tend to adopt an attitude toward biology which is similar to that of their teacher but there is little or no relationship between these student attitudes and achievement in biology. Phillips (1973) found that the attitude of the most recent teacher toward arithmetic had a significant relationship at the .05 level to student attitudes toward arithmetic. These studies suggest that teacher attitudes may have a significant impact on student attitudes but do not seem to influence student achievement.

Teacher Behavior and Student Performance

Soar (1972) reports that numerous studies of teacher-student interactions using the Flanders systems of interaction analysis have found a positive relationship between indirect teacher behavior and various measures of pupil growth in achievement and development of favorable classroom attitudes. Anderson and Kaplan (1974), however, found that teacher behavior had a negligible effect on both mathematics achievement and satisfaction with school. Soar (1967) found that various patterns of teacher affective behavior related differentially to pupil growth in reading and vocabulary. Glass

(1970) found that the profile level of high school students (which included attitude toward biology and understanding of science) were modified to become more congruent with the profiles of their teachers. Since teacher E.E.C. includes both cognitive and behavioral components, based on the results of previous research the effects of teacher E.E.C. upon student E.E.C. are not readily predictable.

Studies previously conducted have sought to indicate the knowledge, attitudes and behaviors of teachers primarily in terms of areas of academic preparation and/or experiences in selected courses, workshops or programs or in terms of attitude preferences indicated by various Likert type scales. Pupil growth has been assessed primarily in terms of generalized achievement test scores and attitudinal scales. Utilization of performance objectives derived from identical educational goals for both students and teachers should provide a useful mode of inquiry into the relationships between overall teacher traits (EEC) and overall student performance (EEC).

Developmental Learning Theories

Introduction and Terminology

Learning theories which attempt to describe characteristics in a manner which is related to age in an orderly way are considered to be "developmental" (Sullivan, 1974). The theory of cognitive development formulated by Jean Piaget and the theories of moral or affective development suggested by Piaget and Kohlberg are also transactional in their philosophic approach to the educational process. Both of these theories utilize a rather distinctive and specialized vocabulary; hence the following definitions and

discussion may be useful in developing an understanding of the essential features of Piaget's and Kohlberg's work.

Content - The observable behaviors of the organism, the "what" is said or done, the "what" of behavioral objectives.

Structure - The principles used to organize content, the underlying frame of reference, the manner of a particular response.

Assimilation - External reality is taken into the organism's information system on terms dictated by the organism; perceptions are directly incorporated into existing cognitive structures. Assimilated perceptions therefore become the individual's translation of the world of reality.

Accommodation - A modification in the organization of a mental structure or the development of a new, enlarged mental framework. Stimuli from the external world cause transformations in cognitive structures.

Operations - Transformations of reality by means of internalized actions of the mind which are then grouped into reversible, coherent (logical) systems (Piaget and Inhelder, 1969).

Equilibration - The stability of a behavioral organization brought about by a regulation of assimilation and accommodation to maintain a state of internal balance; a dynamic reading of the environment (assimilation) and a consequent adjustment to the situation (accommodation). Veatch (1971) suggests that when the order of a mental operation can be reversed a deeper, internal level of understanding has been achieved. Such an understanding results from the process of equilibration.

Egocentrism - The inability to differentiate self from non-self; the lack of awareness of things outside the realm of one's immediate experience; lack of awareness of the perspectives of others and projection of the individual's wishes, fears, and desires onto the world around him (Pulaski, 1971).

Perspectivism - The ability to differentiate self from others; the capacity for putting oneself in the place of another.

Conservation - The ability to comprehend that objects or quantities remain constant despite changes in their appearance.

Decentration - Focusing on both primary and secondary aspects of a stimulus and incorporating them into a unified whole.

Object constancy - Intellectual ability to realize that objects and people exist independently of individual's perception of them (Pulaski, 1971).

Piaget's and Kohlberg's theories suggest that all learning develops through a series of invariant stages which are qualitatively distinct from each other, have structural integrity and which are hierarchially integrated. Thus stages can not be skipped in the learning process, although some individuals progress faster and farther through the various stages. Duckworth (1964) indicates that although the order of the stages is constant, the time of appearance of a particular stage may vary with the individual and with the culture. Each new level of development represents a new coherence, a new structuring of elements of reality which until that time have not been systematically related to each other.

Movement from stage to stage is a long term process and is in no way automatic. Inter- and intra-stages (transitional stages)

exist during which the individual is characterized by a resurgence of egocentrism and disequilibrium. Gordon (1970) suggests that

> ...disequilibrium is created through the transactional relationship between internal growth and external social pressure and acts as a motivating force for development (p. 144).

Allen (1973) characterizes the general pattern of growth from one stage to the next higher stage as a process involving awareness of the next higher stage and the development of dissonance between one's current pattern of reasoning and awareness of reasoning patterns at the next higher level. Also involved are the nature of personal experience, increased sensitivity, general cognitive growth and the degree of risk and support involved in reasoning situations with others. Duckworth (1964) suggests that biological or nervous maturation, experience and social transmission or mediated contact with the world are necessary conditions for development but are largely passive in nature. In addition to these passive factors, the active and dynamic force of the equilibration process is also essential for development or growth. Although all of these factors are necessary in the developmental process, none are sufficient in and of themselves. Hence it is the dynamic interactions of these factors which take place as the individual experiences various transactions with the environment that ultimately direct the nature and rate of individual development.

Cognitive Development

Since the early 1940's, Piaget and his associates have interviewed hundreds of subjects and have confirmed their

original position that stages of cognitive development exist and that although the age of attainment of certain concepts may be somewhat variable, the order of development is still invariant (Phillips, 1974).

The first developmental stage identified by Piaget is the sensorimotor stage which generally characterizes individuals in the age range from birth to approximately two and one-half years. The primary intellectual instruments at this stage are perceptions and physical movement.

Children from two or three years to seven or eight years are generally characterized by pre-operational thought. This is a pre-conceptual stage of development in which the child is capable of thought or representation but cannot perform mental operations; that is, the child can differentiate words or images (signifiers) from the objects or events to which the thoughts, images, or representations refer. However thoughts cannot be integrated into networks of ideas which he can reverse in his thinking. Thought is perception-bound therefore the child at this stage will make decisions based on perceptual clues if a conflict arises between cognitions and perception. Spontaneous reasoning regarding a part of the whole in relation to the whole itself is impossible. Thought is not yet organized into rules and concepts and definitions tend to be functional rather than abstract. Pre-operational thought involves transductive reasoning (reasoning from particular to particular) and tends to link things together which are unrelated. Generally such individuals are egocentric and tend to

believe that all events are caused by people. Mental comparisons are still impossible and perception tends to center around one area or feature of an object at a time. Although thinking is more advanced, the child is still unable to deal with more than one relationship at a time and thought is still largely unsystematic (Steward, 1973).

The majority of the third grade students who were the subjects of this study can be expected to be in a transitional stage between pre-operational and concrete operational thought depending upon their age and the type of experiental background. Around seven or eight years there is a major revision in a child's thought as a shift occurs from the pre-operational stage to the stage of concrete operations. This shift permits the child to conceptualize certain types of relationships and is marked by development of the child's ability to decenter from a focus on the perceptually dominant features of reality. There is an accompanying decentering from focus on the more obvious overt behaviors of others to the less obvious underlying behavioral mechanisms (Whiteman, 1967).

During this stage of concrete operations (seven or eight years to eleven or twelve) the child can operate intellectually on concrete objects or their representations and can serialize, extend, differentiate or combine existing structures to form new relationships or groupings. Thought is still limited to concrete experiences and the child is not capable of dealing with abstractions. Reversibility characterizes this stage and the

child can range forward and backward in space and time on a mental level (Pulaski, 1971).

The development of conservation is one of the most significant achievements of this period. This ability is important for values development as well as cognitive development since human relationships are dependent upon the ability to hold certain relationships constant in the face of numerous changes (Steward, 1973). Phillips (1974) points out that an individual child may function at the concrete operations level at certain times or with certain types of content and may function at a different level with different content or in different situations. Thus a "concrete operational" child does not exist; the designation of stages are merely constructs presenting optimum capabilities which are not always observable in any given child. Therefore when describing the level at which an individual child seems to be functioning, it would be most proper to specify that the child was functioning at the concrete operational stage in regard to the specific task under consideration.

The level of formal operations generally characterizes development from eleven or twelve to adulthood and may be established as early as 15 or 16 years. Abstract and formal thought is possible and consideration can be given to the form of an argument as well as its content. Reasoning is hypothetico-deductive in that a person can reason about a specific hypothesis and draw conclusions regarding possible outcomes. Operations are coordinated and issues and principles become important.

Reflective thought is possible and egocentrism is replaced by perspectivism once equilibration at this level has been achieved (Stewart, 1973).

Recent work (Marek and Renner 1972 and McKinnon and Renner 1971) suggests that many individuals who should chronologically be at the formal operational level are still functioning at the concrete level with regard to the majority of educational tasks, and hence tend to ignore variables or are incapable of considering many variables concurrently. This is significant in the development of environmental education programs since the concrete thinker tends to select the most obvious cause and effect while the formal operational thinker is capable of identifying and mentally manipulating the larger number of variables which is required for consideration of most environmental problems.

Affective or Moral Development

A developmental perspective on morality would suggest that there is no fixed morality throughout one's life. Instead an individual's moral stance depends upon current and past transactions or interactions with the environment and how this content has been internally organized into a cohesive structure which tends to provide the framework for all decisions and behaviors. According to Allen (1973) individuals at different ages may differ in the following dimensions:

1. Differentiation of what one considers significant in taking any moral stance or action. Differences in knowledge base and the cognitive skills required to understand what is happening

and to perceive consequences and implications will therefore affect one's moral stance.

2. Empathy; the ability to consider the perspective, interests and feelings of others affects the sensitivity of an individual in weighing actions and making judgments.

3. The reference group considered significant in defining one's sense of responsibility and obligation may vary from the family to universal concern for all mankind and, it would be hoped, by extension to the entire biosphere.

These variables are reflected in the suggested stages of moral development formulated by Kohlberg.

Kohlberg (1968) extended the work of Piaget (1932) by presenting moral dilemmas to a wide variety and age group of subjects who were asked to judge the morality of conduct in a series of stories. Each level and stage of Kohlberg's moral typology requires and assumes the achievement of certain cognitive Piaget stages, tasks and traits.

Stage zero, the amoral or premoral stage, characterizes the child from birth to about four and one-half years old. At this stage the child does not understand the concepts of rules, power and authority and judges good and bad in terms of what is pleasant or exciting. There is no sense of obligation even in terms of external authority.

The first level of moral thinking is the <u>preconventional level</u> and is usually occupied by children aged from four to ten; hence the third grade children who were the subjects of this

study would be expected to be functioning primarily on this level. There are two stages which are discernable at this level: stage one, the obedience and punishment stage, and stage two, the back-scratching stage. At stage one the moral perspective of authority is paramount and the physical consequences of an action determine its positive or negative value. Stage two reasoning recognizes that each individual has his own idea of what is "right" but the child usually feels that his own idea is best. Human relations contain elements of fairness, recriprocity and sharing but these are always pragmatically interpreted; hence relationships are based on a "you scratch my back and I'll scratch yours" principle and not upon loyalty, justice or gratitude. To summarize, the preconventional child is usually well-behaved and responsive to social labels of good and bad but these labels are interpreted in terms of the physical power of the authority figure. (Kohlberg, 1968).

Level two, the conventional level, containing individuals from ten or twelve years and older, has been described by Kohlberg (1968) as conformist because conforming to the rules and expectations of one's family, group and nation is regarded as valuable in its own right. Not only is conforming a primary concern but so is the maintenance, supporting and justifying of the order established by these groups.

Stages three (conformity) and four (law and order) are discernable in Level Two. At stage three, the child is perspectivistic and is primarily concerned with the evaluative judgments made by others. Hence "good" behavior pleases or helps others

and is approved by them; ergo approval is earned by being "nice". The intentions of others are considered for the first time in forming evaluations of behaviors and actions. Stage four individuals are characterized by a strong orientation toward authority, and what is "good" is what appears to be best for society and for the majority. "Right" behavior involves doing one's duty and maintaining the social order. This stage characterizes many Americans and many adults never develop beyond this level.

The third or post conventional level is characterized by a thrust toward autononomous moral principles which have universal application apart from the authority or groups who hold them and apart from the individual's identification with these groups or persons. Stage five (social contract) individuals define individual rights and standards in terms of those agreed upon by the whole society. "Right" action is therefore a matter of personal opinion except where democratically or constitutionally defined; thus this is the official morality of the American constitutional government. Emphasis is upon the legal perspective; however, laws can be changed for the benefit of society. Stage six (universal principles) individuals define "right" in terms of a decision of conscience in accordance with internalized ethical principles. These are universal principles such as justice, equality of human rights and human dignity.

Although data from empirical studies is not yet conclusive, Kohlberg (1973) speculates on the existence of a stage seven in which all life and that which supports life is of primary value.

Such a level is reminiscent of Aldo Leopold's "land ethic" and would be of paramount significance to environmental educators if adequately demonstrated by future research findings.

Application of the Kohlberg levels and stages to the development of values regarding human life is of particular interest to environmental educators. In terms of the value of human life the six stages can be characterized as follows:

Stage 1 - The value of human life is not distinct from the value of physical objects and is based upon the physical attributes or social status of its possessor.

Stage 2 - Human life is valued as instrumental to satisfaction of needs of its possessor or of other persons.

Stage 3 - The value of human life is dependent upon the empathy and affection of family members and others toward the individual.

Stage 4 - Life is sacred in terms of its place in a religious or moral order of rights and duties.

Stage 5 - Life is valued in terms of its relation to community welfare and in terms of being a universal human right.

Stage 6 - The sacredness of human life is a universal human value and is expressed as respect for the individual (Kohlberg, 1968).

Allen (1973) suggests that persons at any particular moral stage will understand all lower stages and occasionally will employ lower stage operations depending upon motives, needs, attitudes, moral sensitivities and awareness in a particular situation. This

has many implications for the environmental educator who is attempting to foster development of a moral-ethical environmental perspective.

Implications for Elementary Environmental Education

Havinghurst (1953) identified the primary developmental tasks of middle childhood as development of concepts necessary for everyday life, development of conscience, morality, and a scale of values, and development of attitudes toward social groups and institutions. These developmental tasks involve both cognitive and affective growth; hence the theories of Piaget and Kohlberg have numerous implications for elementary environmental education.

Piaget's work in the cognitive domain indicates that all knowledge is made up by man in the process of making sense out of his environment; therefore all knowledge is tentative. This lends support and provides a basis for inquiry, problem-solving, and discovery approaches to learning-- the learning by doing, the field work and other hands-on activities characteristic of environmental education.

Perhaps an even more significant result of Piaget's work deals with the findings that indicate that children are not merely "little adults" but actually utilize a different logical pattern of learning or interacting with the environment. Piaget's stages of cognitive development provide a basis for examining the learning process at different levels of maturity and are most useful in determining what types of learning materials and experiences are appropriate at what level of development or at what grade level in

the school curriculum.

In the affective domain the work of Lawrence Kohlberg is very significant to environmental educators. As a transactionalist he believes that the values an individual holds at any moment are the result of his current and past interactions with his environment and that as new information becomes available and different interactions take place, the individual's values are likely to change. Hence to identify or clarify one's value-stance at any point in time is only useful for that particular point in time.

Since environmental educators are vitally concerned with value development, environmental education activities based on this ecological model of learning should provide the opportunity for numerous interactions which can foster progression through Kohlberg's stages of moral development. Allan (1973) suggests that environmental education should facilitate student dialogue and reasoning appropriate to the student's cognitive and moral stage and should encourage progress to the next level.

Kelly and White (1975) utilize Piaget's and Kohlberg's work to describe the cognitive and affective characteristics of children in the lower elementary grades (K-3) and to suggest implications of these characteristics for environmental education. (Table 1). They point out that principal access to the environment of children at this level is through direct sense perception; therefore, learning activities should promote sensory utilization to obtain information about the environment and its components.

The primary school child is likely to be possessive and egocentric in his contact with nature and as such tends to enjoy collecting objects from nature and from the man-made technological world; thus these interests can serve as a focus for planned environmental education experiences. Since children at this stage of development are learning to assess the attitudes of others as a function of their verbal and nonverbal behavior, they are likely to be particularly sensitive to the attitude of the teacher in relation to environmental activities; thus teacher attitudes can be expected to influence the impact of these experiences upon the child. The primary role of the elementary teacher in environmental education is to assist the students to better know as many parts of their environment as possible and to facilitate the development of concepts regarding simple relationships which can provide a basis for discrimination and formulation of simple classification systems.

TABLE I
Implications of Developmental Learning Theory for Elementary Environmental Education

Characteristic of Primary School Child	Implication for E.E.
1. Children exhibit a wide range of cognitive abilities	1. ...therefore a wide range of educational activities should be available.
2. Limited abilities to interpret time, space and distance	2. ...suggest that activities involving these concepts should be gradually introduced and developed slowly and carefully.
3. The difficulty of the child in recognizing that objects may hold several properties concurrently	3. ...suggests that E.E activities emphasize a small number of rather obvious properties for any natural or man-made object.
4. Difficulty in maintaining logical consistency in thought process	4. ...requires that activities demanding logical development of relationships should be presented slowly and carefully with a great deal of redundancy and reinforcement.
5. Although the rudiments of understanding cause and effect relationships exist	5. ...activities should be selected that tend to promote the examination of only the most simple cause and effect environmental relationships.
6. Children tend to enjoy pictures and project their own experiences into them	6. ...ergo careful selection and use of illustrations can foster interests in the environment and promote consideration of simple relationships.
7. The primary child has limited dexterity, stamina and psychomotor coordination	7. ...therefore selection of E.E. activities should be made carefully so that unrealistic demands are not made on the child's endurance or capabilities.
8. Although the moral sense level at this stage is based on personal concepts of right and wrong	8. ...only activities which avoid complex value questions related to externally-based moral principles should be selected.

(Adapted from Environmental Education Guide, K-12, Divisions of Elementary, Secondary and Vocational Education, State Department of Education, Richmond, Virginia, 1974 as presented by Kelly and White (1975).

CHAPTER III

DESCRIPTION OF THE STUDY

Overview

Experimental Design

Four hundred and thirty-six (436) third grade students representing twenty classes in eight different public school districts of Michigan's lower peninsula were given an Environmental Education Competency Measure (E.E.C.M.) based on Michigan K-3 Minimal Performance Objectives. The cognitive component of the instrument was administered to groups of ten students orally by the researcher. Posters illustrating both questions and answers were read to the students and they were asked either to mark an "X" through the appropriate circle on the answer sheet representing the response of their choice or to write four or five words in list format. The total number of correct responses constituted the C-score for each student. In addition, teachers were asked to observe specific environmental education behaviors of their students during a two-month period and then to rate each student in regard to frequency of exhibited behavior on a behavioral checklist. The scores derived from this checklist constituted the AB component of the E.E.C.M.

The teachers of the twenty third grade classes used in the study were given an E.E.C.M. based on Michigan 7-9 Minimal Performance Objectives. The cognitive component of the instrument was open-ended in format and was scored by comparing the teachers responses with those of ten environmental education "experts" who were members of or consultants to the committees developing environmental education performance objectives. (Appendix II) One point was given for each acceptable response. Two separate scorings of these responses were made by different individuals and the scorer reliability coefficient determined. The total number of correct responses constituted the C-score for each teacher. The AB component of the instrument involved self-reported responses regarding environmentally-related behaviors. These responses were verified by an interview with the researcher, who then accordingly evaluated each teacher on a behavioral checklist. The scores derived from this checklist constituted the AB-score of the E.E.C.M.

The data were then evaluated using a combination of item analysis, descriptive reports and parametric and non-parametric statistical procedures.

Hypotheses

The following questions were of interest in this study

1. Is there a relationship between cognitive (C-score) and AB scores of students and/or teachers in general? The null hypothesis tested was that there is no significant relationship between C-scores and AB-scores for either group.

2. Is there a relationship between cognitive scores of teachers and those of their students? The null hypothesis tested was that there is no significant relationship between C-scores of teachers and the mean C-scores of their respective classes.

3. Is there a relationship between AB scores of teachers and those of their students? The null hypothesis tested was that there is no significant relationship between AB-scores of teachers and the mean AB-scores of their respective classes.

4. Is there a relationship between environmental education competency (E.E.C.) of teachers and that of their classes? The null hypothesis tested was that there is no significant relationship between the E.E.C. of teachers and the mean E.E.C. of their respective classes.

In addition to these questions, determination of current levels of environmental education competency of third grade students and their teachers was also of interest. No hypotheses were formulated in this regard. The descriptive data contained in subsequent sections of the study best describe the results obtained.

Assumptions and Limitations

In this study the following assumptions have been made

1. The sample population was representative of third grade students and teachers in Michigan.

2. Uncontrolled variables (sex, socio-economic status, intelligence quotient, age) will tend to distribute their effects widely throughout the experimental sample.

3. The cognitive component of the E.E.C.M. reflected accurately environmental education cognitive achievement.

4. Teachers' observations of affective behaviors were accurately reflected by use of the behavioral checklist.

5. The teachers' responses to the self-report AB component of the instrument were validated by the interview process and reflected in the final AB-scores.

The following limitations have been recognized in this study

1. The test items represent only a small fraction of the items that could be utilized to assess whether or not a specific performance objective has been mastered.

2. Some of the test items may require modification.

3. The existing minimal performance objectives used in this study have not been refined.

4. Additional performance objectives may be needed to accurately reflect existing levels of environmental education competency in terms of established goals.

5. The size of the teachers' sample is small.

6. Teachers' observational skills vary.

Performance Objectives and the E.E.C.M.

Minimal performance objectives relating to the five Michigan Goals of Environmental Education were developed for grades K-3, 4-6, and 7-9 by the Michigan Environmental Education Referent Committee. Both student and teacher environmental education competency

measures (E.E.C.M.) are based directly upon existing objectives for their respective levels. The student E.E.C.M. specifies behaviors to be achieved at the completion of the third grade while the teacher E.E.C.M. specifies behaviors to be demonstrated at the completion of the ninth grade. The ninth grade competency level represents the minimal adult level of achievement to be assessed; therefore teachers with or without specialized training and/or background in environmental education would be expected to demonstrate this minimal level of environmental education competency.

Student E.E.C.M.

The student E.E.C.M. consists of two parts: a cognitive component assessed in written form and an AB component assessed through the use of a behavioral checklist. Test items (Appendix III) for the cognitive component were generated in multiple choice or list format from the performance objectives specified for Goals 1 and 2, while items for the behavioral checklist (Appendix IV) were developed from performance objectives specified for Goals 3, 4, and 5. Table 2 indicates the goals and related performance objectives for the third grade utilized in this study (Michigan Department of Education, June 1974).

Test items were pre-tested with a group of thirty third grade students from a parochial school in Lansing and necessary modifications were made. Third grade teachers from several parochial schools were asked to examine and criticize the items of the behavioral checklist in terms of utility and applicability to the

third grade classroom. Their suggestions were incorporated into the final form of the checklist.

TABLE 2-A
Environmental Education Goals and Third Grade Performance Objectives

GOAL 1 - To realize and appreciate that man is an inseparable part of a life support system and that whatever he does alters the interrelationships within the system.

GENERAL OBJECTIVE 1 - The learner should recognize and identify components of our life system--spaceship earth.

PERFORMANCE OBJECTIVES: Audience - At the end of the third grade the learner will....

Number	Conditions	Behavior	Degree	Test Item Number
1.1	Given paper and pencil	Sketch or describe in writing components of his environment.	at least 4	1-4
1.2	Given a list of environmental components	Separate those that are living from those that are non-living.	with 100% accuracy	5,6
1.3	Given a picture or description of a place where living things are found (habitat)	Identify plants and/or animals that are associated with that habitat.	at least 3	7-11
1.4	Given the name or a picture of a plant/ animal (organism)	A. Identify the habitat of the organism, and B. Associate the organism with its food supply	with 100% accuracy	12-16
1.5	Given paper and pencil	Identify natural resources used in his environment	at least 5	41-45

GENERAL OBJECTIVE 2 - The learner should recognize and describe fundamental relationships among components of our life support system.

PERFORMANCE OBJECTIVES: Audience - At the end of the third grade the learner will....

Number	Conditions	Behavior	Degree	Test Item Number
2.1	Given a list of objects found in the environment	Identify those that show a relationship to each other	with 100% accuracy	18-21
2.2	Given a sample or picture of specific organism or individuals	Identify it as part of a specific group of organisms	with 100% accuracy	17,22,23
2.3	Given the picture of a specific organism or individual	Describe orally or in writing...role played by the organism	at least 1	24-27

GENERAL OBJECTIVE 3 - The learner should identify and describe effects of some fundamental changes that occur in our life support system.

PERFORMANCE OBJECTIVES: Audience - At the end of the third grade the learner will....

