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The Effect of an Outdoor Experience on Sixth Grade Students' Cognitive Understanding of Ecological Concepts

Donald P. Slater

SIXTH GRADE STUDENTS' COGNITIVE UNDERSTANDING OF ECOLOGICAL CONCEPTS · SLATER

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THE EFFECT OF AN OUTDOOR EXPERIENCE ON SIXTH GRADE STUDENTS' COGNITIVE UNDERSTANDING OF ECOLOGICAL CONCEPTS

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DISSERTATION

Submitted in Partial Fulfillment of the
Requirements for the Degree of

Doctor of Education in Curriculum and Instruction
in the Graduate School of
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ABSTRACT OF DISSERTATION

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Statement of the problem. This study was an investigation of the impact an exploratory field trip experience had on sixth grade students' cognitive understanding of specific ecological concepts being taught by their respective instructor.

The purpose of this study was to analyze the change in the cognitive level of students' classroom dialogue before and after being exposed to an exploratory field trip experience. Further, this study was to verify whether a significant change in the students' cognitive understanding of the ecological concepts had occurred as a result of a specific series of multi-sensory encounters in the out-of-doors.

Methodology. A class of sixth grade elementary school students, studying the ecological concepts of adaptation, change, and interdependency in ecological communities, was observed for three class periods both before and after participating in an exploratory field trip experience of three ecological zones located in the Sandia Mountains near Albuquerque, New Mexico. A Campbell and Stanley Time

Series Research Design and the FLORIDA TAXONOMY OF COGNITIVE BEHAVIOR were used to measure changes in students' cognitive understanding of three ecological concepts over a specified period of time. See Appendix A, page 66.

The seven-point scale of the FLORIDA TAXONOMY OF COGNITIVE BEHAVIOR was modified and used as a two-point scale separating rote recall skills from problem-solving skills. A test of the null hypothesis was achieved by grouping all pre-trip frequency marks in observation periods O_1, O_2, and O_3, and all post-trip frequency marks in observation periods O_4, O_5, and O_6, into two groups which represented pre- and post-trip cognitive ratio means. These fractional means were translated into pre- and post-decimal means and subjected to an "F" test to note a significant change in students' cognitive understanding.

Results. A significant change in the level of students' cognitive understanding of the three ecological concepts being taught was noted as a result of the outdoor experience. This change was found to be significant at the .05 level.

Conclusions. The exploratory field trip experience together with the traditional procedures used in pre-planning and follow-up experiences produced significant gains in the students' level of cognitive understanding of ecology.

TABLE OF CONTENTS

LIST OF FIGURES

FIGURE PAGE

LIST OF TABLES

CHAPTER I

THE PROBLEM, INSTRUMENTATION, AND DEFINITIONS OF TERMS USED

I. INTRODUCTION

Many authorities in the area of outdoor education have implied that outdoor education experiences were influential in students' understanding of curriculum content. Hammerman and Hammerman stated:

> Outdoor education is an approach to more efficient and more effective learning. The purpose of an outdoor education is to enrich, vitalize and complement content area of the school curriculum by means outside the classroom. Instruction which traditionally has been limited to the four walls of the classroom is for the most part highly verbal. Extending the classroom into the out-of-doors provides the setting for bringing deeper insight, greater understanding, and more meaning to those areas of knowledge which, ordinarily, are merely read and discussed . . . . [sic] seldom experienced.[1]

If, as Hammerman and Hammerman stated, outdoor education provides the means for more efficient and effective learning through participation in an outdoor experience, behavioral outcomes such as "deeper insight" and "greater understanding" can be specified and measured by the use of a rank order cognitive taxonomy.

Of the more than eighty masters' theses and doctoral dissertations in outdoor education included in the Education Resources Information Center's integrated and computerized microfilm record retrieval

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[1]Donald R. Hammerman and William M. Hammerman, Teaching in the Outdoors, (Minneapolis: Burgess Publishing Co., 1968), p. 1.

system,[2] not one study dealt with the attempt to measure the increase in students' cognitive understanding of curriculum content as a result of participating in an outdoor learning experience. The students' increased cognitive understanding of curriculum content as a result of a first-hand sensory experience in the out-of-doors has, to the writer's knowledge, never been statistically substantiated.

II. THE PROBLEM

Statement of the problem. The purpose of this study was to investigate students' understanding of the three ecological concepts of adaption, change, and interdependency to determine whether students would achieve a "deeper insight" and a "greater understanding" of these concepts as a result of an outdoor learning experience. The investigation was conducted with a sixth grade class on a typical one-day exploratory field trip experience at the Albuquerque Public Schools' Environmental Education Laboratory located in the Sandia Mountains near Albuquerque, New Mexico. A significant change in the cognitive level of students' classroom dialogue regarding these concepts would indicate that the outdoor exploratory experience influenced the level of students' cognitive understanding of the ecological concepts being taught.

The content area of the curriculum utilized in this study was designed to increase students' environmental awareness. The use of the

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[2] Prentice-Hall Editorial Staff, Complete Guide and Index to ERIC Reports through December, 1969, (Englewood Cliffs: Prentice-Hall, 1970).

ecological concepts of adaptation, change, and interdependence in the curriculum presented to the students was designed to increase students' understanding of man's relationship to his environment and to increase students' understanding of ecology.

The classroom dialogues, over three time periods before and after the outdoor exploratory experience, were tape recorded. These were analyzed to determine if any significant change in students' cognitive understanding regarding ecology occurred as a result of a one-day, first-hand, sensory exploration of the three ecological zones located at the Albuquerque Public Schools' Environmental Education Laboratory.