Number	Conditions	Behavior	Degree	Test Item Number
3.1	Given a series of pictures of an organism, natural or man-made object or habitat that changes with successive observations	State..properties that are changing.	at least 1	28-31

TABLE 2-B

Number	Conditions	Behavior	Degree	Test Item Number
3.2	Given a set of pictures illustrating change	Arrange them in order in which changes occurred	with 100% accuracy	32,33
3.3	Given sample organisms or populations or pictures of such	Measure and describe their growth	with 100% accuracy	34

GENERAL OBJECTIVE 4 - The Learner should recognize and identify some of the changes that man is capable of making in our life support system.

PERFORMANCE OBJECTIVES: Audience - At the end of the third grade the learner will....

Number	Conditions	Behavior	Degree	Test Item Number
4.1	Given a series of pictures depicting changes in the environment	Identify those changes that are man-made	with 100% accuracy	35

TABLE 2-C

GOAL 2 - To obtain a basic awareness and understanding of the environment with its associated problems and to learn ways they can be effectively solved.

GENERAL OBJECTIVE 1 - The learner should demonstrate awareness of air, water, and land pollution.

PERFORMANCE OBJECTIVES: Audience - At the end of the third grade the learner will....

Number	Conditions	Behavior	Degree	Test Item Number
1.1	Given a list of types of pollution and a list of possible sources	Match each pollution source with 1 or more appropriate pollution types	with 100% accuracy	36-38

TABLE 2-D

GENERAL OBJECTIVE 2 - The learner should demonstrate awareness of the relationship between a healthy environment and healthy organisms or groups of organisms.

PERFORMANCE OBJECTIVES: Audience - At the end of the third grade the learner will....

Number	Conditions	Behavior	Degree	Test Item Number
2.1	Given a picture or description of a set of environmental conditions	State...positive/ negative effect the conditions have upon an organism in that environment	at least 1	39-40

GOAL 3 - To recognize and clarify values concerning the environment.

GENERAL OBJECTIVE 1 - The learner should recognize some of the feelings that may be generated in response to environmental issues.

PERFORMANCE OBJECTIVES: Audience - At the end of the third grade the learner will....

Number	Conditions	Behavior	Degree	Test Item Number
1.1	Given a specific environmental event or situation or a description of such (especially neighborhood/community environment)	Identify various feelings a person involved in the event may have	Frequently	AB 1

TABLE 2-D

GENERAL OBJECTIVE 2 - The learner should give evidence that he/she values a healthy environment (clean air, clean water, healthy organisms, etc.)

Number	Conditions	Behavior	Degree	Test Item Number
2.2	Given a picture or description of 2 or more environments	Will choose the 1 indicating the healthy environment and will state why he has chosen that environment	Frequently	AB 2 AB 3

GOAL 4 - To develop a personal responsibility for environmental protection and enhancement - stewardship.

GENERAL OBJECTIVE 1 - The learner should demonstrate an appreciation of and respect for other organisms.

PERFORMANCE OBJECTIVES: Audience - At the end of the third grade the learner will....

Number	Conditions	Behavior	Degree	Test Item Number
1.1	Voluntarily	Gives evidence of caring about other organisms that are part of his environment	Frequently	AB 4

GENERAL OBJECTIVE 2 - The learner should demonstrate that he has a sense of personal responsibility toward his environment - stewardship.

PERFORMANCE OBJECTIVES: Audience - At the end of the third grade the learner will....

Number	Conditions	Behavior	Degree	Test Item Number
2.1	Voluntarily	Gives evidence of stewardship directed toward protection or enhancement of his environment	Frequently	AB 5, AB 6

GOAL 5 - To develop motivation to work toward the prevention of and solutions to environmental problems--action.

GENERAL OBJECTIVE 1 - The learner should recognize at least one problem in his immediate environment and voluntarily do something to help solve it.

PERFORMANCE OBJECTIVES: Audience - At the end of the third grade the learner will....

Number	Conditions	Behavior	Degree	Test Item Number
1.1	Orally, pictorially or in writing	Recognize an environmental problem in home, school, or neighborhood community	Frequently	AB 8, AB 9
1.2	Voluntarily, orally or by physical action	Give evidence of working toward the prevention of and/or solution to an environmental problem in his local environment	Frequently	AB 10, AB 7

TABLE 2-E

Teacher E.E.C.M.

The teacher E.E.C.M. consists of a cognitive component assessed in written form and an AB component assessed through a combination of self-reports, interview and a behavioral checklist. Test items for the cognitive component (Appendix V) were in the form of open-ended essay questions instead of short answer or multiple choice format in order to obtain information that more readily reflects the actual thought pattern of the teacher. Test items relating to performance objectives specified for Goals 1, 2, and part of Goal 3 constituted the cognitive component of the E.E.C.M. A self-report (Appendix VI) of environmentally-related behaviors contained questions relating to performance objectives specified for Goals 3, 4, and 5. These responses were verified by an interview with the researcher (Appendix VII) who then evaluated each teacher accordingly on a behavioral checklist (Appendix VIII). Table 3 indicates the ninth grade goals and related performance objectives utilized in this study. (Michigan Department of Education, June 1974).

TABLE 3-A
Environmental Education Goals and Ninth Grade
Minimal Performance Objectives

GOAL 1 - To realize and appreciate that man is an inseparable part of a life support system and that whatever he does alters the interrelationships within the system.

GENERAL OBJECTIVE 1 - The learner should demonstrate a basic understanding of the necessity for and the interrelationships of the various parts that constitute the life support system.

PERFORMANCE OBJECTIVES: Audience - At the end of the ninth grade the learner will....

Number	Conditions	Behavior	Degree	Test Item Number
1.1	Given paper and pencil and a list of elements of a life support system	Diagram the system	with 100% accuracy	1,2,9,10
1.2	Given paper and pencil and a list of elements of a life support system	Discuss the interrelatedness of the system	with 100% accuracy	none
1.3	Given paper and pencil and a list of elements of a life support system	Construct operational definitions such as a) closed system, b) carrying capacity, c) limiting factors, d) natural resources for the system	with 100% accuracy	3-6
1.4	Given a paper and pencil and a list of elements of a life support system	Explain the relationship between increased populations and environmental use in an interacting community	with 100% accuracy	7,8,11,12

TABLE 3-B

GENERAL OBJECTIVE 2 - The learner should demonstrate an awareness of the possible effects of selected institutions on his life support system.

PERFORMANCE OBJECTIVES: Audience - At the end of the ninth grade the learner will....

Number	Conditions	Behavior	Degree	Test Item Number
2.1	Given several examples of man's institutions (i.e. free enterprise system, industrial complex, right to own property)	Demonstrate knowledge of the effects of permitting unlimited production of automobiles in the face of the energy crisis and pollution problems	with 100% accuracy	16-19

GENERAL OBJECTIVE 3 - The learner should realize the benefits to man from understanding his life support system--that through man's understanding of and concern for the life support system he can maintain or improve his quality of life.

PERFORMANCE OBJECTIVES: Audience - At the end of the ninth grade the learner will....

Number	Conditions	Behavior	Degree	Test Item Number
3.1	Given pencil and paper	List benefits that he/she derives from understanding this system	5	13

GENERAL OBJECTIVE 4 - The learner should demonstrate the interrelatedness of man and the life support system.

PERFORMANCE OBJECTIVES: Audience - At the end of the ninth grade the learner will....

Number	Conditions	Behavior	Degree	Test Item Number
4.1	Given the name or description of a natural or man-made environment	List ways in which the life support system affects man	Several (3 or more)	14

Number	Conditions	Behavior	Degree	Test Item Number
4.2	Given the name or description of a natural or man-made environment	List ways that man affects the life support system	Several (3 or more)	15

GOAL 2 - To obtain a basic awareness and understanding of the environment with its associated problems and to learn ways they can be effectively solved.

GENERAL OBJECTIVE 1 - The learner should demonstrate awareness and understanding of problems associated with the environment.

PERFORMANCE OBJECTIVES: Audience - At the end of the ninth grade the learner will....

Number	Conditions	Behavior	Degree	Test Item Number
1.1	Given paper and pencil	List important environmental problems	At least 10	20
1.2	Given an example of a natural or man-made environment	List significant problems of that environment	3	21,26

TABLE 3-C

GENERAL OBJECTIVE 2 - The learner should analyze problems of the environment and analyze possible solutions to these problems.

PERFORMANCE OBJECTIVES: Audience - At the end of the ninth grade the learner will....

Number	Conditions	Behavior	Degree	Test Item Number
2.1	Given a description of an environmental problem	State some possible solutions	with 100% accuracy	24,29
2.2	Given an example of a natural or man-made environment (ecosystem)	Describe why problems listed are problems	with 100% accuracy	none
2.3	Given an example of a natural or man-made environment (ecosystem)	Identify cause of the problems	with 100% accuracy	22,27
2.4	Given an example of a natural or man-made environment (ecosystem)	Describe effects of these problems	with 100% accuracy	23,28

GENERAL OBJECTIVE 3 - The learner should identify new problems associated with suggested environmental solutions.

PERFORMANCE OBJECTIVES: Audience - At the end of the ninth grade the learner will....

Number	Conditions	Behavior	Degree	Test Item Number
3.1	Given some possible solutions to an environmental problem	Identify new problems that may occur as a result of the suggested "solutions"	with 100% accuracy	25,30

TABLE 3-D

TABLE 3-E

GOAL 3 - To recognize and clarify values concerning the environment.

GENERAL OBJECTIVE 1 - The learner should apply the steps in values clarification in order to recognize, evaluate and clarify his/her own values regarding the environment and its associated problems.

PERFORMANCE OBJECTIVES: Audience - At the end of the ninth grade the learner will....

Number	Conditions	Behavior	Degree	Test Item Number
1.1	Given pencil and paper	State the steps used in the values clarification process	with 100% accuracy	37

GENERAL OBJECTIVE 2 - The learner should express a recognition of his/her own values concerning the environment and its associated problems.

PERFORMANCE OBJECTIVES: Audience - At the end of the ninth grade the learner will....

Number	Conditions	Behavior	Degree	Test Item Number
2.1	Voluntarily	Express feelings related to environment and environmental problems	Frequently	34, C 1
2.2	Voluntarily	Exhibit pride in regard to environmental concerns and values--is willing to defend his/her position	Frequently	C 3

GENERAL OBJECTIVE 3 - The learner should recognize the values held by others and be able to analyze how and why their values may differ from his/her own values.

PERFORMANCE OBJECTIVES: Audience - At the end of the ninth grade the learner will....

Number	Conditions	Behavior	Degree	Test Item Number
3.1	Given the description of an environmental problem	Identify and state values held by other individuals/groups in regard to the problem	with 100% accuracy	35
3.2	Given a statement regarding value positions held by individual/groups	Explain how and why the values of these individuals/groups differ	with 100% accuracy	36

GENERAL OBJECTIVE 4 - The learner should recognize the choices available in order to clarify what he/she holds in esteem.

PERFORMANCE OBJECTIVES: None were written at the time of this study.

GENERAL OBJECTIVE 5 - The learner should evaluate the possible consequences of the choices available.

PERFORMANCE OBJECTIVES: Audience - At the end of the ninth grade the learner will....

Number	Conditions	Behavior	Degree	Test Item Number
5.1	Having chosen a particular value position in regard to a specific environmental problem	Identify what effects this choice may have on various components of the life support system	with 100% accuracy	31,32,33

TABLE 3-F

GOAL 4 - To develop a personal responsibility for environmental protection and enhancement--stewardship.

GENERAL OBJECTIVE 1 - The learner should demonstrate a concern for the well-being of himself and others by assuming responsibility for environmental protection and enhancement.

PERFORMANCE OBJECTIVES: Audience - At the end of the ninth grade the learner will....

Number	Conditions	Behavior	Degree	Test Item Number
1.1	Voluntarily by overt action	Give evidence of concern for the well-being of self and others by involvement in environmental protection/enhancement activities	Frequently	C 2

GENERAL OBJECTIVE 2 - The learner should demonstrate a concern for the well-being of other organisms in the life support system.

PERFORMANCE OBJECTIVES: Audience - At the end of the ninth grade the learner will....

Number	Conditions	Behavior	Degree	Test Item Number
2.1	Voluntarily by overt action	Give evidence of concern for the well-being of other organisms in the life support system	Frequently	C 4

TABLE 3-G

TABLE 3-H

GOAL 5 - To develop motivation to work toward the prevention of and solution to environmental problems--action.

GENERAL OBJECTIVE 1 - The learner should demonstrate that he/she has developed a motivation to work on environmental activities.

PERFORMANCE OBJECTIVES: Audience - At the end of the ninth grade the learner will....

Number	Conditions	Behavior	Degree	Test Item Number
1.1	Voluntarily by overt action	Give evidence of working on environmental activities	Frequently	C 5, C 6, C 7

Population Selection and Description

The population for this study consisted of a stratified sample of third grade students and teachers from public school districts in Michigan's lower peninsula. Since research on the significance of geographical location and other demographic variables upon environmental education knowledge/attitudes seems to conflict (Hess and Torney 1967, Sherman 1970, Solid 1971, Hilgerson, et al., 1971, Dorsey 1972, Perkes 1973, Hounshell and Liggett 1973, Volker, Heal, and Horvat 1973), demographic factors were given some consideration in the development of the stratified sample in order to assure validity.

The 613 local school districts of the state are divided by the Michigan Department of Education into five types based primarily on population and economic focal point. The designations of these types and the ranges of population size are shown in Table 4 (Michigan Department of Education, June 1971).

Local district names and vital educational statistics for each district are contained in Michigan Educational Assessment Program (MEAP) reports. The December 1971 MEAP was utilized to select districts for the stratified sample as follows

1. Districts in each population group were numbered consecutively.

2. Using a table of random numbers five district names were selected from each group. Only those districts found in the lower peninsula were acceptable for the sample.

3. A letter was sent to the superintendent of each district describing the study and requesting cooperation.

4. Using the Michigan Education Directory, 1973-74 a specific school in each district was chosen on the basis of population size. The school containing the largest K-3 population was selected and request for participation of this school in the study was made to the superintendent's office.

5. Occasionally the superintendent's office recommended substituting a different school within the district for the one originally selected. This advice was followed and the substitution made.

TABLE 4
Types of Michigan School Districts

Type	Number within state	Description
Metropolitan Core City	15	1 or more adjacent cities with a population of 50,000 or more which serves as economic focal point of environs
City	24	Community of 10,000 to 50,000 that serves as economic focal point of environs
Town	105	Community of 2,500 to 10,000 that serves as economic focal point of environs
Urban Fringe	122	Community of any size that has as its economic focal point a metropolitan core or city
Rural	347	Community less than 2,500

Table 5 contains the list of districts that agreed to participate in the study and thus composed the actual stratified sample.

TABLE 5
Participating Districts

District and Number Classes Participating	Total Number Classes	Total Number Students
Metropolitan Core City	5	113
Lansing (1)		
Pontiac (4)		
City	2	39
Holland (2)		
Town	5	117
Bad Axe (4)		
Otsego (1)		
Urban Fringe	5	113
Birmingham (1)		
Fitzgerald Schools (4)		
Rural	3	54
Bloomingdale (3)		
Total =	20	436

Operational Procedures

Each participating school was visited early in the fall in order to acquaint the third grade teachers with the purpose of the study and with relevant procedures. The Student Behavioral Checklist to be used by the teachers in assessing the environmental behaviors of their students was explained and necessary clarifications

regarding the intended observations were made. The teachers were asked to observe these behaviors for a period of two months and then to complete a checklist for each child in their classes.

During this initial visit the Teacher E.E.C.M. was introduced and a brief discussion concerning the meaning of the concept "life-support system" was held. The Teacher E.E.C.M. was labeled "Environmental Education Survey for Teachers" to minimize anxiety concerning the test. In order to further reduce anxiety teachers were assured that the information and scores obtained would be utilized only for the research purposes stated and that no reports regarding individual scores would be reported to school administrators. The teachers were asked to base their answers solely upon the knowledge they already possessed and to take as much time as they needed to complete the survey instrument. It was announced that the completed surveys were to be collected after a period of two months.

All third grade students were tested in groups of 10 during a second visitation to each school two months after the initial contact. Prior to testing the students were given a brief introduction to the study. They were told that the information and scores obtained would not affect their grades in any way, and that the research was primarily concerned with what they thought about the "environment". After ideas regarding the meaning of the word "environment" were solicited from the group a brief introduction to the testing procedure was given. Students were asked either to place an "X" through the circle on the answer sheet that

indicated the answer of their choice or to list the items requested. All of the multiple choice questions (Numbers 5-40) were administered before allowing time for students to fill in the lists required in questions Numbers 1-4 and 41-45 (see Appendix III). All questions and answers were illustrated and each item was read to the students in order to minimize effects of differential reading levels. Students were permitted to ask questions and a relaxed testing atmosphere was maintained. Thirty minutes was allocated as testing time for each group.

Student Behavioral Checklists based on teacher observation and the completed Teacher E.E.C.M. were collected during this second visitation as well. Each teacher was interviewed to varify information on his or her survey form and to provide general feedback relative to procedures utilized.

Scoring Procedures

Since the formats of student and teacher E.E.C.M. differed a great deal, scoring procedures for each will be discussed separately.

Student E.E.C.M.

Data from the student answer sheets (Appendix IX) for the cognitive component of the E.E.C.M. ("What I Think About the Environment") were transferred to IBM 0-8165(MSU-OS-102) forms to permit machine scoring and automatic punching of computer cards. Since the scoring machines allow only one correct response for each question, the data were recoded to indicate a separate item for each of the five options to each multiple choice question in

which there were two or more correct answers. Options indicating a correct response for an item were coded as "true" using the number one position on the IBM answer sheet. Options indicating an incorrect response were coded as "false" using the number two position on the answer sheet. The codebook for this transformation is found in Appendix X and the key for the machine scored answer sheets is found in Appendix XI. Ten eighth grade girls were trained to assist in the transfer and to verify the accuracy of the transferral process. Each student answer sheet was reviewed a third time by the researcher to check the accuracy of the transferred data and to hand score the two lists requested in question Numbers 1-4 and 41-45. Table 6 contains a sample of acceptable and non-acceptable responses given by students. One point was given for each correct response and the standard formula to correct for guessing on a 5-item multiple choice test (right minus wrong divided by 4) was utilized (Stanley, 1964 p. 195). The maximum possible score for this portion of the test was 121 points.

Data from the Student Behavioral Checklists (Appendix IV) were collected directly on IBM #0-8152 forms utilized by the teachers and each item was machine scored. Computer cards were punched directly as scoring took place. Responses in the First column, "frequently", were weighted by three, responses in the Second column, "occasionally", were weighted by two and responses in the Third column, "rarely", were weighted by one to give a maximum possible score of 30.

TABLE 6
Student Responses to Listing Items

Questions 1 - 4: "Name four things that are part of our environment"

Acceptable	Non-acceptable
Physical, biological and social components of environment such as:	Largely omissions or duplications of an item previously listed. Also items such as:
animals	helping
fire	snacks
smoke	keeping things in place
houses	don't pollute
flowers	clean-up
woods	
pollution	
air	
food	
snow	
policemen	
sunshine	
cars	
litter	
germs	

Questions 41 - 45: "Name five natural resources"

Acceptable	Non-acceptable
Specific or general descriptions of items commonly recognized as natural resources including:	Largely omissions or duplications of items previously listed. Also included:
land	electricity
water	factories
forests	buildings
animals	stores
plants	cars
air	plastic
soil	air pollution
oil	radar
gas	clothes
sand	shelter
coal	
salt	

Teacher E.E.C.M.

The responses of ten environmental experts, either members of, or consultants to M.E.E.R.C. were used to generate the key of acceptable responses to the Environmental Education Survey for Teachers, the cognitive component of the Teacher E.E.C.M. This key (Appendix V) was open-ended and one point was allocated for each acceptable response. Since the number of correct responses varied with the perceptiveness of the teacher there was no upper limit or maximum number of possible points for this component of the E.E.C.M. In order to minimize scoring bias two separate ratings of each test were made by different individuals with backgrounds in natural resources and environmental education--one by the researcher and the other by a graduate student in fisheries and wildlife. The scores thus obtained were compared by means of one parametric (Pearson r) and two non-parametric tests of correlation (Spearman's Rank and Kendall's Tau). Table 7 contains the results of this comparison.

TABLE 7
Scorer Reliability Teacher Cognitive E.E.C.M.

Statistical Test	Significance Level
Pearson r = .9699	.001 (Downie and Heath 1959 p. 306)
Spearman Rank r = .9470	.01 (Tate and Clelland 1957,p.132
Kendall's Tau = .8298	.01 (Tate and Clelland 1957,p.132

Although scorer reliability was very high a few differences between scores were evident. To accommodate for these differences an adjusted cognitive score was obtained for each teacher by averaging the scores assigned by both evaluators for each item and for the

total test. This adjusted C-score should more nearly reflect the actual achievement of the teachers on this portion of the E.E.C.M. (See Table 24, page 119).

The teacher's AB score was obtained by use of a combination of self-report questions (Appendix VI) and interview questions (Appendix VII) to provide information used by the researcher to subjectively rate each teacher on a Behavioral Checklist (Appendix VIII) indicating degree of environmental education concern/commitment.

Table 8 shows the relationships among self-report, interview, and checklist items. In deriving the AB-score from a completed Behavioral Checklist, responses in the category "strong" received three points, "moderate" received two points and "weak" received one point for a total maximum score of 21 points.

TABLE 8
Related Components of Teacher AB-Scores

Behavioral Checklist Item	Interview Question	Self-Report Item
C1	1, 2, 3	
C2	1, 12	
C3	2, 3	
C4	4, 5, 6, 7	1, 2, 3, 4
C5	11	8
C6	12	
C7	8, 9, 10	5, 6, 7

Statistical and Data Processing Procedures

All data were coded with a sequence of six numbers; the first number indicated the school district, the second and third numbers identified the teacher and the last three numbers indicated the individual student. For example, number 296001 would mean that student number 001 was part of teacher 96's class in participating district number 2. Since the specific data for each teacher and district would be valuable only to those involved, the code sequence for this information is not presented in this report.

The questions of interest in this study and the hypotheses derived from them relate directly to statistical tests of degree of relationship or correlation. Since some students were absent from school the day the cognitive component of the E.E.C.M. was administered and therefore only AB-scores were available from the teachers for these students, only data for which both cognitive and AB-components (matched pairs) were available were utilized in this study. The n for students participating in the study was therefore reduced from 436 to 406.

Pearson's product-moment correlation coefficient, a standard parametric test of degree of relationship, is most useful when the n is large enough to presuppose a normal distribution. Therefore this test was most applicable to research questions associated with the student data in which the n was more than 400. Data obtained from this test were considered significant if the probability of obtained values lay between the .1 and .001 levels.

Non-parametric tests of correlation are most useful when the n is small and a normal distribution is not presupposed. Two such correlational tests were considered for this study: the Spearman Rank Correlation Coefficient and the Kendall's Tau Coefficient of Correlation. Since Kendall's Tau Correlation is very sensitive to ties occurring in ranks and Spearman's Rank Correlation is not seriously affected by such ties, the latter was selected as the major statistical test for data in this study in which n is less than 25. Data obtained from the Spearman's Rank Correlation test were considered significant if the probability of the obtained values lay between the .20 and .10 levels.

All student data were processed initially by use of computer programs. The Michigan State University Computer Institute for Social Science Research (CISSR) data analysis system was utilized in the form of the 1975 GRADER program, which provided the following outputs for the student data: raw scores, mean and standard deviation for both components of the E.E.C.M. and for the combined scores by class or section and for the total sample. GRADER also provided a frequency distribution and histogram for each E.E.C.M. component and for the entire sample.

Item analysis for the cognitive component of the Student E.E.C.M. was provided by the Office of Evaluation Services at Michigan State University. Five indices were of importance in this study: the index of item difficulty, the index of item discrimination, the discriminating efficiency, the standard error of measurement, and the Kuder-Richardson Reliability #20.

The index of difficulty is the proportion of the total group who answered the item incorrectly. A high index therefore indicates that the item was difficult. Generally,

> For achievement tests, most test constructors desire items with indices of difficulty from 20-80; with an average index of difficulty from 50-60 (Office of Evaluation Services, 1965, p. 4).

Since items utilized in this study were developed from minimal performance objectives they constitute a mastery or criterion-referenced test; and as such differ significantly from ordinary achievement test items in terms of underlying theory and assumptions. Table 9 indicates suggested indices of item difficulty that can be used in the evaluation of mastery test items for future usefulness.

TABLE 9
Evaluation of Indices of Item Difficulty for Mastery Test Items

Index	Item Evaluation
71+	Very Difficult
70-50	Difficult
49-30	Medium Difficulty
29-19	Easy
18 - below	Very Easy

The index of item discrimination is the difference between the percentage of the upper group who answered the item correctly and the proportion of the lower group who answered correctly. The upper group was defined as the 27% who received the highest overall C-scores while the lower group was defined as the 27% who received the lowest overall C-scores. This index is dependent upon the difficulty index

and may reach a maximum value of 100 or 1 for an item with an index of difficulty of 50. For achievement type tests a discrimination index of 40 (or .40) or greater is considered desirable. Since the items used in this test were mastery or criterion-referenced items instead of achievement items, different discrimination indices must be used for analysis. Stanley and Hopkins developed a procedure useful for the evaluation of items based on indices of discrimination for achievement type tests (1972, p. 273). The criteria thus established were adapted for mastery tests items by decreasing the required value for each rating by ten points. The resulting criteria were used in this study for the evaluation of indices of discrimination and are found in Table 10.