The null hypothesis. The null hypothesis, as stated, was there would be no significant difference between the mean cognitive level of sixth grade students' understanding of ecology before and after being treated with a one-day sensory exploration of three ecological zones located at Albuquerque Public Schools' Environmental Education Laboratory.

The curriculum process. The curriculum process being evaluated consisted of three pre-planning class sessions in which the classroom teacher discussed the ecological concepts of adaptation, change, and interdependency. The objective was to discuss ecological communities affected by changes in their surrounding environments. The students discussed their own school community before they participated in a one-day exploratory field trip experience of three ecological communities

located at Albuquerque Public Schools' Environmental Education Laboratory. Afterwards, the class returned to the classroom for three additional class sessions with the classroom teacher to review and discuss man's influence on ecological communities in general.

The Research Design. A shortened version of the Campbell and Stanley Research Design Number Seven[3] was used to analyze the change in students' cognitive understanding of the ecological concepts over time. This Time Series Research Design was modified to fit the curriculum pattern under investigation. Three, instead of four, equal time periods were used before and after the outdoor experience (O_1, O_2, O_3 X O_4, O_5, O_6) to test whether a change in the mean cognitive level of students' classroom dialogue had occurred. See Table 1, page 5.

Testing the null hypothesis, that there would be no significant difference in the students' cognitive understanding of three ecological concepts being taught as a result of participating in an outdoor exploratory experience, was accomplished by:

1. taking the total high and low cognitive skill responses of the students during the pre-observation periods, and

2. comparing them with the total high and low cognitive skill responses of the students during the post-observation periods by the use of pre- and post-test ratio means.

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[3]Donald T. Campbell and Julian C. Stanley, Experimental and Quasi-Experimental Designs for Research, (Chicago: Rand McNally and Co., 1963), pp. 37-43.

Cognitive Skill Levels		Pre-Trip Ratio $\frac{\bar{X}\cdot}{\bar{Y}\cdot}$ Sg_2	Post-Trip Ratio $\frac{\bar{X}\cdot}{\bar{Y}\cdot}$ Sl_2
Low (Recall Skills) X_i	1.00 Knowledge		
	2.00 Translation		
	3.00 Interpretations		
High (Problem Solving Skills) Y_i	4.00 Application		
	5.00 Analysis		
	6.00 Synthesis		
	7.00 Evaluation		
Time Periods		O_1 O_2 O_3	X O_4 O_5 O_6

DEFINITIONS OF SYMBOLS

X_i = low level cognitive skills
Y_i = high level cognitive skills
N = frequency of students' cognitive oral responses
X = experimental treatment
$\frac{\bar{X}\cdot}{\bar{Y}\cdot}$ = Sg_2 = pre-trip ratio mean
$\frac{X\cdot}{Y\cdot}$ = Sl_2 = post-trip ratio mean

TABLE 1. TABLES, SYMBOLS, AND RESEARCH DESIGN USED

$$\left(\frac{1}{N}\sum_{1}^{N}\frac{X_i}{Y_i} = \frac{\bar{X}'}{\bar{\bar{Y}}'}\right), \text{ and}$$

3. subjecting this decimal mean to an "F" test for significance

$$\left(F = \frac{Sg_2}{Sl_2}\right).$$

(See Table 1, page 5.)

A significant change in the mean cognitive level of classroom dialogue after the outdoor experience would indicate that students had achieved a "deeper insight" and a "greater understanding" of the ecological concepts being presented to them as a result of the participation in an outdoor experience.

III. INSTRUMENTATION

A rank order scheme based on Bloom's Taxonomy of Educational Objectives was used to gather and evaluate the data on students' cognitive understanding of the ecological concepts being taught. Bloom stated:

> To return to the illustration of the use of the term 'understanding', the teacher might use the taxonomy to decide which of the several meanings he intended. If it meant that the student was sufficiently aware of a situation or phenomenon to describe it in terms slightly different from those originally used in describing it, this would correspond to the taxonomy category of 'Translation.' Deeper understanding would be reflected in the next-higher level of the taxonomy, 'Interpretation' where the students would be expected to summarize and explain the phenomenon in his description. And there are other levels of the taxonomy which the teacher could use to indicate still

deeper 'understanding.' In short, teachers and curriculum makers should find this a relatively concise model for the analysis of educational outcomes in the cognitive area of remembering, thinking, and problem solving.[4]

Bob Burton Brown[5] used Bloom's Taxonomy of Educational Objectives as an observational measuring instrument when he adapted Bloom's cognitive categories to design the Florida Taxonomy of Cognitive Behavior. See Appendix A, page 66. Frequency marks were used to rank the level of cognitive behavior of the students and teachers. This process was recognized by the American Educational Research Association as a one of many methods used for ranking the cognitive level of classroom dialogue.[6]

The Florida Taxonomy of Cognitive Behavior was used in this study to rank the level of students' classroom dialogue, which was felt to indicate the cognitive level in which the class was functioning in a given time period. A shift toward the higher cognitive categories, according to Bloom and Brown, would indicate students' achievement of deeper understanding.

Brown described how he applied Bloom's concepts to ranking cognitive behavior in the classroom:

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[4]Benjamin S. Bloom (ed.), Taxonomy of Educational Objectives, (New York: David McKay, Inc., 1959), p. 2.

[5]Bob Burton Brown, "Florida Taxonomy of Cognitive Behavior," Mirrors for Behavior, (Philadelphia: Research for Better Schools, Inc., 1967), pp. 37.1-37.2-9.

[6]Samuel E. Wood, "A Factor Analysis of Three Sets of Simultaneously Collected Observational Data," Paper read at American Educational Research Association Meeting, Los Angeles, California, 1969.

The first field test of the instrument was made in a single school system in which one hundred and thirty-two classrooms at all grade levels, first through twelve, and in all subject matter areas were observed. Each teacher was visited for a single, 30-minute period; the observations produced 132 scores which represented the cognitive behavior of both teachers and students.