TABLE 10
Evaluation of Indices of Item Discrimination
for Mastery Test Items

Index	Item Evaluation
30+	Very Good
29-20	Good
19-10	Reasonably Fair
9-1	Poor
0 or Negative	Ambiguous

The discriminating efficiency of an item is the ratio of the actual discrimination achieved to the maximum possible discrimination for an item with that given index of difficulty. Since discriminating ability for items in which the index of difficulty is either high or low is greatly reduced, and criterion-referenced examinations contain a relatively high proportion of such items, the index of

discrimination may not accurately reflect the appropriateness of any particular item for this type of test situation. The discriminating efficiency, however, indicates what proportion of the maximum possible discrimination at a given index of difficulty was actualiy achieved, and therefore provides additional information on appropriateness of items, particularly useful for evaluation of criterion-referenced examinations. The values listed in Table 9 for indices of discrimination will be used to determine which discriminating efficiencies indicate acceptable and non-acceptable items. For the purpose of this study, any item having a discriminating efficiency of 10 or more will be considered acceptable.

The standard error of measurement (SEM) and the Kuder-Richardson Reliability #20 (KR #20) are useful indications of the overall merit of the test. Tne SEM is related to both the reliability of the test and the standard deviation. The greater the reliability, the smaller the SEM. If the reliability of a test was equal to zero, the SEM would equal the standard deviation. If the test was perfectly reliable (1), the SEM would equal zero. The Kuder-Richardson Reliability #20 examines the relationship between each item and all the rest of the items and as such determines the extent to which the test is reliable. The range of the KR #20 coefficient is from 0 to 1, therefore the greater the KR #20 value the greater the degree of internal correlation among test items, and the greater the reliability of the test.

The Statistical Package for the Social Sciences (SPSS), a program made available to the Michigan State University Computer Center from the Vogelback Computing Center, Northwestern University (Version 6, April 1, 1975), was utilized to provide the following outputs for matched pair data: Pearson Correlation Coefficients for cognitive and AB components of the Student E.E.C.M., frequency distribution, histogram, mean, and standard deviation for each test component separately, for the total score, and for analysis of frequency of each category of response on the Student Behavioral Checklist.

Data in which the teachers' scores and the mean scores or ranks of each class were involved were analyzed by use of standard formulae and tables with the assistance of an electronic calculator. Ranks for the teachers' scores and for class means were determined utilizing techniques described by Downie and Heath (1959, p. 206).

Data for both components of the Student and Teacher E.E.C.M. were also examined with regard to achievement attained in relation to each goal and for all performance objectives. For this analysis all objectives were weighted equally. Since the computer analysis of student data included percent correct for each item of the cognitive component and percentages for each category of response on the Behavioral Checklist, the achievement attained for each objective was determined by calculating the mean percentage for all questions relating to that objective. The teacher data were

based on raw scores and therefore contained a variable number of points for different questions. These raw scores were therefore weighted in order to make comparisons possible. The maximum raw score value attained was 10; ergo all raw scores were weighted accordingly so that the highest value attained would be comparable (10 points). Items thus weighted were then converted to percentages and the achievement attained for each objective was determined by calculating the mean percentage for all questions relating to that objective.

CHAPTER IV

ANALYSIS AND INTERPRETATION OF DATA

Analysis of Instruments

The design of this study provides a means for assessing the environmental education competency of students and teachers based on their performance on both a cognitive test instrument and subjective affective-behavioral (AB) evaluations. Analytic data for these instruments and data derived from their use will be presented in the following manner:

1. Data from Cognitive Component Student E.E.C.M., "What I think about the Environment".
2. Data from AB Component Student E.E.C.M., Student Behavioral Checklist.
3. Data from Total Student E.E.C.M.
4. Data from Cognitive Component Teacher E.E.C.M., "E.E. Survey for Teachers".
5. Data from AB Component Teacher E.E.C.M., Teacher Behavioral Checklist.
6. Data from Total Teacher E.E.C.M.

Comparative data in the form of correlation coefficients determined in relation to each hypothesis and descriptive data concerning achieved environmental education competency levels will then be presented and analyzed.

Cognitive Component Student E.E.C.M.

The following tables (Table 11 and 12) and graph (Figure 3) provide data concerning the distribution and frequency of raw scores (C-scores) for "What I Think about the Environment", the cognitive component of the student E.E.C.M.. Table 11 also indicates the percent of the maximum possible score correct for each raw score value.

TABLE 11
Frequency Distribution and Percent Correct of Student C-Scores

Score	Frequency	Percent Correct	Score	Frequency	Percent Correct
34	2	38.10	67	7	55.37
36	1	29.75	68	18	56.20
37	1	30.58	69	12	57.02
39	1	32.23	70	11	57.85
40	2	33.06	71	17	58.68
41	1	33.88	72	19	59.50
42	1	34.71	73	14	60.33
43	1	35.54	74	18	62.81
45	1	37.19	75	24	61.98
46	1	38.02	76	19	62.81
47	1	38.84	77	13	63.64
48	1	39.67	78	12	64.46
49	5	40.50	79	7	65.29
50	2	41.32	80	13	66.12
51	8	42.15	81	11	66.94
52	2	42.98	82	9	67.77
53	2	43.80	83	11	68.60
54	4	44.63	84	9	69.42
55	6	45.45	85	8	70.25
56	8	46.28	86	12	71.07
57	5	47.11	87	4	71.90
58	6	47.93	88	3	72.73
59	4	48.76	89	2	73.55
60	8	49.59	90	2	74.38
61	8	50.41	91	2	75.21
62	8	51.24	92	2	76.03
63	3	52.06	99	1	81.82
64	10	52.89			
65	13	53.72		406	
66	10	54.55	Maximum Score = 121		

TABLE 12
Grouped Frequency Distribution Student C-Scores

Scores	Frequency
103-97	1
96-90	6
89-83	49
82-76	84
75-69	115
68-62	69
61-55	45
54-48	24
47-41	6
40-34	7

Table 13 provides statistical data describing this distribution of scores.

TABLE 13
Descriptive Statistics Cognitive Component Student E.E.C.M.

Statistic	Value
Mean	70.53
Median	71.26
Mode	75.00
Standard Deviation	11.21
Variance	125.75
Range	66.00
Maximum Score	121

Interpretation of the significance of the data contained in Tables 11, 12 and 13 and Figure 3 must be made in light of the nature of the testing situation. Since this examination is designed as a pre-test to determine student entry levels of behavior prior to introduction of specific instructional strategies, achievement test criteria must not be applied to the resulting data. For example, a mean score of 70.53 represents only 58.29% of the maximum possible score of 121 points. Such a mean would indicate a very difficult achievement type test when administered at the completion of a set

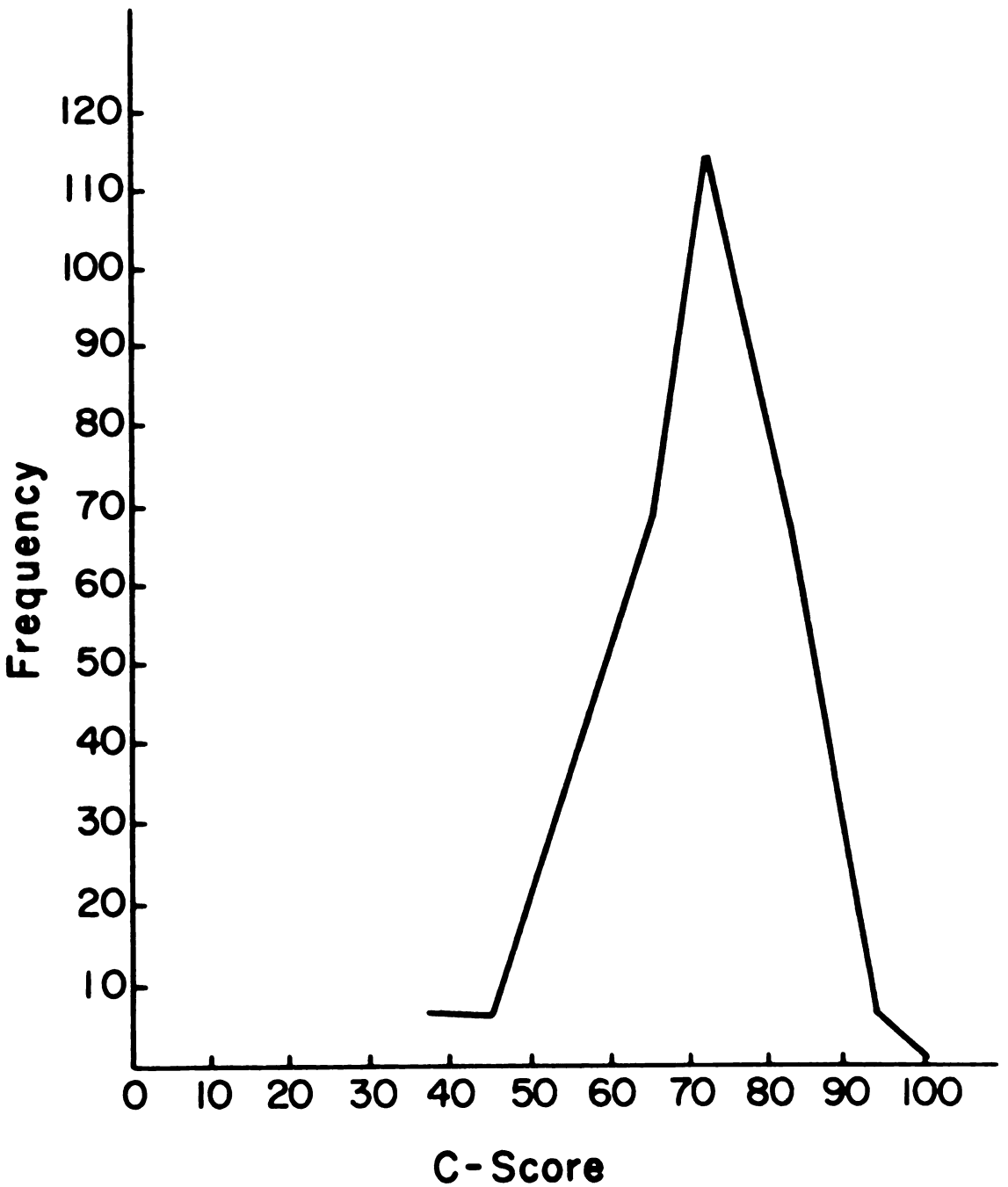


Figure 3. Frequency Polygon for Student C-Scores.

of instructional activities designed to teach the content contained in the examination. Yet for a criterion-referenced pre-test this mean, interpreted along with the median, mode, and standard deviation, indicate that the content tested is well within the capabilities of third grade students and that, given appropriate instructional strategies, there is every indication that the content can be mastered at levels established by the minimal performance objectives. This is supported by the fact that the obtained scores are clustered about the mean in such a way that 279 students or 68.7% of the total sample lie within one standard deviation of the mean. The median and mode are also within close proximity of the mean.

The frequency polygon (Figure 3) derived from these scores indicates that the distribution of scores closely approximates a normal curve and is skewed very slightly to the right. The curve obtained for terminal behavioral levels following completion of educational activities in a mastery learning situation would be skewed sharply to the right indicating that most students had mastered the specified content. Since 68.7% of the students were able to answer 49.02 - 67.56% (the mean $\pm$ one standard deviation) of the content correctly <u>without</u> prior instruction the probability of the curve shifting sharply to the right following instruction is very high. Therefore the data derived from the distribution of C-scores clearly indicate that the test measures content well within the capabilities of the third grade students assessed.

Table 14 indicates the distribution of the mean class C-scores and the resulting class ranks.

TABLE 14
Distribution and Rank of Mean Class C-Scores

Section Number	Mean C-Score	Rank
295	76.82	1
308	76.50	2
617	76.31	3
720	73.67	4
309	73.54	5
297	73.50	6
412	72.56	7
902	72.39	8
294	71.82	9
718	71.79	10
821	71.57	11
311	71.48	12
293	71.24	13
719	70.56	14
310	70.04	15
516	68.12	16
515	67.48	17
901	64.48	18
513	61.50	19
514	59.95	20

1. Item Analysis - Difficulty and Discrimination

Table 15 indicates the frequency distribution and percentage of the indices of item difficulty obtained for the cognitive component of the Student E.E.C.M.. Figure 4 shows the percentage distribution of these indices of item difficulty.

TABLE 15
Frequency Distribution Indices of Item Difficulty for Student Cognitive E.E.C.M.

Difficulty Index	Evaluation	Number of Items	Percentage
71 - above	Very difficult	15	12.4
70 - 50	Difficult	19	15.7
49 - 30	Medium Difficulty	26	21.5
29 - 19	Easy	19	15.7
18 - below	Very Easy	42	34.7

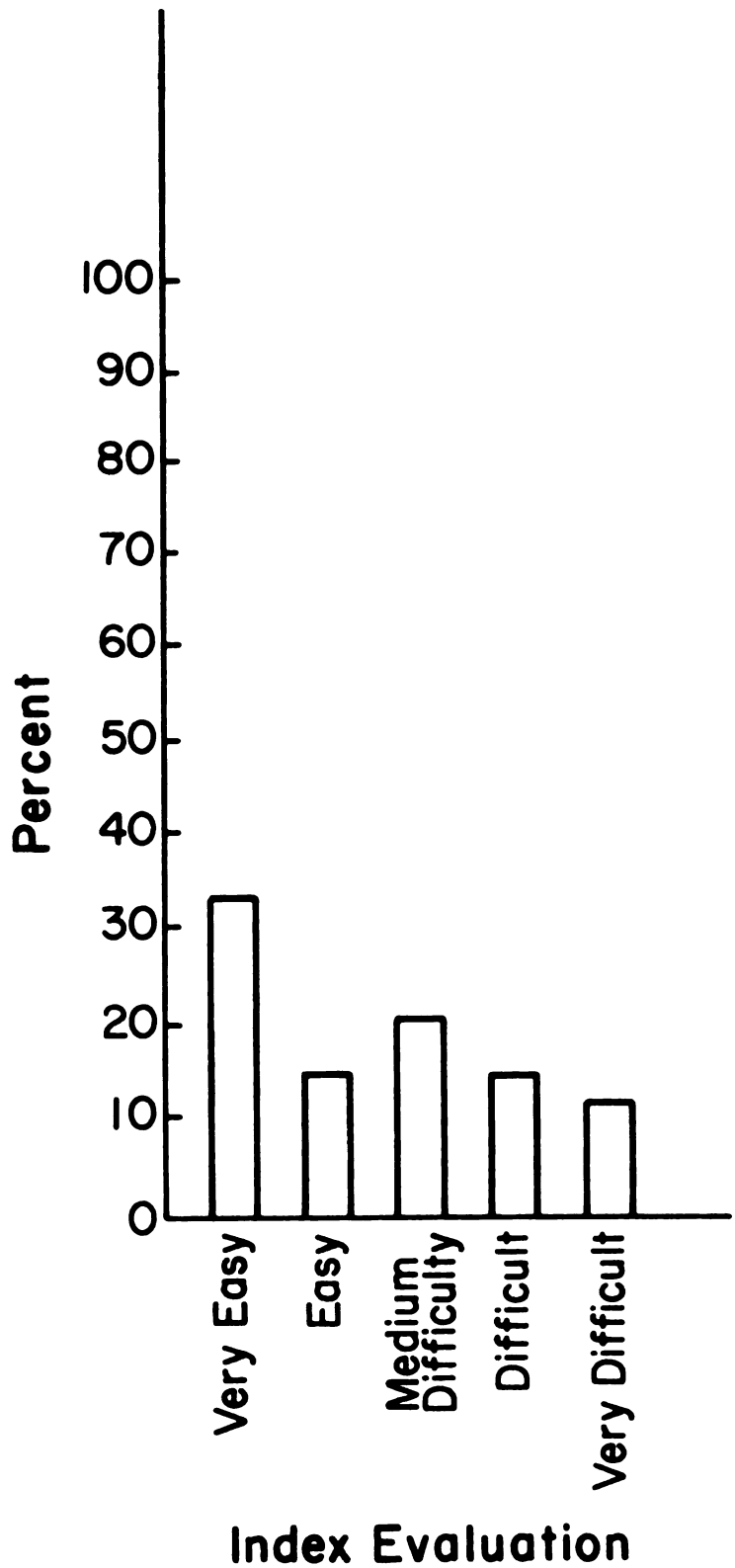


Figure 4. Percentage Distribution of Indices of Item Difficulty for the Cognitive Component of the Student E.E.C.M.

Table 16 shows the frequency distribution and percentage of the indices of item discrimination and the discriminating efficiencies obtained for this portion of the Student E.E.C.M. Figure 5 indicates the percentage distribution of these indices.

TABLE 16
Frequency Distribution of Indices of Item Discrimination and Discriminating Efficiencies for Student Cognitive E.E.C.M.

Index	Evaluation	No. Items Discrimination Index	Percentage	No. Items Discriminating Efficiency	Percentage
30-above	Very Good	19	15.70	87	71.90
29-20	Good	37	30.58	11	9.10
19-10	Fair	47	38.84	13	10.74
9- 1	Poor	12	9.92	4	3.30
0 or Negative	Ambiguous	6	4.96	6	4.96

Table 17 provides additional descriptive statistics for the item analysis of the Student Cognitive E.E.C.M.

TABLE 17
Descriptive Statistics Item Analysis Student Cognitive E.E.C.M.

Statistic	Value
Mean Item Difficulty	36
Mean Item Discrimination	18
Mean Discriminating Efficiency	48.91
Kuder-Richardson Reliability No. 20	0.8481
Standard Error of Measurement	4.3287

Table 15 and Figure 4 indicate that 50.41% of the items/options were either easy or very easy, 21.5% were of medium difficulty and 28.1% were difficult to very difficult. This distribution of indices of item difficulty is suitable for a criterion-referenced examination based upon minimal performance objectives since the expectation in such an examination is that the majority of the students will be able to master the performances indicated by the test items. The mean item difficulty of 36 indicates that the average test item/option was of medium difficulty.

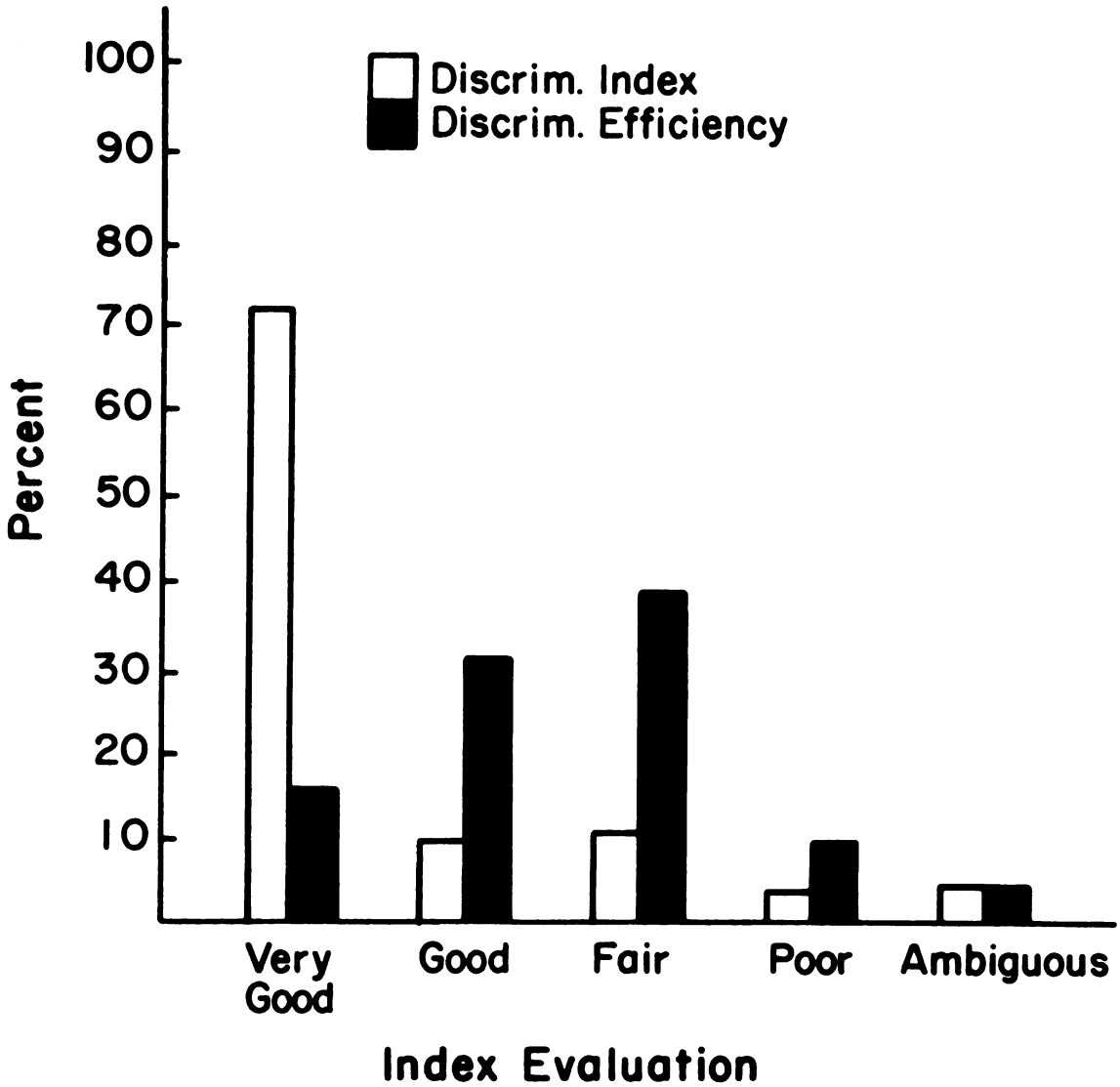


Figure 5. Percentage Distribution for Item Discriminations and Discriminating Efficiencies of the Cognitive Component of the Student E.E.C.M.

Table 16 and Figure 5 show that 85.12% of the indices of discrimination and 91.74% of the discriminating efficiencies indicate items/options that are reasonably fair to very good. The mean item/option discrimination of 18 indicates that the average item discrimination was fair. The mean discriminating efficiency of 48.91% indicates that the average discriminating ability of the test items/options was very good. Based upon the criteria for evaluation of test items established in Chapter Three in relation to discriminating efficiency, ten items/options or 8.26% of the items/options should be rejected.

2. Acceptable and Non-acceptable Items/Options: Any item/option having a discriminating efficiency of ten or more was considered acceptable for this study. Of the 121 items/options, 111 or 91.74% of the total were able to meet this criterion of acceptability. Eight questions contained one or more non-acceptable options but only one question, number 12, was completely unacceptable. The following items/options were non-acceptable:

a). Question 9 - Which plants or animals would you find living here? (Forest)

Option A - Bobcat. Apparently this option was incorrectly keyed for "false" instead of "true". If the key had been correct 74% of the upper group and 76% of the lower group or 78% of the total number of students tested would have correctly identified the forest as the appropriate habitat for the bobcat. Since a higher number of students in the lower group responded correctly than students in the upper group, there is some indication that guessing

may have played a major role in the selection of response for this item.

Option B - Daisy. This option was answered correctly by 21% of the upper group and 43% of the lower group by indicating that the forest is not the habitat of the daisy. This resulted in a negative index of discrimination (-22) and a negative discriminating efficiency (-34). Apparently this option was confusing, especially to students in the upper group. Perhaps this confusion is due to the fact that daisies are often found along roadsides bordering a forested area and in openings in the forest canopy.

b). Question 10 - Which of these plants or animals would you find living here? (Field or lawn)

Option D - Pine tree. Thirty-eight percent of the upper group and 41% of the lower group answered this option by correctly indicating that the field or lawn is not the habitat of the pine tree. This resulted in a discriminating index which was negative (-3) and a negative discriminating efficiency (-3). This option was therefore confusing; perhaps because conifers, especially pines, are often planted as ornamental trees on lawns surrounding homes.