The unique feature of this field test was that the taxonomy was used in conjunction and simultaneously with two other observational instruments, the Reciprocal Category System and the Teacher Practice Observation Record. Thus there were three records made of the same classroom situation during each observation period. Factor analysis of the resulting data revealed that the taxonomy does indeed measure aspects of classroom behavior which were not detected by the other systems.[7]

The Florida Taxonomy of Cognitive Behavior has fifty-five specific verbal behavior categories clustered into seven weighted general categories of cognitive behavior. The general categories are: knowledge of specifics, knowledge of ways and means of dealing with specifics, knowledge of universals and abstractions; translation; interpretation; application; analysis; synthesis; and evaluation. By comparing the mean cognitive level of teachers' questions and comments during each time period with the mean cognitive level of students' classroom dialogue during each time period, it was possible to graphically compare at what level students were cognitively understanding the ecological concepts being taught.

Collection of the data. Data was collected for this study by tape recording the first half-hour segments of the three classroom

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[7]Ibid., pp. 37.2-3.

periods prior to the students' field trip to the Albuquerque Public Schools' Environmental Education Laboratory, and by tape recording the first half-hour segments of the three classroom periods following the outdoor field trip experience. Each recording was categorized according to the _Florida Taxonomy of Cognitive Behavior_, for analysis. The results of the pre- and post-trip experiences were then compared and related to the null hypothesis. The students were aware that their comments were being recorded and frequency marks replaced oral responses in the process of analysis to assure anonymity.

IV. DEFINITION OF TERMS USED

For the purpose of this study, the following terms have been defined:

Curriculum process. The curriculum process, for the purpose of this study, was the sequential presentation of a body of knowledge into the classroom for the purpose of having the students absorb and ultimately communicate to others the level in which they understood the body of knowledge being presented to them. This body of knowledge was called the curriculum content. The outdoor setting provided for the utilization of this knowledge encountered in the classroom.

Students' deeper understanding of ecological concepts. Students' deeper understanding of the ecological concepts was indicated by student ability to utilize higher levels of cognitive thinking, by

moving from rote recall and comprehension of facts to application, analysis, synthesis, and critical judgments of the material being discussed in the classroom, as indicated by the fifty-five specific types of classroom behavior ranked in seven hierarchical classifications of the Florida Taxonomy of Cognitive Behavior.

Intra-rater reliability. Intra-rater reliability of the observer was achieved by the "test-retest" correlation (Pearson-Product Moment) for internal consistency. See Appendix C, page 92.

Exploratory field trip. Exploratory field trip was where:

> The learner is led to explore the unknown objects and processes in the natural environment. Through skillful questioning the learner is guided to look for himself and to see, to think about what he has observed, to integrate and synthesize the significant elements of his observations until he is able to formulate a reasonable conclusion as to 'what happened here.' The pupil acquires knowledge through the use of the resources and materials of reality rather than through mere verbal dissemination of factual content. Telling, alone, is not teaching. Teaching calls for the involvement of the learning organism in experiencing. In this way the student is motivated to utilize all of his senses (multi-sensory learning) in seeking answers to the countless mysteries which confront his every step along the outdoor path of learning. The pupil substitutes his own direct experience in the form of sights, sounds, odors, tastes and feelings for mere words in a text, and thus enhances and makes more meaningful the great mass of verbal knowledge to which he has already been exposed.[8]

Outdoor curriculum enrichment. Outdoor curriculum enrichment, as expressed by writer-naturalist Edwin Way Teale, is:

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[8]Hammerman and Hammerman, op. cit., p. 13.

> The strangeness of the familiar is too familiar to be observed. It is to help the learner become aware of the strangeness of the familiar and to incorporate these discoveries into his own system of applications and understandings that an exploratory approach to learning can be most effectively employed by the teacher out-of-doors.[9]

V. LIMITATIONS OF THE STUDY AND SUMMARY

Limitations of the study.

1. This study was limited to examining an exploratory field trip used in teaching ecology to a class of sixth grade elementary school students.

2. This study was limited to a selected sixth grade class in the Albuquerque Public School system.

3. This study was specifically limited to the examination of observed changes in students' cognitive understanding of ecological concepts by exhibited changes in the cognitive level of classroom dialogue.

4. No random method was used in the selection of the classroom to be observed; therefore, this study cannot be considered a representative sample of the universe.

5. Only a frequency distribution of a rank order scale was applied to the classroom dialogue to measure the students' increase in cognitive understanding of ecological concepts.

6. There was no way to force students to respond; therefore, the investigator was limited to the recording of the classroom dialogue and the ranking of the frequency of those responsive occurrences in a taxonomic table as they occurred naturally in the classroom.

7. This study was limited by the students' socio-economic background and intelligence level.

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[9] Ibid.

Summary. Leading authorities in the area of outdoor education have made assumptions regarding the potential of outdoor learning activities for increasing "deeper insight" and "greater understanding" of students when exposed to a first-hand learning experience in the out-of-doors. These authorities have also implied that such insight and understanding would occur regardless of grade level. The purpose of this study was to determine if there was a change in students' understanding of ecological concepts when a specific sixth grade class studying ecological communities had an outdoor encounter with items only talked about in the classroom. Positive results would tend to reinforce Hammerman and Hammerman's statement that "deeper insight" and "greater understanding" did occur as a result of an outdoor experience, and would illustrate that direct experience in the out-of-doors did meet the cognitive objectives of education.

Organization of the remainder of the study. Chapter II provides a review of related literature concerning an increase in students' cognitive understanding of curriculum content as a result of outdoor experiences. Chapter III presents the methodology used to control the research under investigation. The data is presented and analyzed in Chapter IV. Findings and recommendations follow in Chapter V.

CHAPTER II

REVIEW OF RELATED LITERATURE

The program of the Albuquerque Public Schools' Environmental Education Laboratory is similar to other elementary schools' outdoor education programs. Elementary school exploratory field trips usually include pre-planning and follow-up experiences. The exploratory field trips together with the means for defining and evaluating students' cognitive understanding is reviewed in this chapter.

Relevant literature, regarding the use of pre-planning and follow-up experiences were reviewed to ascertain interrelationship between pre-planning, outdoor, and follow-up experiences. The focus of the review was on how desired behavioral outcomes were achieved in this planned curriculum process. The Review of Related Literature contains current methods used in evaluating behavioral outcomes resulting from outdoor learning experiences. Indication was that a minimal amount of research has been initiated in the cognitive domain of outdoor education. Additional review into the area of Gestalt psychology revealed that the evaluation of cognitive understanding of curriculum content could be best achieved by observing students' behavior in a given behavioral setting such as the classroom.

The last part of this chapter was concerned with the presentation of literature in reference to the selection of a taxonomic model which was used as a means for evaluating students' cognitive enrichment. The presentation of the taxonomic literature described

how the level of students' cognitive oral behavior in the classroom could be used to indicate a change in the students' cognitive understanding of the curriculum content being taught.

I. PRE-PLANNING EXPERIENCE

The exploratory field trip was cited by Smith, Carlson, Donaldson, and Masters as being the most commonly used of all outdoor experiences.

They stated:

> Of all outdoor learning experiences, the most common is the field trip or exploration. It may consist of a few minutes spent in a school yard or an extended visit to a forest or farm. The value of any field trip depends upon the extent to which it is a real learning experience. To the participant it should be interesting and adventurous. Emotionally it should relate to the total program of the classroom or to that of the sponsoring agency.
>
> The field trip generally consists of three parts:
>
> 1. The pre-planning, including discussion of principles which will be illustrated by the field trip. Research indicates that learning increases markedly when proper pre-planning has been done.
>
> 2. The trip itself. The trip should be well organized with the total objectives in mind. Participants should understand that the trip is to be an educational experience.
>
> 3. The follow-up. After a trip is over, there should be a review of what has been done and the principles that have been learned.[10]

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[10]J. W. Smith, R. E. Carlson, G. W. Donaldson, H. B. Masters, <u>Outdoor Education</u>, (Englewood Cliffs: Prentice-Hall, 1963), p. 50.

The three parts of an exploratory field trip experience were considered by Smith, Carlson, Donaldson, and Masters to be a part of a single curriculum pattern. The cohesion of the "pre-planning" and the "follow-up" stages of the outdoor experience was cited as being as important as the outdoor experience itself. Without adequate pre-planning and adequate "follow-up" experiences predicted behavior outcomes could not be achieved. The use of pre-planning experiences was designed to prepare students for meaningful achievement in the out-of-doors.

A number of factors appeared to be responsible for increasing the students' cognitive understanding of the curriculum content. Curriculum enrichment appeared to be based on essentially four elements which constituted cognitive curriculum enrichment in the out-of-doors:

1. site selection,
2. directing students' multi-sensory encounters to desired objects in the out-of-doors,
3. relating first-hand experience in the out-of-doors to previous classroom learning, and
4. checking the relevance of these first-hand encounters to the students' own needs to know (i.e., motivation).

Knapp, in Science and Children,[11] indicated that different behavior outcomes of field trips would occur as a result of the planned sequence of events. Knapp stated:

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[11]Clifford E. Knapp, "Conducting a Field Trip Organizational Pattern for Instruction," Science and Children, 8:26-28, Sept., 1970.

> One important consideration in selecting the instructional pattern is the objective of the lesson. The assumption is that certain patterns of instruction can better accomplish certain objectives and that changes in organization should be made accordingly.
>
> The student will respond to each instructional pattern in different ways. Certain students will be able to function more effectively in one particular pattern. . . . The field trip should be reviewed as an opportunity to apply a variety of organizational patterns for instruction selected on the basis of the desired student objectives and appropriate student and teacher readiness.[12]

For the teacher to plan for maximum learning in a given time period, Smith[13] indicated the necessity of examining the site selected to assure that it was suitable for adequate learning opportunities, and for the types of multi-sensory experiences desired.

Importance of matching the unit to be taught with the proper outdoor setting was cited by L. B. Sharp.[14] He described a case in point where a teacher spent three lessons trying to teach her class about contour lines while an eight-foot hill outside the school building went unused.

Donaldson and Donaldson[15] stated that human behavior in the out-of-doors depends on: the subject matter to be taught, what was

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[12] Ibid., pp. 26-29.

[13] Julian Smith, Outdoor Education for American Youth, (Englewood Cliffs: Prentice-Hall, 1963), pp. 24-25, 36-37.

[14] L. B. Sharp, "What is Outdoor Education?", School Executive, 71:19-22, August, 1952.

[15] George W. Donaldson and Louise E. Donaldson, "Outdoor Education--A Definition," Journal of Health, Physical Education, and Recreation, 29:17, 63, May, 1958.

expected to be experienced while in the out-of-doors, and on a student's freedom to interact with other students to satisfy his own curiosity.

Observing that the students' age and level of maturation influence the type of outdoor experience most beneficial for learning, Partridge[16] felt that the role of the instructor was to direct students' attention to the desired objects while in the out-of-doors.