Option E - Chipmunk. Sixty-four percent of the upper group and 62% of the lower group answered this option incorrectly. Thirty-six percent of the upper group and 37% of the lower group responded correctly by indicating that the field or lawn is not the habitat of the chipmunk. This resulted in a negative discrimination index (-1) and a negative discriminating efficiency (-1). Perhaps the fact that chipmunks often wander onto lawns

surrounding homes found near wooded areas was responsible for the confusion indicated by this option. However, the presence of this type of confusion may also indicate that the habitat concept involving the place where an organism lives versus places in which the organism may be occasionally found is not well established for third grade students.

c). Question 12 - Where do I live? (Fox). Options included forest, prairie, field, city and desert. This item was very difficult for the students tested and as a consequence 67% of the upper group and 62% of the lower group omitted the item. Thirty-two percent of the upper group and 29% of the lower group or 30% of the total sample responded correctly to the item in selecting the forest as the appropriate habitat. The distractor options were apparently unattractive since no more than 3% of the students in either group selected any one distractor. This may reflect that the fox and its habitat are unfamiliar to the third grade students tested or may be further indication of difficulty in conceptualization of the notion of habitat.

d). Question 17 - This is a mammal (dog). Which of these pictures show other mammals?

Option E - Snake. Although this option was of medium difficulty (48) for the students tested both the discrimination index (7) and the discriminating efficiency (7) were very low. Fifty-seven percent of the upper group and 50% of the lower group or 52% of the total sample responded correctly to this option by indicating that the snake is not a mammal. Data resulting from

item analysis are not sufficient to formulate hypotheses that may be useful in interpreting the obtained results.

e). Question 26 - What is my job in the environment? (bee)

Option E - I build a fancy house. Apparently this option was keyed incorrectly for "true" instead of "false". If the key had been correct 62% of both upper and lower groups or 61% of the total student population would have been correct in indicating that while some bees do indeed build a fancy home this is not their role or function in the environment. Therefore this item indicates that conceptualization of the notion of role may be well established in the third grade.

f). Question 35 - Which changes in the environment were man-made?

Option D - Wind blown trash. Forty-six percent of the upper group and 62% of the lower group were able to respond correctly to this option indicating that wind blown trash as pictured in the test item (see Appendix III) was not a change caused by man. The discrimination index of -16 and the discriminating efficiency of -17 indicate that this item was confusing in that more of the lower group responded correctly than did the upper group. Thus the brighter students must have inferred something from the question which led to confusion. The pictured item was extremely clear in illustrating the wind blowing over a trash barrel but apparently some students realized that all trash is generated by man or hypothesized that the lid was not properly attached, or made other observations or inferences which led to ambivalence in the overall response pattern.

g). Question 37 - Which of these cause water pollution?

Option C - Speedboats. Although this was a difficult option (54) it was not discriminating. The discriminating index was low (7) and so was the discriminating efficiency (7). Fifty-four percent of the upper group and 47% of the lower group or 46% of the total responded correctly by identifying speedboats as a cause of water pollution. Forty-six percent of the upper group and 51% of the lower group responded incorrectly. This result may reflect the presence or absence of boating experience on the part of the students tested or may simply indicate that this question was too subtle for third grade students.

h). Question 38 - Which of these cause pollution of land?

Option C - Power plant. Although this option was medium in difficulty (38) it was confusing or ambiguous as indicated by the negative index of discrimination (-3) and the negative discriminating efficiency (-3). In spite of the fact that 62% of the total sample responded correctly indicating that power plants are not ordinarily causes of pollution of land, the option was confusing since 59% of the upper group and 62% of the lower group responded correctly. The students in the upper group perceived aspects of the question which apparently confused them in selection of their response.

3. Reliability

The reliability of this component of the Student E.E.C.M. can be assessed by examining the standard error of measurement (SEM) and the Kuder-Richardson Reliability Number 20 (KR # 20) (Table 16).

The SEM of 4.3287 indicates that the actual score for any given student could vary approximately 4.3 points from the obtained score due to errors in measurement in the testing situation. This represents a possible error of 3.5% of the total score. The greater the reliability of a test, the smaller the SEM. If the reliability was equal to zero, the SEM would equal the standard deviation of 11.214. If the test were perfectly reliable (1), the SEM would equal zero.

Since the greater the KR # 20 value the greater the reliability of the test, a KR # 20 value of .8481 indicates that if the same items were given to a similar group of students the probability of obtaining the distribution derived from this testing is 84.81%. Thus the item analysis indicates that this component of the Student E.E.C.M. is a reasonably reliable test instrument.

AB Component Student E.E.C.M.

A Student Behavioral Checklist was utilized by the teacher to collect data necessary to determine the AB-score for each student. The maximum score for this component of the Student E.E.C.M. was 30 points. Table 18 indicates the frequency distribution of student AB-scores and provides statistical data describing this distribution. Figure 6 presents the frequency polygon derived from the above data.

TABLE 18
Grouped Frequency Distribution and Descriptive Statistics For Student AB-Scores

Scores	Frequency	Statistic	Value
30-26	28	Mean	17.08
25-21	83	Median	16.75
20-16	124	Mode	20.00
15-11	132	Standard Deviation	5.40
10- 6	34	Variance	29.13
5- 1	6	Range	29.0
		Maximum score	30.0

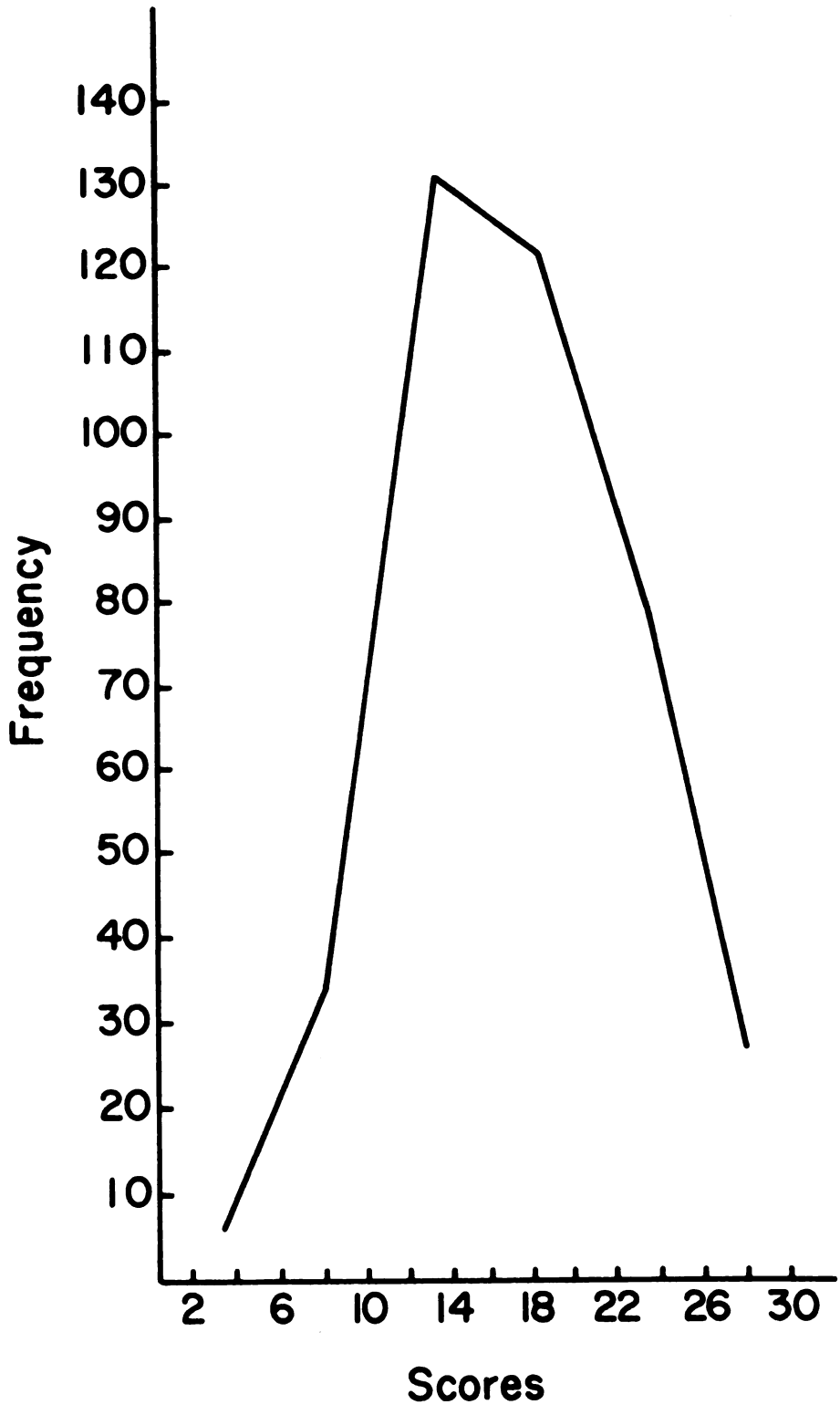


Figure 6. Frequency Polygon for Student AB-Scores.

Interpretation of the significance of these data requires consideration of the nature of this behavioral evaluation. Since the purpose of this evaluation was to determine entry level behaviors prior to introduction of specific educational strategies, the interpretation of obtained statistics differs substantially from those generally utilized for achievement-type post-tests. The mean AB-score of 17.08 represents achievment of only 56.93% of the maximum possible 30 points. The scores of 296 students (72.91%) lie within one standard deviation of the mean. This means that 72.91% of the students achieved from 38.94 to 74.92% of the maximum score without prior instruction. The frequency polygon in Figure 6 indicates that the distribution of scores approximates a normal curve and is skewed slightly to the left. Given appropriate educational strategies in the affective domain it is probable that the distribution curve would shift sharply to the right. Such a shift would be the desired outcome for terminal behaviors stated in the performance objectives.

Table 19 indicates the distribution of the mean class AB-scores and the resulting class ranks.

TABLE 19
Distribution and Rank of Mean Class AB-Scores

Section	Class Mean	Rank	Section	Class Mean	Rank
617	23.33	1	309	17.96	11
516	21.40	2	901	17.70	12
720	20.94	3	412	17.56	13
297	20.25	4	310	16.73	14
293	19.90	5	902	15.83	15
294	19.67	6	295	15.12	16
311	19.52	7	515	13.64	17
513	18.86	8	719	11.75	18
308	18.18	9	821	9.77	19
718	18.05	10	514	8.09	20

Although data derived from a behavioral checklist do not lend themselves to item analysis in the same manner as data derived from multiple-choice questions, Table 20 provides information regarding number and percentage of students rated for each category of response for each item on the checklist.

TABLE 20
Frequency Distribution of Student Behavioral Checklist Ratings

Question Number	Frequently		Occasionally		Rarely	
	Number	Percent	Number	Percent	Number	Percent
AB 1	111	27.3	118	46.3	107	26.4
AB 2	74	18.2	201	49.5	131	32.3
AB 3	65	16.0	153	37.7	188	46.3
AB 4	143	35.2	219	53.9	44	10.8
AB 5	130	32.0	178	43.8	98	24.1
AB 6	102	25.1	179	44.1	125	30.8
AB 7	51	12.6	136	33.5	217	53.4
AB 8	56	13.8	228	56.2	121	29.8
AB 9	28	6.9	156	38.4	221	54.4
AB 10	46	11.3	125	30.8	234	57.6

Student ratings in the category "frequently" were well below those for "occasionally" and "rarely." Both the highest and lowest percent of observed behaviors were recorded in the "rarely" category. The frequency distribution for "occasionally" generally lies between those for "frequently" and "rarely" and may thus indicate a tendency of teachers to select this response option in evaluating the environmental education behaviors of their students. Additional experience in the use of the checklist might help to reduce this tendency and increase the validity of the behavioral observations.

Total Student E.E.C.M.

The environmental education competency was obtained by combining the C-score and AB-score of each student. Tables 21 and

22 and Figure 7 show the distribution of student environmental education competencies and provide descriptive statistics relative to this distribution.

TABLE 21
Grouped Frequency Distribution of Student Environmental Education Competencies

Scores	Frequency	Scores	Frequency
151-142	0	71-62	33
141-132	0	61-52	11
131-122	1	51-42	5
121-112	6	41-32	0
111-102	54	31-22	0
101- 92	116	21-12	0
91- 82	101	11- 0	0
81- 72			

TABLE 22
Descriptive Statistics for Student Environmental Education Competencies

Statistic	Value
Mean	87.61
Median	88.93
Mode	85, 96.5
Standard Deviation	13.68
Variance	187.06
Range	81.00
Maximum score	151.00

Figure 7 clearly indicates that the distribution of student environmental education competencies closely approximates a normal curve as did the distributions of component AB- and C-scores. The mean score of 87.61 represents 58.01% of the maximum possible score of 151 points. Of the students tested 285 or 63.55% scored within one standard deviation of the mean. This means that 63.55% of the students were able to demonstrate competency of

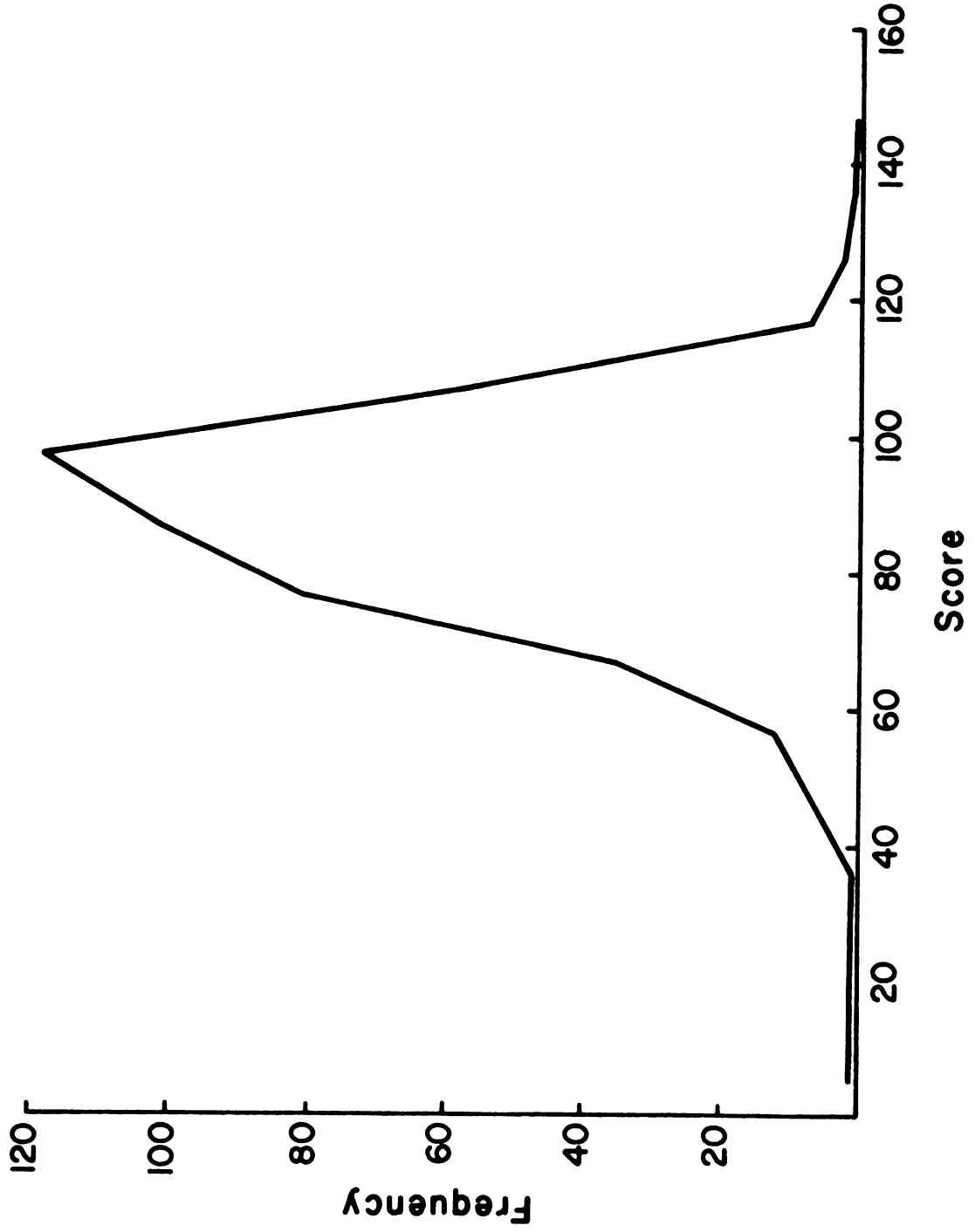


Figure 7. Frequency Polygon for Student Environmental Education Competencies

48.96 to 67.08% of the items evaluated without benefit of prior instruction. This further substantiates the conclusion that the behaviors specified and evaluated for environmental education competency are well within the range of capabilities of the third grade students tested and that, given appropriate instruction, the distribution of scores would be expected to shift sharply to the right in accordance with the desired terminal behaviors as stated in the minimal performance objectives.

Table 23 indicates the distribution of mean class environmental education competencies and the resulting class ranks.

TABLE 23
Distribution and Rank of Mean Class E.E.C.

Section	Score	Rank	Section	Score	Rank
616	104.00	1	516	89.52	11
308	94.68	2	294	88.44	12
720	94.60	3	902	88.22	13
297	93.76	4	310	86.78	14
295	91.94	5	821	84.04	15
309	91.50	6	901	83.90	16
293	91.46	7	719	82.32	17
311	91.00	8	515	81.24	18
718	90.50	9	513	80.18	19
412	90.12	10	514	65.50	20

Cognitive Component Teacher E.E.C.M.

Since the cognitive component of the teacher E.E.C.M. consisted of open-ended essay questions, the number of correct responses varied with the perceptiveness of the teacher; therefore there was no upper limit or maximum score for this portion of the E.E.C.M. In order to minimize scoring bias two separate evaluations of each test were made and an adjusted cognitive score determined. Table 24 contains the raw score ratings of each evaluator and the

corresponding adjusted C-score and rank for each teacher.

TABLE 24
Teachers' Adjusted C-Scores and Corresponding Ranks

Teacher No.	Rating No. 1	Rating No. 2	Adjusted Score	Rank
901	62	56	59.0	10
902	54	58	56.0	12
293	76	79	77.5	7
294	77	80	78.5	6
295	83	82	82.5	4.5
297	69	83	76.0	8
308	51	55	53.0	14
309	77	88	82.5	4.5
310	93	97	95.0	2
311	84	83	83.5	3
412	98	99	98.5	1
513	26	48	37.0	17.5
514	43	41	42.0	16
515	37	36	36.5	19
516	63	62	62.5	9
617	51	50	50.5	15
718	38	36	37.0	17.5
719	53	54	53.5	13
720	53	63	58.0	11
821	27	25	26.0	20

Table 25 presents a grouped frequency distribution of adjusted C-scores and descriptive statistics for this portion of the E.E.C.M. Figure 8 illustrates the frequency polygon derived from these data.

TABLE 25
Grouped Frequency Distribution and Descriptive Statistics For Teachers' Adjusted C-Scores

Scores	Frequency	Statistic	Value
100-84	2	Mean	62.23
83-68	6	Median	57.00
67-52	6	Mode	37,82.5
51-35	5	Standard Deviation	20.97
34-18	1	Variance	439.91
17- 1	0	Range	73.50

The smaller the number of individuals evaluated the more difficult it is to assume a normal distribution of scores. In spite of this difficulty Figure 8 clearly indicated that the actual distribution of C-scores closely approximates a normal curve. Eighty-five percent of the teachers scored from 35-83 points on the test without prior instruction. Eleven teachers or 55% of the sample tested scored within one standard deviation from the mean and thus were within the range of 41.25 to 83.12 points. These data indicate that the instrument used to assess cognitive knowledge of the teachers was within the range of capabilities of the teachers tested.

Although data derived from essay type questions do not readily lend themselves to item analysis, Table 26 provides information regarding the mean of the weighted scores for each item and the corresponding percent correct.

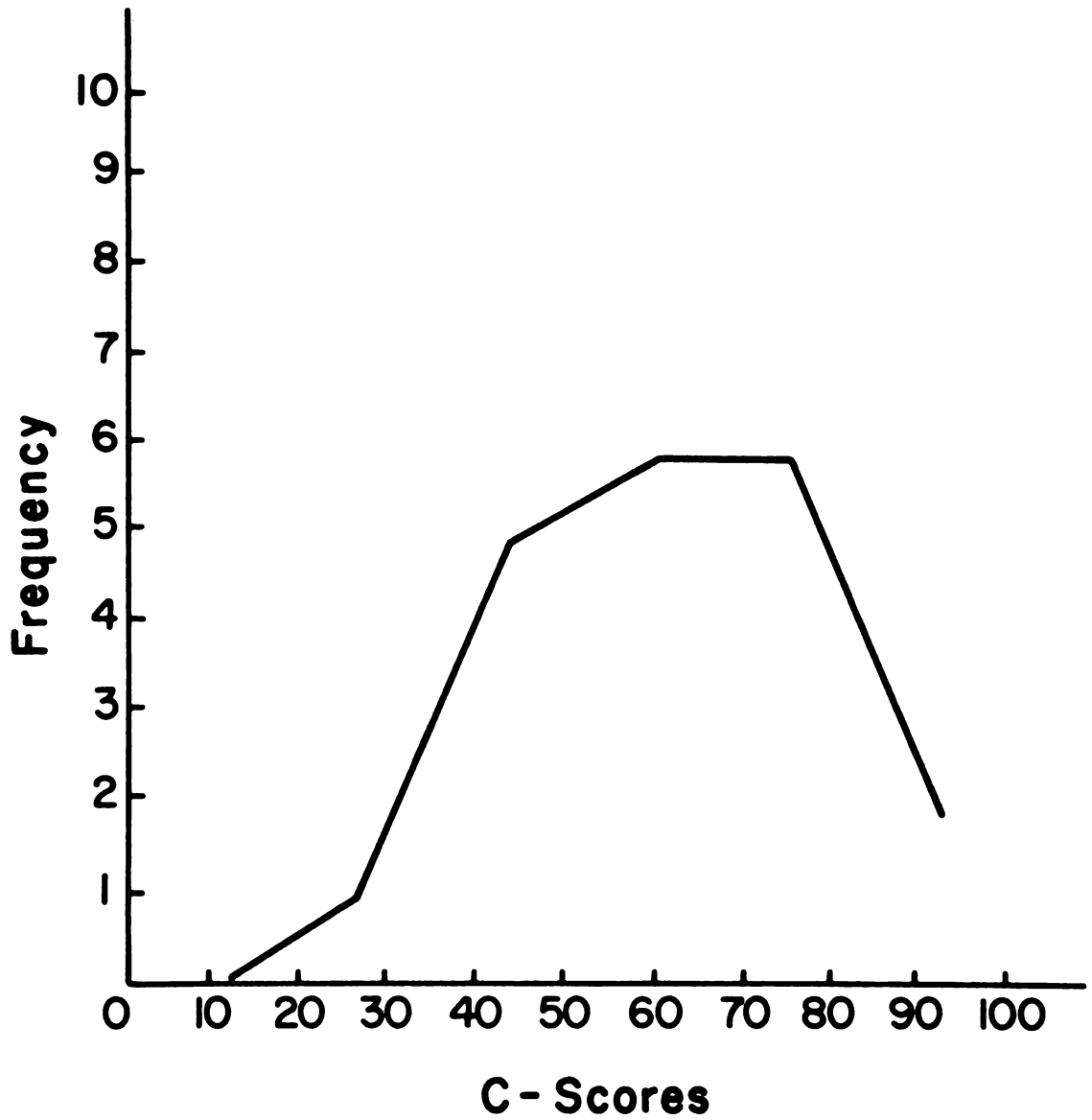


Figure 8. Frequency Polygon for Teachers' Adjusted C-Scores

TABLE 26
Percent/Item Analysis of Teachers' Cognitive E.E.C.M.

Item No.	Mean of Weighted Scores	Mean Percent Correct
1	5.2130	52.13
2	5.0000	50.00
3	2.8570	28.57
4	0.7142	7.14
5	1.4286	14.29
6	3.0952	30.95
7	3.4011	34.01
8	4.0134	40.13
9	5.1667	51.67
10	5.4762	54.76
11	2.2223	22.22
12	3.6190	36.19
13	5.0476	50.48
14	7.8910	78.91
15	7.6978	76.98
16	3.9679	39.68
17	2.7456	27.46
18	3.4286	34.29
19	3.3333	33.33
20	7.8333	78.33
21	6.7857	67.86
22	4.4486	44.29
23	4.6557	46.56
24	6.1899	61.90
25	5.0000	50.00
26	8.2989	82.99
27	6.9041	69.04
28	4.2705	42.71
29	4.2381	42.38
30	3.4916	34.92
31	3.6190	36.19
32	3.8095	38.10
33	2.0633	20.63
34	7.6190	76.19
35	7.1428	71.43
36	3.8091	38.09
37	4.1795	41.80

The data presented in Table 26 indicate that except for seven questions the achievement levels (mean percent correct) are generally below the 70% level generally specified for minimal levels of competence.

AB Component Teacher E.E.C.M.

The AB-score for each teacher was determined through the use of a behavioral checklist which evaluated environmental education behaviors in terms of degree of concern/commitment. The maximum score for this component of the E.E.C.M. was 28 points. Tables 27 and 28 and Figure 9 indicate the distribution of these scores and the corresponding rank for each teacher plus present descriptive statistics regarding this distribution.