> It is now known on the basis of countless experiments and the study of child concepts at various age levels that it is practically impossible to convey to a child exact or adequate meanings to many areas except by actual experience. Indeed, the psychologists who have studied the matter say that even if you talk yourself blue in the face it is quite impossible to carry meaning to a child, but rather the child must develop it himself out of his own experiences. Of course, he can be aided in his learning process by skillful adults who can help him to see relationships or who can at the right moment instruct him in points he otherwise would miss.[17]

II. OUTDOOR EXPERIENCES

Redl[18] indicated that increased free expression in a group living experience provided a challenge to students which the classroom did not provide, and allowed for a greater exchange of ideas.

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[16] E. DeAlton Partridge, "Some Psychological Backgrounds of Camping," Camping Magazine, 15:6-8, March, 1963.

[17] Ibid., pp. 6-8.

[18] Fritz Redl, "The Role of Camping in Education," Camping Magazine, 14:10-13, February, 1942.

directed in understanding adults in the school-camp, and that the camp's greater informality will cause students to accept him as counselor.

Generally then the emotional tone and level of maturation determines the type of outdoor experiences most beneficial for learning. Hutchings[13] felt that the role of the instructor was to direct students attention to the desired relationships in the new situation:

> It is at times in the range of possible experience and the study of child behavior at various age levels that it is practically impossible to furnish to a child enough of adequate experience in each stage related to normal experiences. Indeed, the psychologists who have studied the matter say that some of your most personal feelings had been rendered wholly impossible to carry through to a point, and because the child then decides to knowing out of the own experiences. Of course, he can be aided in the learning process by skillful adults who can help him to see relationships or the use of the right course. Instruct him in points he otherwise would miss.[14]

II. OUTDOOR EXPERIENCES

Reed[15] indicated that increased free experiences in a group living experience provided a challenge to students which the classroom did not provide, and allowed for a greater maturity of ideas.

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[13] D. Hallam Hutchings, "Some Psychological Backgrounds of Camping," Camping Magazine, 17:7-9, March, 1945.

[14] Ibid., pp. 8-9.

[15] Mattie Reed, "The Role of Camping in Education," Camping Magazine, 21:10-11, February, 1949.

Bode[19] implied that experiences in practical living situations have more to do with understanding than what is learned verbally, and also stated that the outdoor group setting links itself more to the concept of democratic living than the indoor classroom.

The belief that an increase in learning occurs in the out-of-doors because children lead a fuller life outside the classroom was expressed by Kilpatrick.[20] He stated that students do not just learn about subject matter, but live and experience it.

The belief that multi-sensory and group experiences in the outdoors increase learning was reinforced by Masters.[21] He stated that outdoor experiences:

1. provide for direct learning,
2. are based on the interest of children,
3. provide for individual differences,
4. are planned for all children,
5. represent a return to the realities of the simple life,
6. provide for a socially satisfying experience, and
7. provide an element of risk and adventure.

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[19]Boyd Bode, "The Role of Camping in a Democracy," Camping Magazine, 14:10-13, February, 1942.

[20]William H. Kilpatrick, "The Role of Camping in Education Today," Camping Magazine, 14:14-17, February, 1942.

[21]Hugh Masters, "Values of School Camping," Journal of Health, Physical Education and Recreation, 112:14-15, January, 1951.

Masters felt these enrichment qualities could meet the needs of students when adjusted to age, and to individual and group interests.

McClusky[22] perceived student involvement in the planning process as essential for turning thoughtful learning of the classroom into action in the out-of-doors. For the development of higher understanding, he felt that students' total involvement in planning learning activities made learning more personalized and helped students to achieve a sense of self-realization.

Freeberg[23] believed that the teaching environment indoors is made up largely of second- and third-hand experiences and that textbook learning should be supplemented with direct experiences. He felt that outdoor experiences allowed the child to explore principles learned in the classroom.

Supporting evidence was given by Blackwood,[24] when he stated that the best way for students to appreciate and understand the nature of the scientific approach was to relive the methods used by scientists "in discovery." By collecting and organizing data in the out-of-doors and incorporating what they had found into the larger body of scientific knowledge, he felt students would experience a deeper understanding of the scientific processes.

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[22]Howard Y. McClusky, "The Out-of-Doors as Part of the Total Education Program," The School Executive, 64:63-5, February, 1945.

[23]William H. Freeberg, "Outdoor Education - A Method of Education," Illinois Journal of Education, 52:11-15, October, 1967.

[24]Paul B. Blackwood, "Outdoor Education and the Discovery Approach to Learning," Journal of Outdoor Education, 1:6-8, Fall, 1966.

Carlson,[25] when defining enrichment, indicated that some of the immediate settings where a field trip could take place were an empty lot, a school garden, a community park, a dairy. Carlson further stressed that such exploration should be linked to textbook learning in the classroom. His theme was that the knowledge of the world begins at home, with what can be observed and felt. Carlson, however, warned against the lack of direction when taking a class out-of-doors:

> It must not be assumed that because a group has been taken out-of-doors that per se something desirable has happened. Preparations for outdoor experiences must be as carefully, if not more carefully, made than for class work indoors. What is done must be meaningful to the students and should be selected in terms of his age and interest. The members of the group should understand the objectives of the trip; what to look for, and how the trip is to be conducted. Careful advance plans relative to transportation, grouping, and equipment will help insure success. Distribution of mimeographed materials related to the trip may be appropriate.[26]

When Brainerd[27] defined the field trip experience as being an outdoor investigation, he cited observation, identification, collection measurement, recording and experimentation as learning processes which could be used to force the student to focus on the desired items. He

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[25]Reynold E. Carlson, "Enriching the School Curriculum by Using the Immediate Environment," The Bulletin of the National Association of Secondary School Principals, 31:83-86, May, 1947.

[26]Ibid., p. 86.

[27]J. W. Brainerd, "School Grounds for Teaching Man's Relationship to Nature," School Science and Mathematics, 64:428-34, May, 1964.

felt such activities caused the students to increase their interactions with certain objects in their natural setting, and, therefore, increased students' ability to analyze what they had seen.

A word of caution was given by Busch[28] regarding overstructuring the planned field trip, so as not to miss the "teachable moment." She stated that the instructor should be open to teach about natural events when they occur, or as they are encountered. She felt that students' questions and teacher's answers should prompt the pattern of outdoor investigation and the exchange of ideas, and emphasized this by stating:

> The teacher must catch the spark, become truly innovative and initiate lessons for carrying indoor investigations to the wider horizons outdoors. . . . I call this the 'indoor-outdoor-indoor' technique.[29]

III. FOLLOW-UP EXPERIENCES

The follow-up learning experience was viewed by Smith, and others, as the final step in the sequential process of the outdoor learning pattern.

The literature related to exploratory field trip experiences indicated the follow-up experience to be where the most meaningful cognitive gains occurred. Most authorities felt that the expected high-level increase in students' cognitive understanding of curriculum content, during the follow-up period, was related to those

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[28]Phyllis S. Busch, "The 'Explorable Instant' or When to Open the Classroom Door," Nature Study, 20:6-9, Winter, 1966-67.

[29]*Ibid.*, p. 9.

multi-sensory experiences felt in the out-of-doors which made concrete the more abstract verbal principles previously learned in the classroom. Brimm[30] implied that once the student had found a familiar object in the out-of doors, and applied several tests of reality to that object, the student would achieve a deeper insight and a greater understanding of curriculum content. This idea, as expressed by Brimm, was best exemplified by the following:

> A field trip emanating from a class in science is much more valuable to classroom work if it is well planned to fit into the material being covered in class. Background information covered in the classroom makes the excursion experiences much more understandable and complete. Likewise, through examination of specimens brought back to the classroom and a discussion of the experience makes the excursion more valuable in terms of understanding and retention of learnings. In any situation, unplanned experiences occur and contribute to learning. But in the classroom, excursions, or in camp most worthwhile learning situations will come from a planned sequence of events.[31]

Piaget's[32] theory of cognitive development tends to support the need for concrete experiences to increase cognitive understanding. The renowned author felt that it was the interplay between verbal learning and concrete experiences which made newly learned concepts functional in the minds of students. Piaget and Inhelder[33] stated:

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[30]R. P. Brimm, "What are the Issues in Camping and Outdoor Education? Camp Centered? School Centered?" Camping Magazine, 31:14-15, January, 1959.

[31]Ibid., p. 15.

[32]Jean Piaget and B. Inhelder, The Growth of Logical Thinking, (New York: Basic Books, 1958).

[33]Ibid.

> If we consider the mental images involved in the problem we can see how difficult it is for the subject to set up the data in his own mind (because only the relations are given). The result is that the subject is unable to translate the data into representational imagery and has to formulate them into exclusively hypothetical terms if he is to see the necessary consequences. This conjunction between what is possible and what is theoretically necessary makes it indispensable that the serial ordering operations used be inserted into a set of implications, made up of the relations which are to be ordered serially, which serves as an inter-propositional form for the intra-proposition context itself.[34]

This concept was further strengthened by Cordier,[35] when he stated that:

> Back in the classroom what happens to this field trip experience? Even though the field trip may have been the culminating activity of a unit of work, reinforcement of the concept learned will help insure the success of the total experience. The total experience of a field trip includes the earliest planning, the trip itself, and the return to the classroom. How the field trip is followed up depends largely on the purpose of the trip. In reviewing the outdoor experience, it will be evident that many purposes other than those specifically planned for were also fulfilled. Pull in these ideas and use them. The boys and girls have shared an experience with each other, with the teacher and with the other adults who assisted with the trip. And this sharing in itself can be one of the most important and lasting effects of the field trip experience.[36]

In retrospect, most authorities agreed that some type of follow-up activity was necessary to achieve full benefit from the

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[34] Ibid., p. 252.

[35] Mary Hurlbut Cordier, "Let's Take a Field Trip in the Woods," Science and Children, 4:27-28, September, 1966.

[36] Ibid., p. 14.

outdoor experience. Providing follow-up activities to link concrete learning back to abstract thinking was suggested by Smith:[37]

> Full value from the trip will not be realized without a follow-up. Review in the classroom might include developing a composite list of the trees seen, organizing and identifying the leaves or seeds collected, making ink impressions of some of the leaves, discussing what was learned on the trip, writing about local trees and their values, and carrying on individual projects with trees. The economic, aesthetic, and recreational values of forests might be considered.[38]

IV. EVALUATION

The types of research instruments used at the present to evaluate outdoor education experiences have been directed toward measuring changes in affective behavior; therefore, there were few existing studies found to use as examples in measuring changes in the students' cognitive behavior.

Typical of most attitudinal studies, which dominated efforts in outdoor education research through the questionnaire, was the one by Ashcroft.[39] He examined students' expressed opinions before and after an outdoor experience. This study was designed to ascertain attitudinal changes; however, it provided only low level descriptive data:

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[37] Julian Smith, *op. cit.*

[38] *Ibid.*, p. 52.

[39] J. H. Ashcroft, "The Attitude of Children Toward Outdoor Education," *California Journal of Elementary Education*, 26:96-101, November, 1957.

> Nearly 93 per cent of the 1500 pupils were enthusiastic; 7 per cent reported a 'fairly good time'; and only four children said they did not enjoy the camp experience.[40]

Other affective domain studies examined individual change through case studies, such as Gower's[41] study of Jimmy, the problem child, or Davis'[42] study on sociometric change in friendship as a result of an outdoor experience. Like most studies in outdoor education, these studies further only the educational goals in the affective domain, but indicate no meaningful changes in the cognitive domain. Extensive investigation of research studies, theses, dissertations, educational journals, and the Bibliography of Theses and Dissertation: Recreation, Parks, Camping, and Outdoor Education,[43] revealed only one study that statistically measured students' increase in cognitive understanding as a result of an outdoor experience. This study by Hoesema[44] experimented with two methods of teaching arithmetic.