TABLE 27
Distribution and Rank of Teachers' AB-Scores

Teacher No.	Score	Rank	Teacher No.	Score	Rank
901	15	19	412	18	13.5
902	24	3.5	513	23	5
293	17	16.5	514	17	16.5
294	18	13.5	515	19	10
295	18	13.5	516	24	3.5
297	18	13.5	617	16	18
308	26	2	718	22	6
309	19	10	719	20	8
310	21	7	720	14	20
311	19	10	821	27	1

TABLE 28
Grouped Frequency Distribution and Descriptive Statistics for Teachers' AB-Scores

Scores	Frequency	Statistic	Value
28-26	2	Mean	19.75
25-23	3	Median	19
22-20	3	Mode	18
19-17	9	Standard Deviation	3.58
16-14	3	Variance	12.83
13-11	0	Range	14
10- 8	0	Maximum score	28
7- 5	0		
4- 2	0		
1- 0	0		

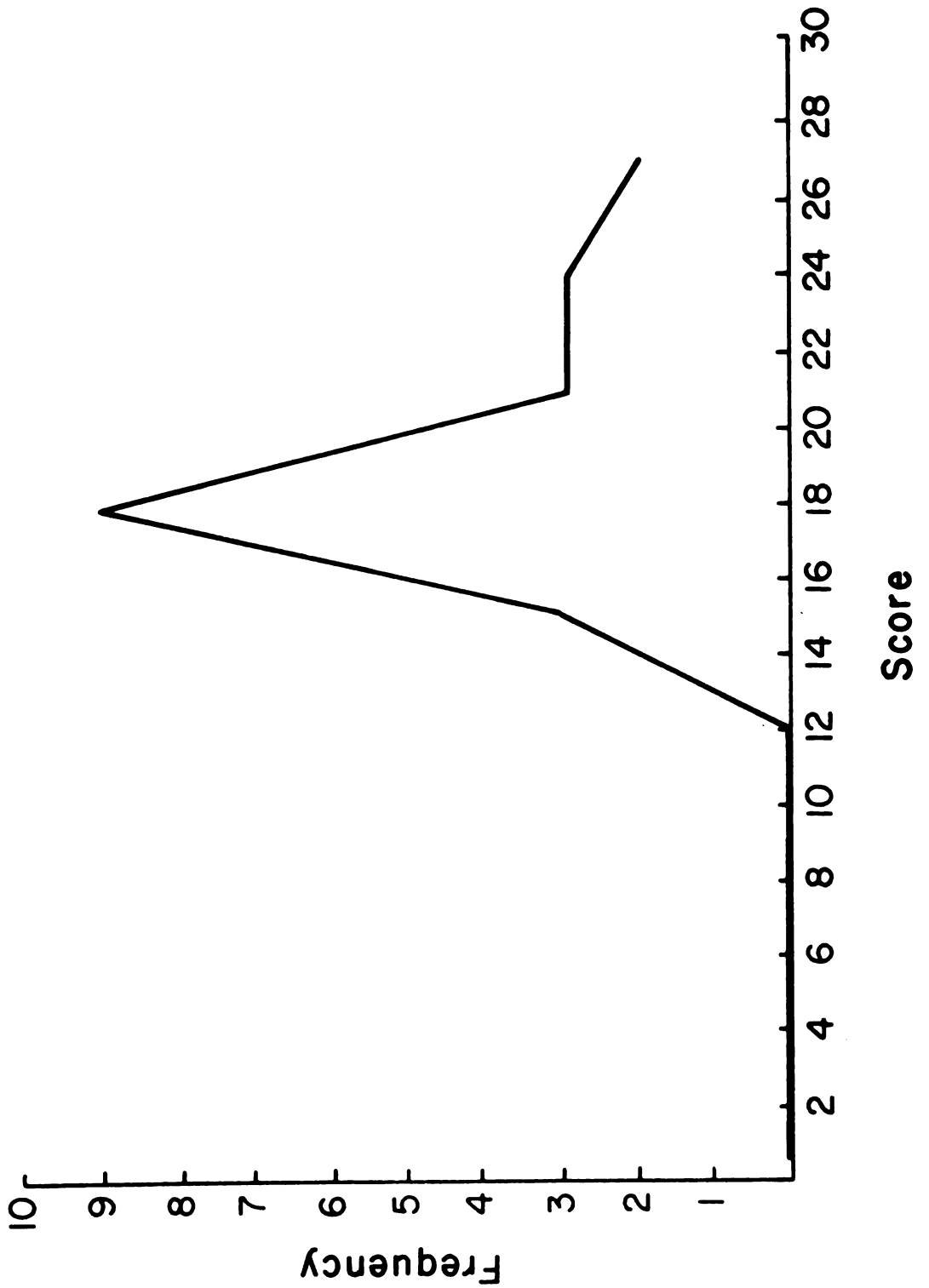


Figure 9. Frequency Polygon for Teachers' AB-Scores

Nine teachers or 45% of the total sample were evaluated within the range of 17-19 points representing 60.71 to 68.86% competency levels. The scores of 14 teachers or 70% of the scores were within one standard deviation of the mean indicating competencies of 57.74 to 83.32%. Since the number of teachers evaluated was small, normality of the distribution is unlikely. In spite of this, Figure 7 indicates that the distribution of obtained scores does approximate a normal curve.

Although data derived from behavioral checklists do not readily lend themselves to item analysis, Table 29 provides information regarding number and percentage of teachers rated for each category of concern/commitment for each item on the checklist.

TABLE 29
Frequency Distribution of Teacher Behavioral Checklist Ratings

Question No.	Strong		Moderate		Weak	
	Number	Percent	Number	Percent	Number	Percent
AB 1	8	38.10	13	61.90	0	0
AB 2	8	38.10	13	61.90	0	0
AB 3	1	4.76	7	33.33	13	61.90
AB 4	10	47.62	11	52.38	0	0
AB 5	2	9.52	17	80.95	2	9.52
AB 6	3	14.29	11	52.38	7	33.33
AB 7	Mean Score = 7					

The distribution of teacher ratings in the category "strong" is generally found between those of the categories "moderate" and "weak." The highest frequencies of ratings are generally associated with the category "moderate" except for item number three.

Total Teacher E.E.C.M.

The environmental education competency was obtained by combining the C-score and AB-score of each teacher. Tables 30 and

31 and Figure 10 show the distribution of environmental education competencies and the corresponding rank for each teacher and provide descriptive statistics relative to this distribution.

In spite of the minor fluctuation in the distribution indicated by Figure 10, the obtained curve approximates a normal curve. The fluctuation of three frequency units between the scores 75 and 101 is related to the difficulty of obtaining a normal curve given a small population. In this type of situation, minor fluctuations such as the three units illustrated in Figure 10 have a disproportionate effect on the total distribution. The approximation of normality is supported by the fact that 16 teachers, or 80% of the sample tested, scored from 56-107 points. In addition, 60% or 12 teachers scored from 62.01 to 101.99 points or within one standard deviation from the mean. The fact that the median score of 79.5 lies within three points of the mean further supports this interpretation of the distribution. The above data indicate that the behaviors specified and evaluated for environmental education competency are well within the range of capabilities of the teachers tested.

TABLE 30
Distribution and Rank of Teacher Environmental Education Competencies

Teacher No.	Adjusted C-Score	AB-Score	E.E.C.	Rank
901	59.0	15	74.0	12
902	56.0	24	80.0	10
293	77.5	17	94.5	7
294	78.5	18	96.5	6
295	82.5	18	100.5	5
297	76.0	18	94.0	8
308	53.0	26	79.0	11
309	82.5	19	101.5	4
310	95.0	21	116.0	2
311	83.5	19	102.5	3
412	98.5	18	116.5	1
513	37.0	23	60.0	16
514	42.0	17	59.0	17.5
515	36.5	19	55.5	19
516	62.5	24	86.5	9
617	50.5	16	66.5	15
718	37.0	22	59.0	17.5
719	53.5	20	73.5	13
720	58.0	14	72.0	14
821	26.0	27	53.0	20

TABLE 31
Grouped Frequency Distribution and Descriptive Statistics for Teacher Environmental Education Competencies

Scores	Frequency	Statistic	Value
120-108	2	Mean	82
107-95	5	Median	79.5
94-82	2	Mode	59
81-69	5	Standard Deviation	19.99
68-56	4	Variance	399.71
55-43	2	Range	64.5
42-30	0		
29-17	0		
16- 0	0		

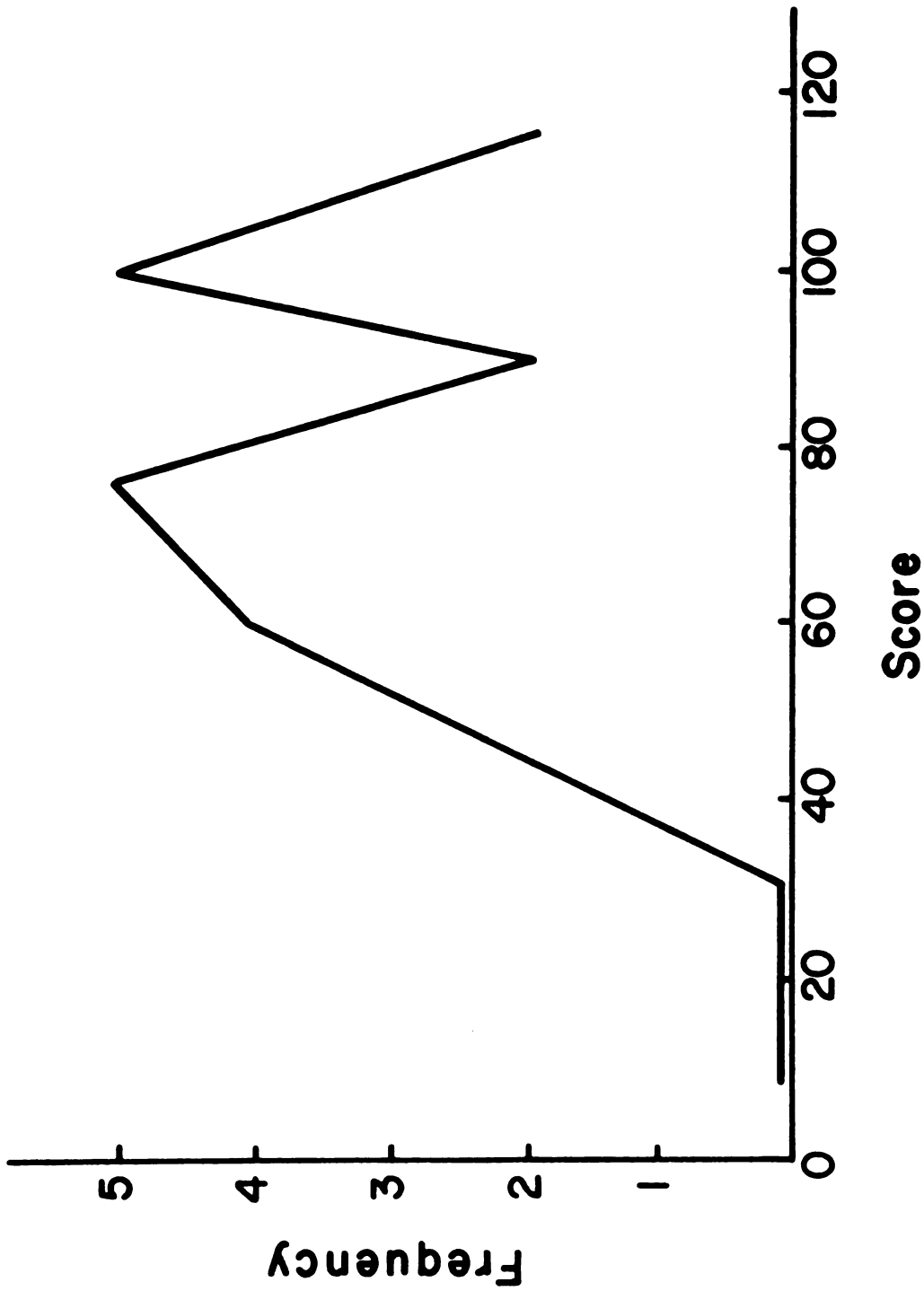


Figure 10. Frequency Polygon for Teachers' Environmental Education Competencies

Comparative Data

Many of the questions of interest in this study and the hypotheses derived from them related directly to statistical tests of degree of relationship or correlation. The Pearson Product-Moment Correlation and the Spearman Rank Correlation were used to test these hypotheses for both student and teacher data. The Pearson Correlation for the student data was obtained from the SPSS computer program. All other correlation coefficients were obtained by the use of standard formulae and tables with the assistance of an electronic calculator. Data generated by these correlational analysis will be presented in relationship to each of the formulated hypotheses.

Hypothesis Number 1

The null hypothesis tested was that there is no significant relationship between C-scores and AB-scores of either students or teachers. Table 32 presents the data derived from a correlational analysis of appropriate scores.

TABLE 32
Correlation of AB and C-Scores

Correlation Tested	N	Statistic	Value	Significance
Student AB/C Scores	406	Pearson r	.2659	.001 level(SPSS)
Class Mean AB/C Scores	20	Spearman r	.2962	.20 level *
Teacher Adjusted C/AB Scores	20	Pearson r	-.4127	.10 level **
	20	Spearman r	-.2718	Not significant at .20 level *

(* Tate and Clelland, 1957, p. 132. ** Downie and Heath, 1959, p. 306.)

On the basis of these data the following conclusions can be stated:

1. The null hypothesis that there is no significant relationship between the C-scores and AB-scores of the students tested must be rejected. The Pearson correlation coefficient and the Spearman rank correlation were both significant at the levels previously specified. These data indicate that there was a significant degree of relationship between the cognitive and behavioral scores of the population tested.

2. The null hypothesis that there is no significant relationship between the C-scores and AB-scores of the teachers tested must be accepted in spite of a Pearson coefficient that lies within acceptable levels of significance. The reason for accepting the null null hypothesis in this case is that the n for the teacher data was very small (20), therefore the most powerful statistical procedures are non-parametric. Thus the Spearman rank correlation is a more reliable indicator of the type and degree of existing relationship. For these data this coefficient does not indicate a significant degree of relationship. Hence we must conclude that there was no significant correlation between the cognitive and AB-scores of the teacher population tested.

Hypothesis Number 2

The null hypothesis tested was that there is no significant relationship between C-scores of teachers and the mean C-scores of their classes. Table 33 presents the data derived from

correlational analysis of appropriate scores.

TABLE 33
Correlation of Teacher and Student C-Scores

Statistic	N	Value	Significance
Pearson r	20	.3694	Not significant at .10 level **
Spearman r	20	.2677	Not significant at .20 level *

(*Tate and Clelland, 1957, p. 132. ** Downie and Heath, 1959, p. 306).

These data indicate that the null hypothesis must be accepted; thus there was no signicant degree of relationship between the C-scores of teachers and the mean C-scores of their classes for the population tested.

Hypothesis Number 3

The null hypothesis tested was that there is no significant degree of relationship between AB-scores of teachers and the mean AB-scores of their classes. Table 34 presents data derived from correlational analysis of appropriate scores.

TABLE 34
Correlation of Teacher and Student AB-Scores

Statistic	N	Value	Significance
Pearson r	20	-.2719	Not significant at .10 level **
Spearman r	20	-.2519	Not significant at .20 level *

(*Tate and Clelland, 1957, p. 132. ** Downie and Heath, 1959, p. 306).

These data indicate that the null hypothesis must be accepted and therefore there was no significant degree of relationship between the AB-scores of teachers and the mean AB-scores of their classes for the population tested.

Hypothesis Number 4

The null hypothesis tested was that there is no significant relationship between the environmental education competencies of teachers and the mean environmental education competencies of their classes. Table 35 presents data derived from correlational analysis of appropriate scores.

TABLE 35
Correlation of Teacher and Student E.E.C.

Statistic	N	Value	Significance
Pearson r	20	.3490	Not significant at .10 level **
Spearman r	20	.3515	Significant at .20 level *

(*Tate and Clelland, 1957, p. 132. ** Downie and Heath, 1959, p. 306).

Careful examination of these data is necessary prior to determining whether or not to accept the null hypothesis. Since the n for this comparison is small (20), the Pearson correlation is not as powerful a statistic as the non-parametric Spearman rank correlation. The value obtained for the Spearman rank correlation indicates that the null hypothesis should be rejected since the obtained value is significant at the .20 level previously specified for acceptability. The conclusion from this analysis is that there is a significant degree of relationship between the E.E.C of teachers and the mean E.E.C. of their class.

Discussion of Results

1. Hypothesis Number 1: The fact that the data indicate a correlation between the cognitive and behavioral scores for the

students tested is interesting in light of the fact that the behavioral or AB-scores of the students were determined through teacher observations. The behavioral evaluation of some students may have been affected by the teacher's knowledge or perception of student academic ability or achievement. Hence the correlation suggested by the data may be due either to an actual correlation between student cognitive and behavioral scores or to a correlation between teacher's knowledge of student academic ability and teacher ratings on the behavioral checklist. Future research will be needed to clarify which of these conclusions best describes the phenomenon questioned. The fact that there was no significant correlation between cognitive and behavioral scores of the teachers tested may indicate that there is no relationship between these variables or that the sample tested was too small to indicate any existing correlation. Future research is needed to address this question.

2. Hypotheses Numbers 2 and 3: The data obtained in regard to these hypotheses indicate that there is no significant correlation between the AB or C-scores of teachers and the corresponding AB or C-scores of their classes. While these results may in fact be related to the small sample size, there are other factors which may also have been operative. Knowledgeable teachers may or may not have had the opportunity to share this knowledge with their students depending upon the sequence of units and curricular structure of the school system in which they operate. In addition, many of the behaviors of the teacher behavioral checklist would be classified as private or personal behaviors; therefore students might simply

be unaware and hence unaffected by this aspect of their teacher's environmental education competency. Future research is needed to explore these possibilities in relationship to the phenomenon questioned.

3. Hypothesis Number 4: Although the data in hypotheses two and three indicated that there was no significant relationship between separate components of the teacher and student E.E.C.M., the data for this hypothesis indicate that there was a significant correlation between the overall environmental education competency of teachers and that of their students. Correlations for hypotheses two and three were obtained by comparing the rank of the teacher on each component of the E.E.C.M. with the mean rank of his/her class for that component. In combining the AB and C-scores of each group in order to determine total environmental education competency, the rank order of teachers and classes was sufficiently affected to alter relationships and ergo result in a positive correlation for the overall E.E.C.-scores. The deviations in rank for each comparison were determined in order to calculate the Spearman rank correlation. In order to further examine the variations that occurred in rank, the rank deviations were squared to eliminate negative signs and the sum of the squared deviations was determined. Table 36 indicates these data and shows the average or mean of the square of the rank deviations for each comparison considered in this study. The size of this mean deviation for each component of the E.E.C.M. and for the total E.E.C. indicates that the smallest rank deviation occurred between the teacher E.E.C. and the mean

class E.E.C. Thus we can conclude that there is a relationship between the teachers' overall E.E.C. and that of their students for the population tested.

TABLE 36
Comparison of Rank Deviations

Comparison	Sum of Rank Deviations Squared	Mean of Square of Rank Deviations
Teacher/Class AB-Score Ranks	1665.0	83.25
Teacher/Class C-Score Ranks	974.0	48.70
Teacher/Class E.E.C. Score Ranks	862.5	43.13

Descriptive Data

In addition to examination of the hypotheses discussed in the previous sections, this study was also concerned with determination of current levels of environmental education competency of third grade students and their teachers in relation to Michigan's Minimal Performance Objectives for environmental education. The following information describes the baseline data obtained in this regard.

Student Environmental Education Competency

The environmental education competencies of the 406 students tested in relation to the Michigan Goals of Environmental Education and the minimal environmental education performance objectives are described in Table 37. The competencies indicated in this table were determined through utilization of percentages correct for acceptable items/options only. These data indicate that the achievement levels for only five of the 21 performance objectives are

above the 70% minimal performance generally accepted as indication of minimal competency.

TABLE 37-A
Student Enrionmental Education Competencies in Relation to Michigan Goals and Minimal Performance Objectives

Performance Objective		Question Number	% Responding Correctly	Mean % Correct *
Goal 1 **	1.1	1	32	
		2	26	21.75
		3	19	
		4	10	
	1.2	5	A93,B95,C94,D93,E60	85.6
		6	A80,B92,C86,D81,E82	
	1.3	7	A93,B86,C79,D94,E95	
		8	A80,B92,C67,D78,E87	82.90
		9	A#,B#,C79,D92,E86	
		10	A85,B59,C79,D#,E#	
		11	A68,B86,C93,D86,E92	
	1.5A	12	12#	25
		13	25	
	1.4B	14	20	
		15	A76,B82,C70,D67,E68	77
		16	A91,B93,C95,D94,E91	
	1.5	41	15	
		42	12	8
		43	6	
		44	5	
		45	2	
	2.1	18	52	
		19	58	50.5
		20	61	
		21	31	
	2.2	17	A39,B66,C51,D66,E#	61.67
		22	70	
		23	78	

= Item rejected

TABLE 37-B

Performance Objective	Question Number	% Responding Correctly	Mean % Correct *
2.3	24	A91,B38,C92,D78,E54	
	25	A72,B44,C64,D59,E62	72.16
	26	A87,B89,C72,D76,E#	
	27	A92,B84,C84,D47,E88	
3.1	28	55	
	29	13	32.25
	30	40	
	31	21	
3.2	32	49	40.5
	33	32	
3.3	34	17	17
4.1	35	A86,B67,C73,D#,E36	
Goal 2 **			
1.1	36	A79,B76,C91,D86,E86	
	37	A37,B79,C#,D43,E71	79.39
	38	A51,B37,C#,D91,E88	
2.1	39	A87,B81,C67,D76,E83	68.17
	40	15	
Goal 3 +		% "Frequently"	Mean % "Frequently"
1.1	AB:1	27.3	27.3
2.1	AB 2	18.2	17.10
	AB 3	16	
Goal 4 +			
1.1	AB 4	35.2	35.2
2.1	AB 5	32	28.55
	AB 6	25.1	
Goal 5 +			
1.1	AB 8	13.8	10.35
	AB 9	6.9	
1.2	AB 7	12.6	12
	AB 10	11.3	

* = Achievement level ** Data from Item analysis + Data from SPSS

An examination of specific objectives in relation to the achievement levels demonstrated may further illuminate the environmental education competencies demonstrated by the third grade students in this study.

Goal 1.

Objective 1.1 - The achievement level for this objective suggests that the term "environment" may be too abstract for many third grade students unless instructional strategies designed to concretize the concept are presented by the teacher.

Objective 1.2 - This objective had the highest achievement level indicating that the ability to distinguish living things from non-living objects is well developed for most students by the third grade.

Objectives 1.3 and 1.4A - Students exhibited a reasonable amount of success in associating plants and/or animals with a particular habitat; however, the average third grade student had much more difficulty identifying the habitat of particular plants and/or animals. Hence, reversibility for this concept was not demonstrated by the students tested. Therefore it appears that this concept is not firmly equilibrated or completely internalized for the majority of third grade students.

Objective 1.4B - The majority of students were able to successfully associate an organism with its food supply.

Objective 1.5 - The lowest achievement level was associated with this objective. This indicates that the term "natural resource" may be too abstract for the average third grade student unless

instructional strategies designed to concretize the concept are presented by the teacher.

Objective 2.1 - The questions developed to test this objective illustrated various types of relationships from similarities in habitat to membership in a particular group of organisms. Apparently the manner in which the questions were asked (Which does not belong?) was too subtle for the average third grade student. Additional test items will be necessary to determine what the competency level is in regard to this concept.

Objective 2.2 - Almost 62% of the students were able to identify an organism as part of a specific group of organisms. Hence this concept is well on the way toward equilibration in the third grade.

Objective 2.3 - The achievement levels obtained indicate that the concept of role is well established by the third grade for most students tested.

Objectives 3.1 and 3.2 - The ability of third grade students to focus upon properties of organisms or environments that change with successive observations appears, from the achievement levels obtained, to be rather limited. Also limited is the ability to arrange pictures in the order in which changes occurred.

Objective 3.3 - The mathematical skills required in regard to the test item used for this objective may have limited the ability of the students to demonstrate existing competencies. Additional test items will be needed to further assess actual competency.

Objective 4.1 - Man-made changes in the environment could be identified by 65.5% of the students. This indicates that the concept is well on the way to equilibration in the third grade.

Goal 2.

Objective 1.1 - The concepts relating to various pollution types and sources are well established by the third grade.

Objective 2.1 - Many students were able to identify positive and/or negative effects of certain conditions upon organisms in a particular environment, indicating that associated concepts are developing in third grade students but are not yet completely equilibrated.

Goal 3.

Objectives 1.1 and 2.1 - Few students spontaneously and frequently identified feelings associated with environmental situations or gave evidence of valuing a healthy environment as defined on the behavioral checklist. This may indicate that the development of environmental values lags behind the development of cognitive knowledge for children in the third grade or that the structure of many classrooms does not facilitate this type of expression.