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[40] Ibid., p. 9.

[41] Tom Gower, "A Good Day in Camp," California Journal of Elementary Education, 28:87-91, November, 1957.

[42] O. L. Davis, "Effect of a School Camp Experience on Friendship Choices," The Journal of Educational Sociology, 33:305-13, March, 1960.

[43] Betty Vander Smissen and Donald V. Joyce (ed.), Bibliography of Theses and Dissertations: Recreation, Parks, Camping, and Outdoor Education, (Washington, D.C.: National Recreation and Park Association, 1970).

[44] Harold L. Hoesema, "Arithmetic Outdoors . . . Does it Make a Difference?", Illinois Journal of Education, 55:18-19, December, 1964.

[illegible]

Other literature exists which describes individual change through case studies, such as Greenberg's[40] study of Danny, the problem child, in Lucas's[41] study of sociometric changes in friendship as a result of an outdoor experience. [illegible] further into the [illegible] gains in the affective domain, and [illegible] changes in the cognitive domain. Extensive investigation of research studies, theses, dissertations, educational journals, and the Bibliography of Theses and Dissertations [illegible] Outdoor Education[43] revealed only one study that statistically measured students' increase in cognitive understanding as a result of an outdoor experience. This study by [illegible][44] experimented with two methods of teaching arithmetic.

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[40]Ibid., p. 9.

[41]Tom [illegible], "A Good Day in Camp," California Journal of Elementary Education, [illegible], November, 195[illegible].

[42]C. L. [illegible], "Effect of a School Camp Experience on Friendship Choices," The Journal of Educational Psychology, [illegible], March, 19[illegible].

[43]Betty [illegible] and Donald [illegible] (ed.), Bibliography of Theses and Dissertations [illegible] Outdoor Education (Washington, D.C.: National Recreation and Park Association, 19[illegible]).

[44][illegible], "[illegible]," [illegible], December, 19[illegible].

A control group was taught exclusively indoors while the experimental group included experiences in the out-of-doors. Each group was subjected to a pre- and post-test examination, and each group achieved significant gains in reasoning and comprehension. In the experimental group, a significant difference was found in computational skills, and when the two scores were combined, the experimental group total score was still found to be significant at the .01 level.

After establishing the fact that significant gains in computational skills had been achieved, Hoesema addressed himself to the issue of why he considered these cognitive gains took place.

Hoesema stated:

> An informal setting, such as the out-of-doors, provided for more interaction among the students. Students freely discussed methods and compared results as well. Some students spent as much time or more time in calculating and checking their problems outdoors than the group who were working strictly from the textbook. Comparing results, in many instances, indicated that a particular answer was not reasonable; thus necessitating recalculation. Most students were very much concerned about right or reasonable answers.[45]

Studies such as Hoesema's are vitally needed so that a better understanding may be achieved of enrichment of curriculum content and how that content relates to outdoor education.

Measuring Cognitive Understanding. Literature in the area of human cognitive understanding revealed that the use of questionnaires and written test instruments cannot adequately measure cognitive

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[45] Ibid., p. 19.

understanding because its origins were based in sensory psychology.

Koffka,[46] the father of Gestalt psychology, stated that an organism's cognitive understanding of its environment originates from the organism's consciousness of objects in its perceptual field and their relationship to that particular organism. The organism, according to Koffka, existed concurrently with its environment and, therefore, its perception of the real geophysical world determines the organism's behavior. In support of this, Koffka stated:

> If anyone wants to speak of the animal's consciousness instead, he must apply this word to those objects which we call behavioural environment. Thus the dog's consciousness in chasing a hare would be 'a hare running through a field,' the ape's consciousness in trying to obtain the suspended fruit would be 'a stool standing in that corner,' and so forth. The field and the hare, the stool and the fruit, by being called conscious, or objects of consciousness, must not therefore be considered as something within the animal, if this has the meaning of a behavioural, or experienced, within.[47]

The renowned Gestaltist believed that it was the organism's ability to perceive and internalize objects, to feel sensory patterns, while participating in a focused task, that moved the organism from conscious awareness of a single event to the understanding of cause-and-effect relationships between events.

Lewin,[48] a fellow Gestaltist, believed that a focused task relationship existed between the organism and his environment, which was essential for the organism to develop structural concepts about

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[46]Kurt Koffka, Principles of Gestalt Psychology, (London: Routledge and Kegan Paul, Lts., 1935).

[47]Ibid., p. 35.

[48]Kurt Lewin, Principles of Topological Psychology, (New York: McGraw-Hill Book Company, 1936), p. 11.

stereotyping between the [illegible], the [illegible] [illegible] [illegible] [illegible] [illegible] that [illegible] [illegible] of the [illegible] of [illegible] [illegible], [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] of the [illegible] [illegible] from the organism's [illegible] of objects in the perceptual field and their relationship to each other [illegible]. The organism, according to Kohler, related [illegible] with its environment and therefore, the perception of the [illegible] [illegible] [illegible] [illegible] the organism's behavior, in [illegible] of [illegible], [illegible] [illegible].