Goal 4.

Objectives 1.1 and 2.1 - Few students gave evidence of voluntarily caring for or about other organisms in the environment or for the enhancement or protection of the environment itself as defined by the behavioral checklist. This may be further evidence of the same cognitive-affective gap suggested above or that this type of behavior needs a great deal of teacher development and encouragement.

Goal 5.

Objectives 1.1 and 1.2 - Very few students spontaneously or frequently indicated recognition of a local environmental problem or gave evidence of voluntarily working toward the prevention or solution to such problems as defined in the behavioral checklist. This further supports the hypothesis of a cognitive-affective gap and illustrates the urgency of additional teacher encouragement and support.

Teacher Environmental Education Competency

Table 38 describes the environmental education competencies of the 20 teachers tested in relation to Michigan Goals of Environmental Education and Ninth Grade Minimal Performance Objectives. These data indicate that the achievement levels for eight of the 22 performance objectives are above the 70% minimal performance generally accepted as indicative of minimal competency.

TABLE 38-A
Teacher Environmental Education Competencies in Relation to Michigan Goals and Minimal Performance Objectives

Performance Objective	Question Number	% Responding Correctly	Mean % Correct (*Achievement level)
Goal 1			
1.1	1	52.13	
	2	50.00	52.14
	9	51.67	
	10	54.76	
1.2	-	-	-
1.3	3	28.57	
	4	7.14	20.24
	5	14.29	
	6	30.95	
1.4	7	34.01	
	8	40.13	33.14
	11	22.22	
	12	36.19	
2.1	16	39.68	
	17	27.46	33.69
	18	34.29	
	19	33.33	
3.1	13	50.48	50.48
4.1	14	78.91	78.91
4.2	15	76.98	76.98

TABLE 38-B

Performance Objective	Question Number	% Responding Correctly	Mean % Correct or "Strong"*
Goal 2			
1.1	20	78.33	78.33
1.2	21	67.86	75.43
	26	82.99	
2.1	24	61.90	52.14
	29	42.38	
2.2	-	-	-
2.3	22	44.29	56.67
	27	69.04	
2.4	23	46.56	44.64
	28	42.71	
3.1	25	50.00	42.46
	30	34.92	
Goal 3			
1.1	37	41.80	41.80
2.1	34	76.19	77.77
	AB 1	79.35	
2.2	AB 3	47.61	47.61
3.1	35	71.43	71.43
3.2	36	38.09	38.09
4	-	-	-
5.1	31	36.19	31.64
	32	38.10	
	33	20.63	
Goal 4			
1.1	AB 2	79.36	79.36
2.1	AB 4	82.53	82.53
Goal 5			
1.1	AB 5	66.67	65.66
	AB 6	60.31	
	AB 7	70.00	

* Achievement Level

An examination of specific objectives in relation to the achievement levels demonstrated may further illuminate the environmental education competencies demonstrated by the teachers in this study.

Goal 1

Objective 1.1 - Teachers generally had difficulty in identifying and diagramming components of a life support system. Since a brief discussion of the term "life-support system" was included in the preliminary meeting with the teachers, the concepts underlying this term were apparently vague for most teachers.

Objective 1.3 - The task of constructing operational definitions was apparently very difficult for most teachers. The terms for which definitions were requested were generally unfamiliar to the teachers and those that were able to define them did so without operationalizing the definition in terms of the context in which the question was asked.

Objective 1.4 - Knowledge of the interrelationships of dynamic populations was low both in regard to natural environmental systems and to social systems.

Objective 2.1 - Awareness of effects of selected institutions upon the life-support system was low.

Objective 3.1 - Most teachers had difficulty in listing five benefits derived from an understanding of the life-support system. Perhaps this is not as surprising as it may first seem when consideration is given to the fact that the concept of life-support system seems to be poorly developed.

Objectives 4.1 and 4.2 - The teachers were generally able to identify ways in which man is affected by and affects the life-support system. The achievement levels for these objectives were among the eight competencies over 70%.

Goal 2.

Objectives 1.1 and 1.2 - The majority of the teachers were able to identify general and specific environmental problems with reasonable accuracy. Achievement levels for these objectives were also among the eight highest competencies.

Objectives 2.1, 2.3 and 2.4 - The ability of teachers to suggest possible solutions to environmental problems, to identify causes of problems and to describe the effects of problems was rather limited.

Objective 3.1 - Ability to identify new problems that might arise from attempted solutions was also generally low.

Goal 3.

Objective 1.1 - Less than 50% of the teachers were able to state the steps in the values clarification process. This may be due to the rather recent development and popularization of this process and to the general emphasis of many curricula upon cognitive rather than affective outcomes of education.

Objectives 2.1 and 2.2 - While the majority of teachers were able to express personal feelings related to the environment and environmental problems, few of them exhibited willingness to defend their position among peers or in public.

Objectives 3.1 and 3.2 - The majority of teachers were able to identify possible values held by other individuals or groups in

regard to environmental problems but few were perspectivistic enough to explain how and why these value positions might differ from their own.

Objective 5.1 - Ability to identify the consequences of one's choices upon various components of the life-support system was very minimal.

Goal 4.

Objective 1.1 - Teachers generally exhibited a satisfactory degree of achievement in regard to assuming responsibility for environmental protection and enhancement.

Objective 2.1 - The highest level of achievement indicated on the E.E.C.M. was related to this objective and suggests that the majority of teachers frequently give evidence of concern for the welfare of other organisms in the life-support system.

Goal 5.

Objective 1.1 - The achievement in regard to this objective is slightly below the acceptable 70% competency level suggesting that while the teachers were to some degree involved in environmental activities, greater levels of motivation and involvement are needed to satisfy this objective.

Competencies and Environmental Education Goals

The competency level for each of the five Michigan Goals of Environmental Education was determined by finding the mean of the achievement levels for all performance objectives relating to a specific goal. Table 39 indicates the achievement levels for each goal and compares the competency of the students and teachers tested.

TABLE 39
Comparison of Student and Teacher Environmental Education Competencies

Goal	Mean Student Competency	Mean Teacher Competency
1	49.22	49.37
2	69.28	58.28
3	22.20	51.39
4	31.88	80.95
5	11.16	65.66
Overall Competency	36.75	61.13

These data indicate major differences exist in the competency levels of the teachers compared to that of their students in regard to the last three goals which are primarily affective in orientation. While the affective competencies of the third grade students were substantially lower than their cognitive competencies, the reverse was true for the teachers tested; that is the affective competencies of the teachers were generally higher than their cognitive competencies. The difference between teacher and student achievement levels for Goals One and Two can probably be attributed to the more difficult nature of the skills and information required of the teachers in regard to environmental understandings. The difference between teacher and student achievement levels for Goals Three, Four, and Five, however, are probably related to a lag between acquisition of cognitive understandings and development of values, attitudes and behaviors based upon those understandings.

The overall competency of both teachers and students was low. However since the nature of this study was to determine baseline information prior to development of instructional activities to

address the performance objectives tested, the low competency levels obtained should not imply a negative assessment of either students or teachers, but should merely indicate the degree and direction of growth that will be necessary in order to achieve minimal environmental education competencies.

CHAPTER V

SUMMARY, CONCLUSIONS AND IMPLICATIONS

Summary

The primary purpose of this study was to determine current levels of environmental education competency (E.E.C.) of third grade students and their teachers in relation to the Michigan Goals of Environmental Education. Also of interest was whether or not a relationship exists between knowledge about the environment and behavior regarding the environment, and also whether it is possible to assess the teachers' E.E.C. at minimal adult level and thereby to gain insights regarding the effects of these competencies on those of their students.

Four hundred and thirty-six third grade students were given an Environmental Education Competency Measure (E.E.C.M.) based on Michigan K-3 Minimal Performance Objectives. The cognitive component of the instrument was administered orally and the total number of correct responses constituted the C-score for each student. In addition, teachers were asked to observe specific environmental education behaviors of their students and then to rate each student in regard to the frequency of exhibited behavior on a behavioral checklist. The scores derived from this checklist constituted the AB component of the E.E.C.M. The total of AB and C-scores

constituted the environmental education competency (E.E.C.).

The twenty teachers of the third grade classes used in the study were given an E.E.C.M. based on Michigan 7-9 Minimal Performance Objectives. The cognitive component was open-ended in format and was scored by comparing the teachers' responses with those of ten environmental education "experts." The total number of correct responses constituted the C-score for each teacher. The AB component of the instrument involved self-reported responses regarding environmentally-related behaviors. These responses were verified by an interview with the researcher who then evaluated each teacher on a behavioral checklist. The scores derived from this checklist constituted the AB-score of the E.E.C.M. The total of AB and C-scores again constituted the E.E.C.

The data were then evaluated using a combination of item analysis, descriptive reports and parametric and non-parametric statistical procedures.

Analysis of the data indicated that the content tested for the cognitive components of both the student and teacher E.E.C.M. was well within the capabilities of the subjects evaluated. In addition, the distributions of both student and teacher AB-scores and overall E.E.C. approximated a normal curve. This suggests that the behaviors identified by the minimal performance objectives are reasonable for the target groups specified.

Actual achievement in relation to Michigan's Minimal Performance Objectives for environmental education was, however, generally low. Data describing the competency levels of the

third grade students tested indicate that the achievement levels for only five of the 21 (K-3) performance objectives are above the 70% minimal performance generally accepted as indication of minimal competency. The teachers tested did little better than their students, achieving 70% or more for only eight of the 22 (7-9) performance objectives.

Further analysis of the data in relationship to individual objectives suggests some interesting possibilities. For example, while the concept of role appears to be fully equilibrated by the third grade students, the habitat concept is not yet reversible; hence it is probably not fully equilibrated at this time. The concept of pollution appears to be well established but the more abstract concepts of environment and natural resources are generally not well understood. In addition, the ability of third grade students to focus on changing aspects of organisms or environments appears to be quite limited and the affective dimensions of environmental education are poorly developed. The third grade teachers studied had little understanding of the concept of a life-support system, were unable to construct operational definitions and had little knowledge of the interrelationships of dynamic populations. Teachers generally were unaware of the effects of selected institutions on life support systems and lacked the ability to identify causes, describe effects or suggest possible solutions to environmental problems. Knowledge of values clarification techniques was also quite low. However teachers indicated a high degree of environmental concern and were willing to assume responsibility for

environmental protection or improvement.

When environmental education competencies were analyzed in terms of the five Michigan Goals of Environmental Education, major differences were found between the competency levels of the teachers compared with that of their students.

Further analysis of data utilizing parametric and non-parametric tests of correlation revealed several correlations of interest. While there was a highly significant correlation between student cognitive and affective-behavioral scores (Pearson r significant at the .001 level), no significant relationship was found for the teachers tested. Neither was a significant degree of relationship found between either the cognitive or affective-behavioral scores of teachers and the mean cognitive or affective-behavioral scores of their classes. However a significant correlation (Spearman r significant at the .20 level) was found between the overall environmental education competencies of teachers and the mean E.E.C. of their class. Table 40 summarizes the data from these correlational analysis.

TABLE 40
Summary of Correlational Analysis

Null hypothesis tested	Correlational Level of Significance		Action on Null Hypothesis
	Pearson r	Spearman r	
1. There is no significant relationship between C-scores and AB-scores of either A) students or B) teachers.	A. .001	.20	Rejected
	B. 10	$<$.20	Accepted
2. There is no significant relationship between C-scores of teachers and the mean C-score of their classes.	$<$.10	$<$.20	Accepted
3. There is no significant relationship between AB-scores of teachers and the mean AB-score of their classes.	$<$.10	$<$.20	Accepted
4. There is no significant relationship between the E.E.C. of teachers and the mean E.E.C. of their classes.	$<$.10	$\geq$ .20	Rejected

Conclusions

Analysis of the findings indicates that:

1). Overall environmental education competency levels of both third grade students and teachers were generally low in relation to the Michigan Goals of Environmental Education.

2). The affective-behavioral competencies (related to Goals 3, 4, and 5) of the third grade students were substantially lower than their cognitive competencies (related to Goals 1 and 2).

3). The affective-behavioral competencies of the third grade teachers were significantly higher than their cognitive competencies.

4). A highly significant correlation was found between the cognitive achievement of students and their affective behaviors as evaluated by their classroom teacher.

5). While there was no significant correlation between the isolated scores of teachers on either component of the instrument and the appropriate scores of their students, the overall scores of teachers did have a significant relationship to total student achievement.

Educational Implications

The highly significant relationship found between the environmental education knowledge and behaviors of third grade students suggests that environmental education represents a truly holistic approach to the educational process. This is further supported by the finding that, although neither cognitive nor affective teacher scores could be independently correlated with appropriate student scores, the overall environmental education competency of teachers did have a significant relationship to total student competency. This finding is supported by the work of Glass (1970). Thus environmental education appears to be a confluent educational approach in which the final learning outcome is greater than the sum of the parts might suggest.

The results of this study support the findings of Swan (1969), Towler and Swan (1972) and Bohl (1974) which indicate that

environmental education knowledge levels are generally low. This points to the urgent need to make environmental education programs available at all educational levels. However since the data collected represent baseline competency levels, they are most useful in identifying individual performance objectives and related curricular areas in need of particular development. Appropriate instructional strategies are needed to concretize and facilitate equilibration of habitat, environment and natural resource concepts by third grade students as well as to assist them in general affective development. Third grade teachers require assistance in development of the life-support system concept and the ability to more critically analyze environmental problems.

Implications for Future Research

As previously noted the determination of a highly significant relationship between the cognitive and affective scores of students is most interesting in light of the fact that the AB-scores of the students were determined through teacher evaluations. Thus the correlation obtained may be due either to an actual correlation between these variables or to a correlation between the teachers' knowledge of student academic ability and teacher ratings on a behavioral checklist. Observer biases have been found to influence the observational process and subsequent behavioral ratings of students by their teachers (Knaffle 1972); hence additional research utilizing more than one observer is necessary to further clarify this point.

Due to the nature of this study it was necessary to utilize a relatively small number of third grade classes, which resulted in a very small sample of third grade teachers. Additional research to gather data from a broader teacher base would be most useful and might also afford an opportunity to study possible effects of demographic variables upon environmental education competencies.

No attempt was made in this study to identify the curricular content and sequence in each classroom. Hence it was not possible to determine if environmentally knowledgeable teachers were given an opportunity to share this knowledge with their students; nor was it possible to identify particularly effective delivery systems. This suggests an important area for future investigation.

The degree of student awareness of teacher environmental behaviors was not ascertained. Would increased student awareness of the environmental attitudes and behaviors of their teachers effect student environmental behaviors? This is an important question requiring additional exploration.

Since neither the cognitive nor the affective scores of teachers correlated significantly with the cognitive or affective scores of their students it is interesting to speculate <u>how</u> these factors interact to result in a significant degree of relationship between overall teacher competency and total student achievement. This is a difficult question to investigate but research in this regard could have a potentially profound impact on the future directions of environmental education.

LIST OF REFERENCES

LIST OF REFERENCES

Allen, R. F. 1973. But the Earth Abideth Forever: Values in Environmental Education. Washington, D.C.: United States Department of Education, National Institute of Education.

Ames, E.A. 1971. Schools and the Environment in Outlines for Environmental Education. Edited by Clay Schoenfeld. Madison, Wisconsin: Dembar Educational Research Services.

Ammons, M. 1962. The Definition, Function, and Use of Educational Objectives. Elementary School Journal 62:432-436.

Anderson, B.D. and Kaplan, J. 1974. Towards A Model of Teacher Behavior and Student Achievement. Washington, D.C.: United States Department of Health, Education and Welfare, National Institute of Education.

Arnstein, D. G. 1964. The Language and Values of Programmed Instruction. The Educational Forum 28(3): 337-346.

Aronstein, L.W. 1972. A Study of Attitudinal Change in College Students as a Result of Constructive Participation in an Environmental Community Service Project. Dissertation Abstracts 33(3): 1068-A.

Atkin, J. M. 1968. Behavioral Objectives in Curriculum Design: A Cautionary Note. The Science Teacher 35(5): 27-30.

Atkinson, R. C. 1967. Computerized Instruction and the Learning Process, Technical Report Number 122. Stanford, California: Institute for Mathematical Studies in the Social Sciences.

Baker, E. L. 1969. Effects on Student Achievement of Behavioral and Nonbehavioral Objectives. Journal of Experimental Education 37(4): 5-9.

Bart, W. 1972. A Hierarchy Among Attitudes Toward the Environment. The Journal of Environmental Education 4(1): 10-14.

Bennett, D.B. 1973. Guidelines for Evaluating Student Outcomes in Environmental Education. Maine Environmental Education Program. Washington, D.C.: United States Department of Health, Education and Welfare, Office of Education.

Bishop, D.D. 1969. Effectiveness of Prior Exposure to Performance Objectives as a Technique for Improvement of Student Recall and Retention. Unpublished Ph.D. Dissertation, The Ohio State University, Columbus, Ohio. Dissertation Abstracts 30(9) 4345-A.

Blaney, J. P. and McKie, D. 1969. Knowledge of Conference Objectives and Effect Upon Learning. Adult Education Journal 19: 98-105.

Block, J. H. 1971. Criterion-Referenced Measurements: Potential. School Review 79: 289-298.

Bloom, B. 1968. Learning for Mastery, U.C.L.A.-C.S.E.I.F. Evaluation Comment 1(2): 47-63.

_____, Englehart, M.D., Furst, E.J., Hill, W. H., and Krathwohl, D.R. 1956. Taxonomy of Educational Objectives, Handbook 1: Cognitive Domain, New York: Longmans Green, Inc.

Boardman, D.E. 1970. The Effects of Advanced Knowledge of Behavioral Objectives on Students' Achievement in Remedial Chemistry. Unpublished Ph.D. Dissertation, University of California, Los Angeles. Dissertation Abstracts 31(7): 3286-A.

Bohl, W.B. 1974. A Survey of Environmental Knowledge and Attitudes of Tenth and Twelfth Grade Students from Four Southwestern States, Six Mideastern States and Twelve Plains and Mountain States. Unpublished Ph.D. Dissertation, The Ohio State University, Columbus, Ohio.

Booth, J.L. 1974. Behavioral Objectives-A Review of Theoretical Positions and Empirical Evidence and an Investigation of the Effects of Two Types of Instructional Objectives on Student Achievement and Attitude in a Basic Speech Communication Course. A paper presented at the Annual Meeting of the Speech Communication Association, Chicago, Illinois.

Bowman, M.L. 1974. Assessing College Student Attitudes Toward Environmental Issues. The Journal of Environmental Education 6(2): 1-5.

Brandt, R.M. 1973. Toward a Taxonomy of Observational Information in Observational Methods in the Classroom. Washington, D.C.: Association for Supervision and Curriculum Design.

Briggs, L.J. 1970. Handbook of Procedures for the Design of Instruction. Washington, D.C: American Institute for Research.

Brooks, G.D. and Friedrich, G.V. 1973. Teaching Speech Communication in the Secondary School. Boston: Houghton-Mifflin Company.

Brown, G.I. 1971. Human Teaching for Human Learning. New York: The Viking Press.

Bryant, N. Jr. 1972. Effects of Performance Objectives on Achievement. Journal of Research in Science Teaching 9(4): 369-375.

Burchett, B.M. 1971. A Descriptive Study of Fourth, Fifth and Sixth Grade Students' Attitudes Relating to Environmental Problems. Unpublished Ph.D. Dissertation, Indiana University. Dissertation Abstracts 32(8): 4439-A.

Carroll, J. 1963. A Model of School Learning. Teachers' College Record 64: 723-733.

Cauley, V.B. and Groves, D.L. 1974. Variables Related to Conservation. American Biology Teacher 36(8): 500.

Churchman, C.W. 1968. Humanizing Education. Center Magazine 1: 90-98.

Cogswell, J.F. 1966. Instructional Management Information Systems in Machine Systems in Education. Edited by V.W. Loughany. New York: Harper and Row.

Cohen, M.R. 1973. Environmental Information Versus Environmental Attitudes. The Journal of Environmental Education 5(2): 15-18.

Cook, D. 1975. Proposed Learning Objectives for Environmental Education. Washington, D.C.: Environmental Protection Agency.

Cook, J.M. and Neville, R.F. 1971. The Faculty as Teachers: A Perspective on Evaluation. Columbus, Ohio: ERIC Higher Education Report Number 13.

Cronbach, L.J. 1949. Essentials of Psychological Testing. New York: Harper and Brothers.

Dalis, G.T. 1970. Effect of Precise Objectives Upon Student Achievement in Health Education. The Journal of Experimental Education 39(2): 20-23.

DeCecco, J.D. 1968. The Psychology of Learning and Instruction: Educational Psychology. Englewood Cliffs, New Jersey: Prentice-Hall, Inc.

Doran, R.L., Guerin, R.O., and Sarnowski, A.A. Jr. 1974. Assessing Students' Awareness of Environmental Problems. The Journal of Environmental Education 5(4): 14-18.

Dorsey, A.H.H. 1972. A Survey Study of the Comparative Status of Understanding and Reasoning in Conservation Concepts by Ninth Grade Students in the Public Schools of South Carolina. Unpublished Ph.D. Dissertation, University of Virginia. Dissertation Abstracts 32(2):549-A.

Downie, M.N. and Heath, R.W. 1959. Basic Statistical Methods, Second Edition. New York: Harper and Row.

Duckworth, E. 1964. Piaget Rediscovered in Piaget Rediscovered: A Report of the Conference on Cognitive Studies and Curriculum Development. Edited by Richard Ripple and Verne Rockcastle. Ithaca, New York: Cornell University and the University of California.

Ebel, R.L. 1970. Behavioral Objectives-A Close Look. Phi Delta Kappan 52:171-173.

_____, 1971. Criterion-Referenced Measurements: Limitations. School Review 79: 282-288.

Eisner, E. 1967. Educational Objectives:Help or Hinderance. School Review 75:251-282.

_____, 1969. Instructional and Expressive Objectives: Their Formulation and Uses in Curriculum in Instructional Objectives, AERA Monograph III. Edited by James Popham. Chicago:Rand McNally and Company.

Eiss, A.F. and Harbeck, M.B. 1969. Behavioral Objectives in the Affective Domain. Washington, D.C.:National Science Supervisors Association.

Ekstrom, R. 1974. Teacher Aptitude and Cognitive Style:Their Relationship to Pupil Performance. A paper presented at the 82nd Annual Meeting of the American Psychological Association, New Orleans, Louisiana.

Elmore, P.B. and Beggs, D.L. 1972. Stability of Teacher Ratings of Pupil Behavior in a Classroom Setting. A paper presented at the Annual Meeting of the American Personnel and Guidance Association. Arlington, Virginia:ERIC Number ED-066-685.

Engle, R.S. 1968. An Experimental Study of the Effect of Stated Behavioral Objectives on Achievement in a Unit of Instruction on Negative and Rational Base Systems of Numeration. Unpublished Masters Thesis. University of Maryland, College Park, Maryland.

Evans, R.H. 1974. An Experimental Investigation of Attitude Change. A paper presented at the Annual Conservation Education Association Conference. August, Syracuse, New York.

Ferrier, M.A. 1972. A Study of Elementary Teachers' Opinions: An Evaluation. State College Area School District. Washington, D.C:Bureau of Elementary and Secondary Education, United States Department of Health, Education and Welfare, Office of Education.

Fishbein, M. 1967. Attitudes and the Prediction of Behavior in Readings in Attitude Theory and Measurement. Edited by M. Fishbein. New York:Wiley Company.

Frey, S. 1973. Teachers and Behavioral Objectives. Washington, D.C.:United States Department of Health, Education and Welfare, National Institute of Education.

Gagne', R.M. 1967. Curriculum Research and the Promotion of Learning in Perspectives of Curriuclum Education. AERA Monograph Series on Curriculum Education, Monograph Number 1. Chicago:Rand-McNally.

_____, 1972. Behavioral Objectives? Yes! Educational Leadership 29(5):304-306.

Geis, G.L. 1966. Retention-A Pseudo Problem? National Society for Programmed Instruction Journal 5:10-13.

_____, 1972. Behavioral Objectives:A Review of the Literature. Stanford, California:ERIC Clearinghouse of Media and Technology, Stanford University.

George, R.W. 1966. A Comparative Analysis of Conservation Attitudes Where Conservation is a Part of the Educational Experience. Unpublished Ph.D. Dissertation, Michigan State University, East Lansing, Michigan.

Glaser, R. 1967. Objectives and Evaluation! An Individualized System. Science Education News June:1-3.

_____, 1968. Adapting the Elementary School Curriculum to Individual Performance in Proceedings of the 1967 International Conference on Testing Problems. Princeton, New Jersey:Educational Testing Service.

Glass, L.W. 1970. An Analysis of the Influence of Selected Teacher Behavior Upon Development of Corresponding Student Behaviors. Unpublished Ph.D. Dissertation, University of Iowa. Ann Arbor, Michigan:University Microfilms Number 70-23.

Good, C.V. 1963. Introduction to Educational Research, Second Edition. New York:Appelton-Century-Crofts.

Gordon, I.J. 1970. Affect and Cognition:A Reciprocal Relationship. Educational Leadership 27(7):661-664.

Governor's Environmental Education Task Force, 1972 and 1973, First and Second Editions. Lansing, Michigan.

Graff, G.P. 1962. Conservation Understandings in the Intermediate Grades. Unpublished Ph.D. Dissertation, The Ohio State University, Columbus, Ohio. Ann Arbor, Michigan:University Microfilms Number 63-52.

Harless, J.H. 1971. Objective Objectives. Falls Church, Virginia: Harless Educational Technologists, Inc.

Harsh, R.L. 1974. The Forest, Trees, Branches and Leaves Revisited-Norm, Domain, Objective and Criterion-Referenced Assessments for Educational Assessment and Evaluation in Association for Measurement and Evaluation in Guidance Monograph Number 1. Fullerton, California:California Personnel and Guidance Association.

Havinghurst, R.J. 1953. Developmental Tasks in Curriculum Planning: A New Approach. Edited by Glen Hass, Joseph Bondi and Jon Wiles. Boston:Allyn and Bacon, Inc.

Hess, R.D. and Torney, J. V. 1967. The Development of Political Attitudes in Children. New York:Anchor Books, Doubleday and Company.

Hilgerson, S.L., Hilburn, N., Wiley, K., Blosser, P.E. et al. 1971. A Review of Environmental Education for Elementary and Secondary School Teachers. Columbus, Ohio:The Ohio State University Research Foundation.

Hounshell, P.B. and Liggett, L. 1973. Assessing the Effectiveness of Environmental Education. The Journal of Environmental Education 5(2):28-30.

Insko, C.A. and Schopler, J. 1967. Triadic Consistency:A Statement of Affective-Cognitive-Conative Consistency. Psychological Review 74:361-376.

Jenkins, J.R. and Deno, S.L. 1971. Influence of Knowledge and Type of Objectives on Subject Matter Learning. Journal of Educational Psychology 62:67-70.

Kelly, J.R. and White, E.P. 1975. A Developmental Framework for Planning Environmental Education Programs. Science and Children 12(7):14-17.

Kibler, R.J., Barker, L.L. and Cegala, D.J. 1970. A Rationale for Using Behavioral Objectives in Speech Communication Instruction. Speech Teacher 19(4):245-256.

Kimball, R.L. 1974. Some Aspects of the Role of Affective Development:Relating Formal Operations Learning to Emotional Maturity. A paper presented at the 4th Annual Conference on Piaget and the Helping Professions, Los Angeles, California.

Knafle, J.D. 1972. The Relationship of Behavioral Ratings to Grades Earned by Female High School Students. The Journal of Educational Research 66(3):106-110.

Knapp, C. 1972. Attitudes and Values in Environmental Education. The Journal of Environmental Education 3(4):26-29.

_____, 1975. Teachers and Students as Environmental Communicators in What Makes Education Environmental? Edited by N. McInnis and D. Albrecht. Louisville, Kentucky:Data Courier, Inc. and Environmental Education, Inc.

Kohlberg, L. 1968. The Child as a Moral Philosopher. Psychology Today 2(24):25-30.

_____, 1973. Stages and Aging in Moral Development-Some Speculations. The Gerontologist 13(4):497-502.

Krathwohl, D.R., Bloom, B.S., and Masia, B.B. 1964. Taxonomy of Educational Objectives, Handbook II:The Affective Domain, New York:David McKay Company, Inc.

Kurtz, E.B. 1965. Help Stamp Out Non-Behavioral Objectives. The Science Teacher 32:31-32.

Lawrence, R.M. 1970. The Effects of Three Types of Organizing Devices on Academic Achievement. Unpublished Ph.D. Dissertation, University of Maryland, College Park. Dissertation Abstracts 31(11):5939-A.

Lindvall, C.M., ed. 1964. The Importance of Specific Objectives in Curriculum Development in Defining Educational Objectives. Pittsburgh, Pennsylvania:University of Pittsburgh Press.

Love, J.M. 1974. Assessment Using An Observation Procedure in the Cognitively Oriented Curriculum. A paper presented at the 59th Annual Meeting of the American Educational Research Association, Chicago, Illinois.

Lowe, G. 1972. What is E.E.? in Michigan's Environmental Future, 1973. Lansing,Michigan:Governor's Environmental Education Task Force.

MacDonald, J.B. 1966. Perspective on Technological Rationality in Education. Curriculum Research, November. Washington, D.C.:Association for Supervision and Curriculum Development.

Mager, R.F. 1962. Preparing Instructional Objectives. Palo Alto, California:Fearon Publishers.

_____ and McCann, J. 1961. Learner Controlled Instruction. Palo Alto, California:Varian Associates.

_____ and Pipe, P. 1970. Analyzing Performance Problems or "You Really Oughta Wanna". Belmont, California:Fearon Publishers.

Maier, N.R.F. 1930. Reasoning in Humans, One Direction. Journal of Comparative Psychology 10(2):115-143.

Marek, E. and Renner, J.W. 1972. Operational Thinking and Tenth Grade Students. The Science Teacher 39:39.

May, K.O. 1964. Programmed Learning and Mathematical Education. San Francisco:Mathematical Association of America.

McInnis, N. 1975. What Makes Education Environmental? in What Makes Education Environmental? Edited by N. McInnis and D. Albrecht. Louisville, Kentucky:Data Courier, Inc., and Environmental Education, Inc.

_____ and Albrecht, D. 1975. What Makes Education Environmental? Louisville, Kentucky:Data Courier, Inc. and Environmental Education, Inc.

McKinnon, J.W. and Renner, J.W. 1971. Are Colleges Concerned with Intellectual Development? American Journal of Physics 39:1047-1052.

McNeil, J.D. 1967. Concommitants of Using Behavioral Objectives in the Assessment of Teacher Effectiveness. The Journal of Experimental Education 36(1):69-74.

Michigan Department of Education, June 1971. Local District and School Report:Explanatory Materials, Third Report of 1970-1971 Series, M.E.A.P., Lansing, Michigan.

_____, September 1971. The Common Goals of Michigan Education. Lansing, Michigan.

_____, December 1971. Local District Results Michigan Educational Assessment Program, 4th Report of 1970-71 Series, Lansing, Michigan.

_____ July 1973. Field Testing the State Minimal Student Performance Objectives. Lansing, Michigan.

_____November 1973. Environmental Education Guidelines. Lansing, Michigan.

_____June 1974. Minimal Performance Objectives for Environmental Education in Michigan, Second Draft. Lansing, Michigan. (mimeographed material).

Michigan Education Directory, 1973-74. Michigan Education Directory and Buyers' Guide. Lansing, Michigan.

Moger, R.H. 1975. An Investigation of Factors Influencing Environmental Attitudes. School Science and Mathematics 75(3):266-269.

Office of Evaluation Services. 1965. Item Analysis. East Lansing, Michigan:Michigan State University (mimeographed material).

Passineau, J.F. 1975. Walking the "Tight rope" of Environmental Education Evaluation in What Makes Education Environmental? Edited by N. McInnis and D. Albrecht. Louisville, Kentucky: Data Courier, Inc. and Environmental Education, Inc.

Perkes, A.C. 1973. A Survey of Environmental Knowledge and Attitudes of Tenth and Twelfth Grade Students from Five Great Lakes and Six Farwestern States. Unpublished Ph.D. Dissertation, The Ohio State University, Columbus, Ohio. Arlington, Virginia:Computer International Corporation, ERIC ED 080-350.

Peskin, A.S. 1964. Teacher Understanding and Attitude and Student Achievement and Attitude in Seventh Grade Mathematics. Unpublished Ph.D. Dissertation, New York University, New York City, New York, Dissertation Abstracts 26:3983A.

Phillips, D.G. 1974. Research Related to the Work of Jean Piaget: A Critique, Technical Report Number 3. Iowa City, Iowa: Iowa University, Science Education Center.

Phillips, R.B. 1973. Teacher Attitude as Related to Student Attitude and Achievement in Elementary School Mathematics. School Science and Mathematics 73(6):501-507.

Piaget, J. 1932. The Moral Judgment of the Child. New York: Harcourt Brace.

_____ and Inhelder, B. 1969. The Psychology of the Child translated by Hellen Weaver. New York:Basic Books, Inc.

Piatt, R.G. 1969. An Investigation of the Effect the Training of Teachers in Defining, Writing, and Implementing Educational Behavioral Objectives Has on Learner Outcomes for Students Enrolled in a Seventh Grade Mathematics Program in the Public Schools. Unpublished Ph.D. Dissertation, Lehigh University. Dissertation Abstracts 30(8):3352-A.

Popham, W.J. 1969. Objectives and Instruction. American Educational Research Association Monograph on Curriculum Evaluation, Number 3. Chicago:Rand McNally and Company.

Pulaski, M.A.S. 1971. Understanding Piaget. New York:Harper and Row Publishers.

Raths, J. 1971. Teaching Without Specific Objectives. Educational Leadership 28(7):714-720.

Raths, L.E., Harmin, M. and Simon, S. 1966. Values and Teaching. Columbus, Ohio:Charles E. Merrill Publishing Company.

Rokeach, M. 1968. Beliefs, Attitudes and Values. San Francisco, California:Jossey-Bass, Inc.

Roth, R.E. and Helgeson, S.L. 1972. A Review of Research Related to Environmental Education. Columbus, Ohio:ERIC Science Mathematics and Environmental Education Clearinghouse, The Ohio State University.

Rouse, W. Jr. 1968. A Study of the Correlation Between Academic Preparation of Teachers of Mathematics and the Mathematics Achievement of Their Students in Kindergarten Through Grade Eight. Unpublished Ph.D. Dissertation, Michigan State University, East Lansing, Michigan.

Rowan, T.E. 1971. Affective and Cognitive Effects of Behavioral Objectives. Unpublished Ph.D. Dissertation, University of Maryland, College Park, Maryland. Dissertation Abstracts 32(6):3011-A.

Seed, A.H. Jr. 1970. Who Litters...And Why. The Journal of Environmental Education 1(3):93-94.

Sherman, R.C. 1950. The Conservation Attitudes and Information Possessed by Elementary School Teachers in Training. Unpublished Ph.D. Dissertation, University of Missouri. Ann Arbor, Michigan:University Microfilms Number 1779.

Sheth, J.N. 1974. An Investigation of Relationships Among Evaluative Beliefs, Affect, Behavioral Intention and Behavior in Consumer Behavior:Theory and Application. Edited by J. Farley. Boston:Allyn and Bacon, Inc.

Soar, R.S. 1967. Optimum Teacher-Pupil Interaction for Pupil Growth. Educational Leadership 26(3):275-280.

_____, 1972. Teacher Behavior Related to Pupil Growth. International Review of Education 18(4):508-528.

Solid, M.L. 1971. The Use of a Comparative Analysis as an Evaluation of a Junior High Conservation Education Program. Unpublished Ph.D. Dissertation, University of Colorado, Boulder. Ann Arbor:University Microfilms Number 72-3706.

Stanley, J.C. 1964. Measurement in Today's Schools. Englewood Cliffs, New Jersey:Prentice-Hall.

_____ and Hopkins, K.D. 1972. Educational and Psychological Measurement and Evaluation. Englewood Cliffs, New Jersey: Prentice-Hall.

State of Michigan Legislature, June 3, 1971. Senate Concurrent Resolution Number 69. Lansing, Michigan.

Stern, G.G. 1963. Measuring Non-Cognitive Variables in Research on Teaching in Handbook on Research on Teaching. Edited by N.L. Gage. Chicago:Rand McNally and Company.

Stewart, J.S. 1973. Values Development Education. East Lansing, Michigan:Michigan State University Continuing Education Service.

Strain, L.B. 1970. Behavioral Objectives:A Needed Perspective. Journal of Secondary Education 45:182-184.

Sullivan, E. 1974. A Developmental-Interactionist Perspective to Moral Values:Some Results with Exploratory Studies in Primary and Secondary School Years. A paper presented at the Annual Meeting of the American Montessori Society, Boston, Massachuesetts.

Swan, J.A. 1969. An Analysis of Attitudes and Coping Strategies for High School Youth:Response to Air Pollution. Ann Arbor, Michigan:University Microfilms.

Swan, M. 1975. Forerunners of Environmental Education in What Makes Education Environmental. Edited by N. McInnis and D. Albrecht. Louisville, Kentucky:Data Courier, Inc. and Environmental Education, Inc.

Swanson, J.C. 1972. Second Thoughts on Knowledge and Attitude Effects upon Behavior. Journal of School Health 42:363-365.

Tate, M.W. and Clelland, R.C. 1957. NonParametric and Shortcut Statistics. Danville, Illinois:Interstate Printers and Publishers, Inc.

Tichenor, P.J., Donahue, A., Olien, C.W. and Bowers, J.K. 1971. Environment and Public Opinion. The Journal of Environmental Education 2(4):38-42.

Tieman, P.W. 1968. Student Use of Behaviorally-Stated Objectives to Augment Conventional and Programmed Revisions of Televised College Economics Lectures. A paper presented at the Annual Meeting of the American Education Association, Chicago, Illinois.

Towler, J. and Swan, J. 1972. What Do People Really Know About Pollution? The Journal of Environmental Education 4(1): 54-57.

Trexler, C. 1963. A Study of the Relationship Between the Recorded and Observed Conservation Behavior of Children in an Urban Classroom. Science Education 47(2):144-156.

Tyler, R.W. 1950. Basic Principles of Curriculum and Instruction. Chicago:University of Chicago Press.

United States Congress, 91st. October 1970. Environmental Education Act, Public Law 91-516. Washington, D.C.

Vargas, J.S. 1972. Writing Worthwhile Behavioral Objectives. New York:Harper and Row.

Veatch, J. 1971. Key Words and Piagetian Concepts:A Suggestion. A paper presented at the 61st Annual Meeting of the National Council of Teachers of English. Las Vegas, Nevada, November 25-27.

Volker, A.M., Heal, F.A. and Horvat, R.E. 1973. Environmental Education-Related Research, 1969-1972:An Annotated Bibliography. Madison, Wisconsin:University of Wisconsin Center for Environmental Communication and Education Studies.

Watson, G. 1966. Social Psychology. Philadelphia:J.B. Lippincott Company.

Weinberg, H. 1970. Effects of Presenting Varying Specificity of Course Objectives to Students on Learning Motor Skills and Associated Cognitive Material. Unpublished Ph.D. Dissertation, Temple University. Dissertation Abstracts 31(11): 5951-A.

Whiteman, M. 1967. Children's Conceptions of Psychological Causality. Child Development 38:143-155.

Wicker, A.W. 1969. Attitudes Versus Actions:The Relationship of Verbal and Overt Behavioral Responses to Attitude Objects. Journal of Social Issues 25(4):1-38.

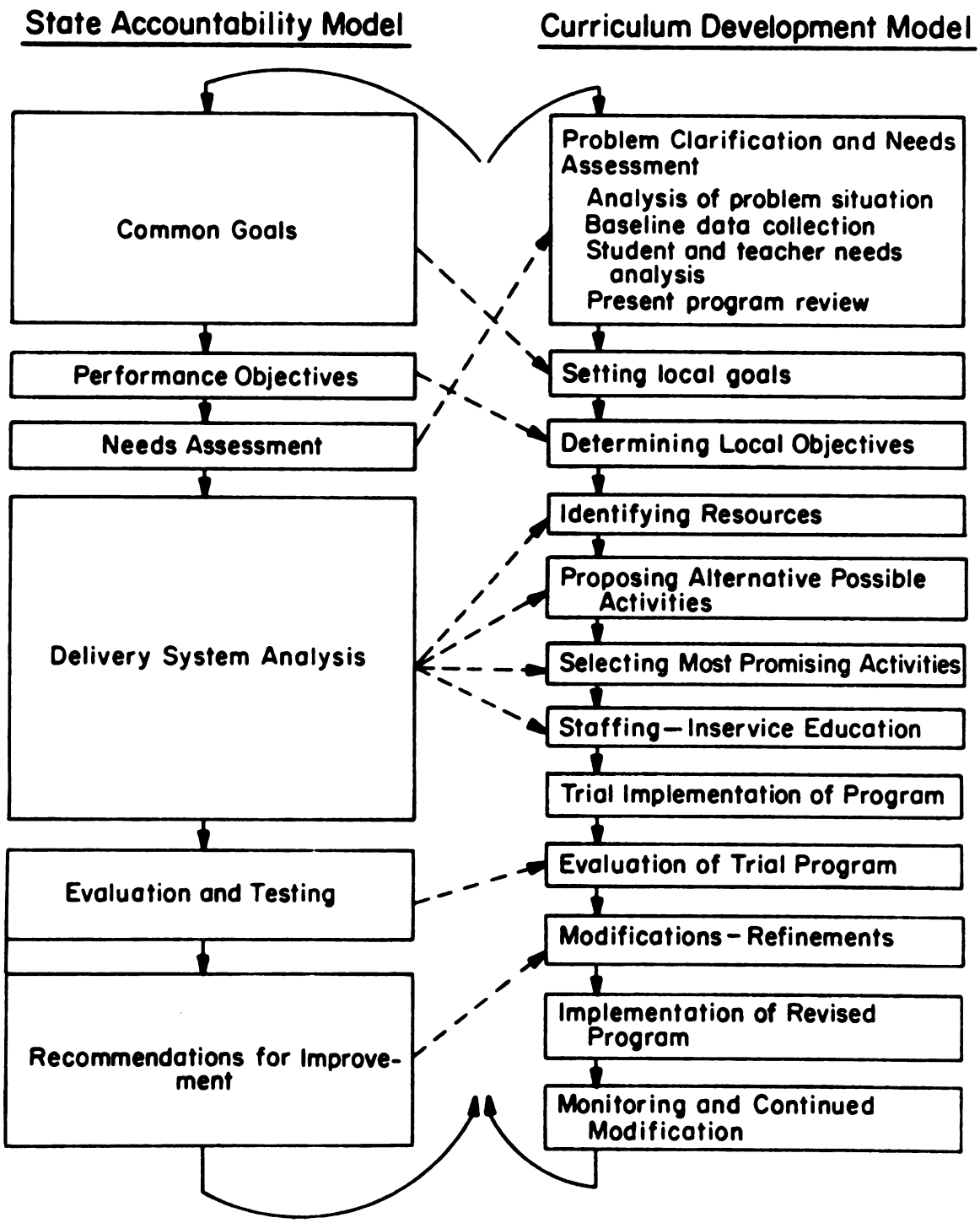
Yelon, S.L. 1976. Advanced Materials for Mastery Learning Seminar, February 25. East Lansing, Michigan:Michigan State University (mimeographed material).

APPENDICES

APPENDIX I

STATE ACCOUNTABILITY MODEL

APPENDIX I
STATE ACCOUNTABILITY MODEL



APPENDIX II

EXPERTS RESPONDING TO TEACHER E.E.C.M.

APPENDIX II

EXPERTS RESPONDING TO TEACHER E.E.C.M.

Name	Affiliation
Michael Alperovitz	Social Studies Specialist, Ann Arbor Public Schools
Dorothy Brooks	Michigan Department of Education, Instructional Specialist
Dorothy Cox	Metropolitan Detroit Science Teachers' Association
Martin Hetherington, Ph.D.	Science and Mathematics Teaching Center, Michigan State University
Wanda Jubb	Michigan Department of Education, Health Education Specialist
Jack Kammeraad	Michigan Department of Education, Science and Environmental Education Specialist
Robert Stout	Michigan Department of Education, Guidance Consultant
Ivan Volkers	Michigan Department of Public Health, Training Section
Sydney Walston, Ph. D.	Health Department, Central Michigan University
June Wilson, Ph.D.	Genesee Intermediate School District

APPENDIX III

WHAT I THINK ABOUT THE ENVIRONMENT

APPENDIX III

WHAT I THINK ABOUT THE ENVIRONMENT

Questions 1 - 4 : Name 4 things that are part of our environment.

5. Which of these pictures shows things that are living ?

A - Rainbow

B - Frog

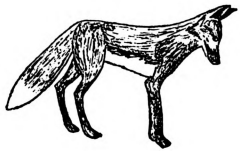
C - Man

D - T.V.

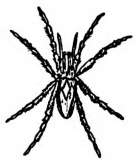
E - Mushroom

6. Which of these pictures shows things that are NOT living ?

A - Moon



B - Fox



C - Spider

D - Rain

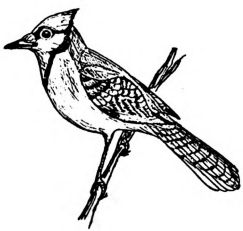
E - Tree

7. Which of these would you find on the moon ?

A - Rock

B - Plant

C - Dust



D - Bird

E - Rain

8. Which plants or animals would you find living here ?

City

A - Owl

B - Dog

C - Dandelion

D - Skunk

E - Fox

9. Which plants or animals would you find living here ?

Forest

A - Bobcat

B - Daisey

C - Trillium

D - Deer

E - Woodpecker

10. Which of these plants or animals would you find living here ?

Field or lawn

A - Rabbit

B - Opossum

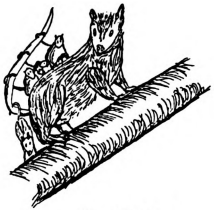
C - Black-eyed Susan

D - Pine tree

E - Chipmunk

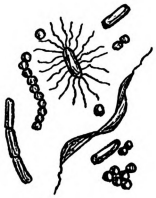
11. Which plants or animals would you find living here ?

Trash Heap



A - Opossum

B - Rat



C - Bacteria
(germs)

D - Fly

E - Flowers

12. Where do I live ?

Fox

A - Forest

B - Prairie

C - Field

D - City

E - Desert

13. Where do I live ?

Racoon

A- Lawn

B - Cornfield

C - Field

D - Woods

E - Desert

14. What do I eat ?

Deer

A - Twigs

B - Squirrel

C - Rabbit

D - Waterlily

E - Frog

15. What do I eat ?

Hawk

A - Twigs

B- Rat

C - Racoon

D - Acorn

E - Snake

16. What do I need to live ?

A - Sun

B - Water

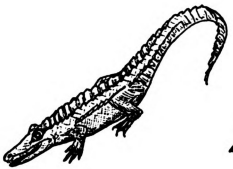
C - Bird

D - Grasshopper

E - Soil

17. This is a mammal .

Which of these pictures show other mammals ?



A - Alligator

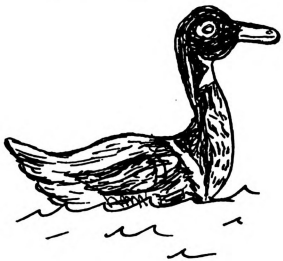
B - Gull

C - Rabbit

D - Deer

E - Snake

18. Which does not belong ?



A - Duck

B - Robin

C - Bee

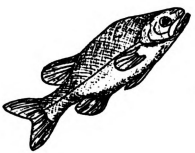
D - Hen

E - Goose

19. Which does not belong ?

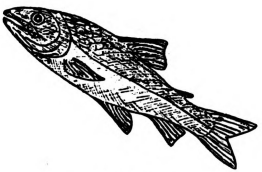
A - Water plants and insects

B - Small Fish



C - Bigger Fish

D - Beaver



E - Big Fish

20. Which does not belong ?

A - Stream

B - Sand dune

C - Lake beach

D - Pond

E - Ocean beach

21. Which does not belong ?

A

B

C

D

E

22. This is an oak leaf .

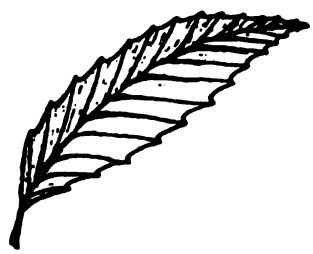
Which of these pictures show other oak leaves ?

A

B

C

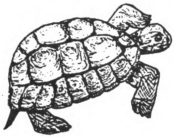
D



E

23. Who is my mother ?

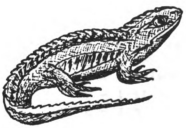
Tadpole



A - Turtle

B - Dragonfly

C - Alligator



D - Lizard

E - Frog

24. What is my job in the environment ?

A - I eat mosquitoes.
B - I put oxygen into the air.
C - I keep it warm outside.
D - I make things look pretty.
E - I am food for animals.

Green plant

25. What is my job in the environment ?

Earthworm

A - I make tunnels in soil - so it stays soft.
B - I let air and water into soil.
C - I eat insect pests.
D - I eat the roots of weeds.
E - I suck blood from animal pests.

26. And my job ?

Bee

A - I eat weeds.
B - I make honey.
C - I bring pollen from one flower to another.
D - I sting.
E - I build a fancy house.

27. What is my job in the environment ?

A - I make it safe to cross the street .
B - I put out fires.
C - I arrest criminals.
D - I judge criminals in court .
E - I help lost children.

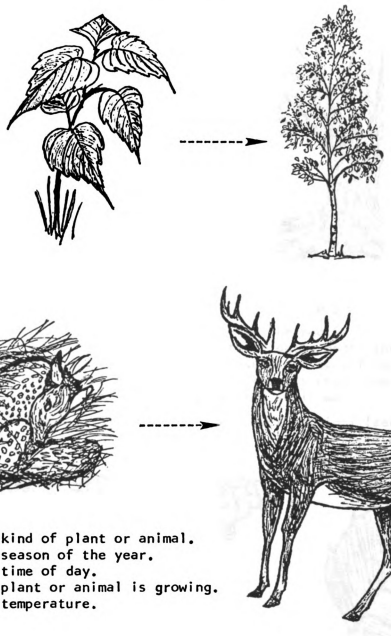
28. Look carefully at these pictures.
Something is changing - What is it ?

A - The time of day .
B - The season of the year.
C - The number of clouds.
D - The amount of wind.
E - The amount of rain.

29. Look carefully at these pictures. Something is changing - What is it ?

A - The kinds of plants and animals.
B - The season of the year.
C - The amount of rain.
D - The time of the day.
E - The temperature.

30. Look carefully at these pictures. Something is changing - What is it ?



A - The kind of plant or animal.
B - The season of the year.
C - The time of day.
D - The plant or animal is growing.
E - The temperature.

31. Picture # 2 shows a change that has taken place. What has changed?

1 # 2

A - Insects got into the roots.
B - Snakes made their nests under the roots.
C - Erosion has taken soil away from the roots.
D - Mice have made tunnels under the roots.
E - A boy has carried soil away.

32. Which order would you put these pictures in ? (earliest to latest growth)

#1 #2

#3

#4

A - 1,2,3,4
B - 3,2,4,1
C - 2,3,1,4
D - 3,4,2,1

33. Which order would you put these pictures in? (earliest to latest growth?

#1

#2

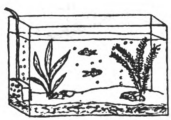
#3

#4

A - 1,2,3,4
B - 2,3,1,4
C - 3,1,2,4
D - 1,3,4,2

34. Jack put two fish in his aquarium. One month later there were four fish in the tank.
If there is plenty of food, how many would Jack find in his tank if he looked again after one more month ?

A - 6
B - 10
C - 12
D - 4
E - 8



35. Which changes in the environment were made by man ?

A - Beaver dam

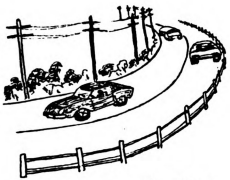
B - Farm

C - Slide

D - Trash

E - Strip mine

36. Which of these cause AIR pollution ?



A - Cars

B - Cigarettes

C - Factories

D - Farming

E - Cattle

37. Which of these cause WATER pollution ?

A - Litter

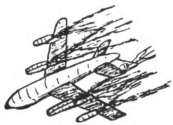
B - City wastes

C - Speedboats

D - Mining

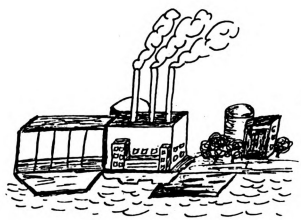
E - Factory

38. Which of these cause pollution of LAND ?



A - Airplane

B - Strip mine



C - Power plant

D - Litter

E - Junk yard

39. If this happened to the place where

Forest fire

I

Live

What would happen to me ?

A - Many would die.
B - Nothing - I would move someplace else.
C - I would have less food and no shelter.
D - Only baby deer would die.
E - Only parent deer would die.

40. You see this sign but you go swimming anyway - What might happen to you ?

A - I might die.
B - Nothing - I can wash after swimming.
C - I might get sick.
D - Nothing - if my mother doesn't find out.
E - Nothing- unless I swallow the water.

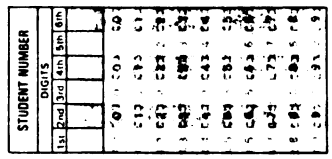
Questions 41 - 45 : Name 5 natural resources.

APPENDIX IV

ENVIRONMENTAL EDUCATION BEHAVIORAL CHECKLIST

APPENDIX IV

ENVIRONMENTAL EDUCATION BEHAVIORAL CHECKLIST
For Third Grade Students



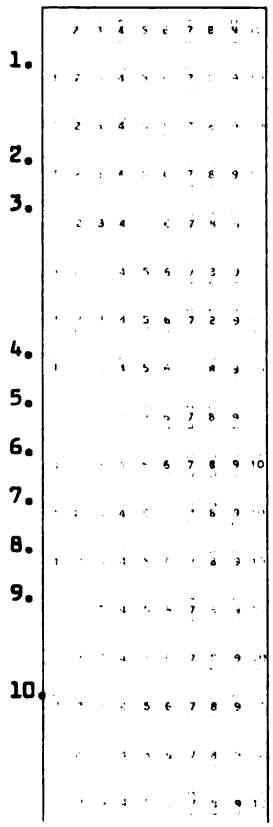
Name:

Date Begun: Date Concluded:

Please use #2 pencil to check behaviors

KEY : Frequently = 1 Occasionally = 2 Rarely = 3

1. Voluntarily expresses feelings related to environment & environmental problems ie. wonder, awe, anger, fear, excitement, etc.
2. Voluntarily expresses concern for a healthy environment ie. clean air, clean water, healthy organisms, etc.
3. Is proud of his concern for environment, proud of his conviction and defends it in front of others.
4. Gives evidence of caring about other organisms in his environment ie. voluntarily cares for plants or animals in classroom, is gentle in handling living things that are a part of his immediate environment such as frogs, pets, trees, etc., respects other people
5. Does NOT engage in littering.
6. Voluntarily picks up litter.
7. Suggests beautification activities such as planting flowers, litter campaign, etc.
8. Is able to recognize local environmental problems.
9. Voluntarily expresses concern about local environmental problems.
10. Voluntarily expresses interest or desire to DO something to solve environmental problems ie work on clean-up campaign, recycle paper or bottles, write letter to congress, etc.



REMARKS OR COMMENTS :

APPENDIX V

ENVIRONMENTAL EDUCATION SURVEY FOR TEACHERS
(with Key)

APPENDIX V

ENVIRONMENTAL EDUCATION SURVEY FOR TEACHERS
(with Key)

Name: School:

I. A VEGETABLE GARDEN CAN BE VIEWED AS A LIFE-SUPPORT SYSTEM FOR MAN.

1. List the elements or components of this system. (1 point per correct item).

   Examples: Water (rain) Plants (seeds)
   Soil (minerals) Animals (including man)
   Sunlight (energy) Air

2. Make a diagram showing how the parts of this system are related to each other. (1 point for energy input; 1 point for cyclic or web-like <u>interrelationships</u> of components indicated).

   Using the relationships you have just diagrammed, construct operational definitions (definitions that fit these particular circumstances) for each of the following: (2 points per definition).

3. Closed system - nothing escapes system, controlled, ideal or balanced, nothing added or taken away.

4. Carrying capacity - the number of organisms an area can hold without destroying the environment.

5. Limiting factor - anything which limits population growth and prevents over population.

6. Natural resources - raw materials supplied by nature that are needed, used and valued by man.

7. Take any organism (living thing) that is a part of this system and explain the effect(s) of an increase in the population of this organism upon the system. (1 point per effect).

   Examples: A. - increase in the number of plants causes a decrease in soil minerals and results in limited food production.

   B. - increase in number of tomato worms causes a decrease in the number of plants and a decrease in available fruit.

APPENDIX V

I. A Vegetable Garden Can Be Viewed As a Life-Support System for Man. (Continued).

8. Could this effect use of the environment?

A. (1 point) ____ Yes _____ No If Yes, explain <u>how</u>.

B. (1 point per reason).

Examples: Too few nutrients for plants to grow.
Plants die from overcrowding.
No longer useable as garden.

II. THE NEIGHBORHOOD IN WHICH YOU LIVE OR TEACH IS ALSO A LIFE-SUPPORT SYSTEM.

9. List the elements or components of this system. (1 point per correct item).

Examples:

Energy	Shelter
Plants (food)	Transportation (roads)
Animals (including man)	Communication
Water	Education
Soil	Recreation
Air	Medicine
Clothing	

10. Make a diagram showing how the parts of this system are related to each other. (1 point).

Cyclic or web-like <u>interrelationships</u>.

11. Take any organism that is part of this system and explain the effect(s) of an increase in the population of this organism upon the system. (1 point per effect).

Examples: A. - Increase in human population results in food, energy and water shortages, overcrowding and stress, increased resource use and increased pollution.

B. - Increase in rats can cause increase in disease and decreased economic values.

C. - Increase in number of trees can increase available wood, increase recreation and wildlife cover.

APPENDIX V

II. The Neighborhood in Which You Live or Teach is Also a Life-Support System. (Continued)

12. Could this effect use of the environment?

A. (1 point) _____ Yes _____ No If Yes, explain <u>how</u>.

B. (1 point per reason).

Examples: A. - Erosion.
Pollution of air and water.
Increase crime.
Decrease quality of homes.
Decrease quality of education and services.

B. - Provide more raw materials.

III.

13. List five (5) benefits that you personally derive from understanding our life-support system. (any 5 of the following) (1 point per item).

1. Better health.
2. Provides jobs.
3. Pleasure-recreation.
4. Better able to improve environment.
5. Appreciation of ALL resources.
6. Wiser resource use.
7. Better political decisions.
8. Increase value of system parts.
9. Knowledge regarding better life styles.
10. Better self-understanding.
11. Increased awareness of environment.
12. Respect for law; natural and man-made.

IV. THE OCEANS ARE AN IMPORTANT INTERNATIONAL NATURAL RESOURCE AND A VITAL COMPONENT OF OUR LIFE-SUPPORT SYSTEM.

14. List three (3) ways in which man is affected by the oceans. (1 point per item) (any 3 of the following).

1. Food.
2. Climate (weather, temperature).
3. Minerals and natural resources.
4. Recreation.
5. Oxygen.
6. Evolution.
7. Transportation; bridge and barrier.

APPENDIX V

IV. The Oceans are an Important International Natural Resource and a Vital Component of our Life-Support System. (Continued).

15. List three (3) ways in which man affects the oceans. (1 point per item) (any 3 of the following).

1. Pollutes - all types of pollution.
2. Changes wildlife populations and types.
3. Controls water level.
4. Fills in shore lines.
5. Changes temperature.
6. Removes mineral resources.

V. IN ORDER TO MEET THE DEMAND FOR AUTOMOBILES, NO LEGAL LIMITATIONS ARE PLACED ON THE YEARLY PRODUCTION OF CARS BY DETROIT. WHAT EFFECT(S) DOES THIS POLICY HAVE UPON EACH OF THE FOLLOWING: (1 point per effect).

Examples:

16. Free enterprise system - Promotes, enhances, benefits system.
Floods market with profit.
Competition helps produce better products.
Leads to lower prices.

17. Industrial complex - Encourages over-use of resources.
Promotes steady employment.
Increases profits of big business.
Increases power of big business.
Encourages growth-related industries.
Permits growth of business.
Creates new jobs.

18. Energy crisis - Negative impact-creates additional and unnecessary energy demands, encourages waste, and drains energy-producing resources.

19. Environmental quality - Increases pollution especially of air and solid wastes.
Decreases environmental quality.
Increases accidents.
Increases number of roads and parking needs therefore decreases natural spaces.
Water resources.

APPENDIX V

VI.

20. List at least ten (10) important environmental problems. (1 point per item). (Any ten of the following).

1. Wasteful life styles, consumerism, greed.
2. Over population.
3. Pollution (any type 1 point each).
4. Environmental laws.
5. Recreation and loss of natural areas.
6. Climate modification.
7. Land-use planning including transportation and housing.
8. Habitat destruction.
9. Energy crisis (oil, gas supply).
10. Endangered species.
11. Natural resource depletion.
12. Pest control.
13. Food production and distribution.
14. Social injustice.
15. Lack of environmental awareness and understanding.
16. Value crisis - economics most important.
17. Resource - use priorities.
18. Lack of international cooperation in resource conservation.
19. Neglect school site development.
20. Beautification.
21. Soil erosion and fertility.

VII. A LAKE IS A NATURAL ENVIRONMENT.

21. List three (3) problems often associated with this environment. (1 point per item) (any 3 of the following).

1. Water quality, sewage, stagnant water.
2. Eutrophication, too many algae, too little oxygen.
3. Changes in number and type of fish and aquatic organisms.
4. Erosion - too much sediment.
5. Over-use and abuse.
6. Thermal pollution.
7. Conflicting people useages.
8. Drying-up.

APPENDIX V

VII. A Lake is a Natural Environment. (Continued)

22. What are some of the causes of these problems? (1 point per response).

Examples: Pollution causes stress on system.
Increase human population.
Attitude and value crisis.
Nutrient levels (fertilizers).
Lack of municipal sewers.
Poor planning.
Lack of law enforcement.
Lack of awareness.
Improper land-use practices.

23. What are some of the effects of these problems? (1 point per response).

Examples: Decrease recreation activities.
Non-potable, unsafe water.
Aging and death of lake.
Non-esthetic environment.
Health problems.
Decrease property values.
Increase costs of correcting problem.

24. What are some possible solutions to these problems? (1 point per solution).

Examples: Environmental Education to develop understanding, attitudes and awareness.
Political activity.
Modify surrounding land use including zoning.
Enact and enforce strong laws.
Control access and useages.
Control pollution.
Introduce biological and chemical controls.
Money for research.
Introduce sewage systems.

APPENDIX V

VII. A Lake is a Natural Environment. (Continued).

25. What new problems may occur as a result of the solutions you have just suggested? (1 point per problem).

Examples: Economics - cost of prevention and clean-up and administration, also loss of jobs.
Political problems.
Injustice to property owners or non-owners.
Who is responsible for solutions being carried out and who pays the bill?
Inconvenience and restrictions on freedom.
Lack of natural predators for introduced species.

VIII. THE INNER-CITY IS A MAN-MADE ENVIRONMENT.

26. List three (3) problems often associated with this environment. (1 point per item for any 3 of the following).

Examples: Disease - physical and mental health.
Crime.
Population over-crowding.
Poor nutrition.
Improper housing.
Sanitation - sewage and solid waste.
Noise.
Rats.
Exodus of business and industry.
Poor air and water quality.
Transportation.
Social injustice.
Economic problems.

27. What are some of the causes of these problems? (1 point per cause).

Examples: Crowding.
Lack of education.
Life styles.
Lack of adequate housing.
Money-poverty, low individual and family income (economics)
Politics.
Factories (industry).
Lack of mobility.
Prejudice.
Difficulties and values.
Lack of trust.

APPENDIX V

VIII. The Inner-City is a Man-Made Environment. (Continued).

28. What are some of the effects of these problems? (1 point per problem).

Examples: Decrease privacy.
Increase unemployment.
Increase crime.
Increase hea..h problems.
Stress - hostility.
High costs of operation of cities.
Limited recreation.
Less production.
Apathy.
Drug abuse.
Lack of educational opportunities.
Pollution.

29. What are some possible solutions to these problems? (1 point per solution).

Examples: Research.
Education.
Change of life style.
Population control.
Legislation - housing regulations and pollution control.
Better housing.
Better social services (police sanitection).
Mass transit.
Neighborhood development.
Human relations programs.

30. What new problems may occur as a result of the solutions you have just suggested? (1 point per item).

Examples: Increased taxes.
Increase suburban exodus.
Who are change agents?
Who pays for change?
Increase costs.
Employment re-adjustments.

APPENDIX V

IX. CHECK THE STATEMENT WITH WHICH YOU MOST STRONGLY AGREE (NO CREDIT)

Nuclear power plants:

_____ are necessary for an industrial society.

_____ are necessary to prevent unsightly air pollution.

_____ are essential to prevent immediate depletion of other types of material resources such as coal, oil, etc.

_____ may be necessary but too expensive.

_____ should be erected in non-populated areas.

_____ are causes for changing environment.

_____ are extremely dangerous to health of man and other organisms and should never be used.

What effect(s) does this choice have on: (1 point per effect).

Examples:

31. You personally - Relate to cost and availability of energy for my use.
Taxes.
Investments.
Concern for future including health.
Recreation in terms of lake quality may be changed.

32. Our economic system - Cost of research and development
Employment related problems.
Effect on G.N.P.
Development of industry effected.
Effects supply and cost of energy.

33. Our social system - Political danger due to control of power production and distribution values.
Change to bring about decrease in consumerism.
Retraining for new jobs causes social disruption.
More stress.

APPENDIX V

X. YOU ARE AN AVERAGE MIDDLE-CLASS CITIZEN OF A TYPICAL SUBURBAN COMMUNITY. A LARGE NEAR-BY CITY NEEDS ADDITIONAL ELECTRICAL ENERGY FOR ITS INDUSTRIAL GROWTH AND DEVELOPMENT. TO PROVIDE THIS POWER THEY WOULD LIKE TO BUILD A COAL-OPERATED POWER PLANT IN YOUR TOWN.

34. How do you feel about this possible action? (1 point per feeling identified).

Examples: Doubtful.
Agree (Good, O.K).
Angry.
Resentful.
Disagree.
Apathy.
Terrible.
Unhappy.

35. How do you think your cousin in the city feels about it? (1 point per item).

Examples: O.K.
Good.
Happy.
Doubtful.
Apathy.

36. If your feelings differ, explain <u>how</u> and <u>why</u> you think this is the case. (1 point per explanation).

Examples: No one wants this type of facility near home.
Want others to beat cost of problem solutions.
They depend more on that energy.
Doesn't effect him or his neighborhood.

XI.

37. What steps would you use to help your students clarify their values regarding the environment and its associated problems? (1 point per step).

Examples: Provide information on value-related topics.
Explore and evaluate present feelings (values): Identify values.
Learn about other values - explore differences of opinion.
Help resolve conflicting values.
Affirm own values publicly and repeatedly.
Act on values held.

APPENDIX VI

TEACHER SELF-REPORT OF ENVIRONMENTAL BEHAVIORS

APPENDIX VI

TEACHER SELF-REPORT OF ENVIRONMENTAL BEHAVIORS

The following questions focus upon your environmental interests, concerns, and activities.

1. Do you like plants? _____ Yes _____ No

2. Do you like animals? _____ Yes _____ No

3. Are you concerned about endangered species? _____ Very

   _____ Somewhat _____ Not really

4. Do you belong to any civic club or group? _____ No

   _____ Yes: Name(s):

5. Have you ever taken part in any of the following activities? Check if 'Yes'.

   _____ Clean-up campaign

   _____ environmental beautification or enhancement project

   _____ environmental protection project

   _____ community service project

6. Do you regularly re-cycle any of these materials? Check if 'Yes'.

   _____ paper _____ bottles _____ cans or metal goods

7. Have you ever done any of the following? Check if 'Yes'.

   ____ attended city or town commission or council meetings regarding environmental problem.

   ____ written a letter to influence environmental legislation.

   ____ written or called a company or organization urging attention to violation of good ecological practices on their part.

8. Do you think teaching about the environment and its problems should be part of the Third (3rd) grade public school program?

   ____ Yes ____ No In <u>either</u> case, why do you think so?

APPENDIX VII

TEACHER INTERVIEW QUESTIONS

APPENDIX VII

TEACHER INTERVIEW QUESTIONS

1. Ecology has become a household word in recent years. How do you view the "environmental crisis" we hear so much about?
2. Have you ever discussed this view with family or friends? Do they share your view?
3. Have you ever defended your position publicly?
4. Do you have a garden at home? _____ Yes _____ No

   Keep household plants? _____ Yes _____ No
   Keep plants in school? _____ Yes _____ No
5. Have any pets at home? _____ Yes _____ No
   at school? _____ Yes _____ No
6. Endangered species: Concern for what species?
   In general?
   Causes of danger?
   Done anything about it?
7. Civic involvement - types of activities, purposes, projects:
8. Clean-up activities:
   Environmental protection:
   Environmental enhancement:
   Community service:
9. Recycling: Where are centers in your community?
   Paper:
   Bottles:
   Cans:

	Problem	Outcome
10. Community meetings:		
Letter to influence legislature.		
Letter to company or organization.		

11. Teaching about environment. 'Yes'. How much time should be spent in this area?

    How approach topic?

    What have you done in past or what are you planning to do?
12. You have identified _____ as your major envir. concern. Have you been able to do anything about it personally? What?

APPENDIX VIII

TEACHER BEHAVIORAL CHECKLIST

APPENDIX VIII

TEACHERS BEHAVIORAL CHECKLIST

		Degree of Concern/Commitment		
		Strong	Moderate	Weak
AB 1.	Expresses feeling related to environment and environmental problems.			
AB 2.	Expressed concern for healthy environment.			
AB 3.	Proud of concern - willing to defend it.			
AB 4.	Evidence of caring about other organisms in environment-cares about plants, animals, concern for endangered species, concern for other people.			
AB 5.	Concern expressed through curriculum-teaches about environment and its problems.			
AB 6.	Motivation in regard to salient problem.			
AB 7.	General motivation: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10.			

APPENDIX IX

STUDENT ANSWER SHEET

APPENDIX IX

STUDENT ANSWER SHEET

WHAT I THINK ABOUT THE ENVIRONMENT

My Name Is_____

SCHOOL CODE #_____
S.C. #_____

Name 4 things that are part of our environment.

1._____ 3._____

2._____ 4._____

5.	(A) (B) (C) (D) (E)	23.	(A) (B) (C) (D) (E)
6.	(A) (B) (C) (D) (E)	24.	(A) (B) (C) (D) (E)
7.	(A) (B) (C) (D) (E)	25.	(A) (B) (C) (D) (E)
8.	(A) (B) (C) (D) (E)	26.	(A) (B) (C) (D) (E)
9.	(A) (B) (C) (D) (E)	27.	(A) (B) (C) (D) (E)
10.	(A) (B) (C) (D) (E)	28.	(A) (B) (C) (D) (E)
11.	(A) (B) (C) (D) (E)	29.	(A) (B) (C) (D) (E)
12.	(A) (B) (C) (D) (E)	30.	(A) (B) (C) (D) (E)
13.	(A) (B) (C) (D) (E)	31.	(A) (B) (C) (D) (E)
14.	(A) (B) (C) (D) (E)	32.	(A) (B) (C) (D) (E)
15.	(A) (B) (C) (D) (E)	33.	(A) (B) (C) (D) (E)
16.	(A) (B) (C) (D) (E)	34.	(A) (B) (C) (D) (E)
17.	(A) (B) (C) (D) (E)	35.	(A) (B) (C) (D) (E)
18.	(A) (B) (C) (D) (E)	36.	(A) (B) (C) (D) (E)
19.	(A) (B) (C) (D) (E)	37.	(A) (B) (C) (D) (E)
20.	(A) (B) (C) (D) (E)	38.	(A) (B) (C) (D) (E)
21.	(A) (B) (C) (D) (E)	39.	(A) (B) (C) (D) (E)
22.	(A) (B) (C) (D) (E)	40.	(A) (B) (C) (D) (E)

Name 5 Natural Resources

41._____ 43._____

42._____ 44._____

45._____

APPENDIX X

CODEBOOK STUDENT DATA TRANSFORMATIONS

APPENDIX X

CODEBOOK STUDENT DATA TRANSFORMATIONS

*R = Recorded Item Number **T = Transformed Item Number

R*	T**	R	I	R	I	R	I
1	1	11	35=11A	25	69=25A	37	101=37A
2	2		36=11B		70=25B		102=37B
3	3		37=11C		71=25C		103=37C
4	4		38=11D		72=25D		104=37D
			39=11E		73=25E		105=37E
5	5=5A						
	6=5B	12	40	26	74=26A	38	106=38A
	7=5C	13	41		75=26B		107=38B
	8=5D	14	42		76=26C		108=38C
	9=5E				77=26D		109=38D
		15	43=15A		78=26E		110=38E
6	10=6A		44=15B				
	11=6B		45=15C	27	79=27A	39	111=39A
	12=6C		46=15D		80=27B		112=39B
	13=6D		47=15E		81=27C		113=39C
	14=6E				82=27D		114=39D
		16	48=16A		83=27E		115=39E
7	15=7A		49=16B				
	16=7B		50=16C	28	84	40	116
	17=7C		51=16D	29	85	41	117
	18=7D		52=16E	30	86	42	118
	19=7E			31	87	43	119
		17	53=17A	32	88	44	120
8	20=8A		54=17B	33	89	45	121
	21=8B		55=17C	34	90		
	22=8C		56=17D				
	23=8D		57=17E	35	91=35A		
	24=8E	18	58		92=35B		
					93=35C		
9	25=9A	19	59		94=35D		
	26=9B	20	60		95=35E		
	27=9C	21	61				
	28=9D	22	62	36	96=36A		
	29=9E	23	63		97=36B		
					98=36C		
10	30=10A	24	64=24A		99=36D		
	31=10B		65=24B		100=36E		
	32=10C		66=24C				
	33=10D		67=24D				
	45=10E		68=24E				

APPENDIX XI

IBM ANSWER SHEET AND KEY

APPENDIX XI

IBM ANSWER SHEET AND KEY