> If [illegible] [illegible] to [illegible] of the animal's [illegible] [illegible] [illegible], we [illegible] apply this word to those objects which we call [illegible] [illegible]. This the [illegible] [illegible] in [illegible] a [illegible] [illegible] [illegible] [illegible] a field, [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] in that [illegible] [illegible] [illegible] the field and the tree, the stick and the fruit, by being called [illegible], [illegible] of [illegible], [illegible] not therefore be considered as something within the animal, if this has the [illegible] of a [illegible] [illegible] [illegible], [illegible].[10]

The rebuked Gestaltist believed that it was the organism's ability to perceive and internalize objects, to [illegible] [illegible] [illegible], while participating in a focused task, that moved the organism from conscious awareness of a single event to the understanding of cause-and-effect relationships between events.

Lewin,[11] a fellow Gestaltist, believed that a focused task relationship existed between the organism and its environment, which was essential for the organism to develop [illegible] [illegible] [illegible]

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[10][illegible] [illegible], [illegible] [illegible] [illegible] (London: [illegible] [illegible] [illegible] [illegible], [illegible]), p. [illegible].

Ibid., p. [illegible].

[11][illegible] [illegible], Principles of [illegible] Psychology (New York: McGraw-Hill Book Company, [illegible]), p. [illegible].

his environment. Lewin believed the organism's environmental interplay, described as life space when internalized, provided the organism with a somewhat distorted conceptual understanding of the geophysical world around him.

Lewin stated:

> If one represents behavior or any kind of mental event by B and the whole situation including the person by S, then B may be treated as a function of S : B = f (S). In this equation the function f, or better its general form, represents what one ordinarily called a law. If one substitutes for the variables in this formula, the constants which are characteristic for the individual case, one gets the application to the concrete situation . . . One can hope to understand the forces that govern behavior only if one includes in the representation the whole psychological situation.
>
> In psychology one can begin to describe the whole situation by roughly distinguishing the person (P) and his environment (E). Every psychological event depends upon the state of the person and at the same time on the environment, although their relative importance is different in different cases. Thus we can state our formula B = f(S) for every psychological event as B = f(PE). The experimental work of recent years shows more and more this twofold relationship in all fields of psychology. Every scientific psychology must take into account whole situations, i.e., the state of both person and environment. This implies that it is necessary to find methods of representing person and environment in common terms as parts of one situation. We have no expression in psychology that includes both. For the word situation is commonly used to mean environment. In the following we shall use the term psychological life space to indicate the totality of facts which determine the behavior of an individual at a certain moment.[49]

To clarify life space for its relevancy to this study:

1. The classroom is a manipulated environment which contains many individual life spaces focused on a common task, learning the

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[49]<u>Ibid</u>., p. 35.

curriculum content being presented in a classroom.

2. Measuring the students' and the teacher's cognitive oral behavior during the presentation of the content area of a curriculum provides a method of representing the person and the environment in common terms as part of one united situation.

3. Thus, the measurement of the achievement, of deeper insight and greater understanding of any curriculum content presented in classroom can therefore be achieved by comparing the cognitive level of the teacher's presentation to the cognitive level of students' responses in any given time period

Therefore, B = f(PE) expressed a method for measuring the cognitive influence of a particular curriculum process on specific types of human behavior, e.g., students' cognitive understanding of ecological concepts. Lewin warned that consequential changes of events in the geophysical world outside of the organism's focused-task could provide drastic changes in the organism's cognitive perception of reality:

> One can roughly distinguish two cases in which the life space is influenced from the outside: (1) the influence can occur by way of a perceptual process usually leading to a change of the cognitive structure of the field with reference to the object in question; (2) the influence can be a gross somatic one. A stone may hit a person and cause injury or loss of consciousness. This stone need not necessarily appear in the perceptual field of the person . . . . Certainly, the perception of a physical object and an injury inflicted by a stone are events of very different character. But the effect of a perception also may go beyond a change of the cognitive structure of the life space. It may, for instance, produce a change of the goal and lead to a change in the person's direction of action.[50]

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[50] Ibid., pp. 27-28.

This development of the students' cognitive understanding of his living environment over time was best described in Flavell's[51] book, The Developmental Psychology of Jean Piaget, which went beyond the scope of this study in describing the sequential order in which cognitive development, from childhood to adulthood, occurred. Flavell reported that human acquisition of a vocabulary allowed for more mental manipulation, more abstract cognitive skills of hypothesizing, and better prediction of causal relationships between objects in a hypothetical set of circumstances. Flavell described how internalized verbal structures increased reorganization of knowledge, which increased the rate of the assimilation of new knowledge into cause-and-effect relationships:

> Cognitive progress, in the Piaget system, is possible for several reasons. First of all, accommodatory acts are continually being extended to new and different features of the surround. To the extent that a newly accommodated-to feature can fit somewhere in the existing meaning structure, it will be assimilated to that structure. Once assimilated, however, it tends to change the structure in some degree and through this change make possible future accommodatory extensions. Also, as discussion of schemes will show, assimilatory structures are not static and unchanging, even in the absence of environmental stimulation. Systems of meanings are constantly becoming reorganized internally and integrated with other systems. ... . What prevents the organism from mastering, in one fell swoop, all that is cognizable in a given terrain? The answer is that the organism can assimilate only those things which past assimilations have prepared it to assimilate. There must already be a system of meanings, an existing organization, sufficiently advanced that it can be modified to admit the candidates for assimilation which accommodation places before it.[52]

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[51]John H. Flavell, The Developmental Psychology of Jean Piaget, (Princeton: D. Van Norstrand Co., Inc., 1963).

[52]Ibid., pp. 49-50.

Students' cognitive understanding of curriculum, therefore, may be described as students' adjustment in the perception of the geo-physical world due to changes in accommodation, of already existing logico-deductive structures, based on verbal understanding. Piaget, in The Mechanics of Perception,[53] concluded that when the human organism encounters a concrete situation in which he can apply abstract logico-deductive structures, he learns. Successes or failures allow the human organism to reevaluate his verbal understanding, to decentralize his beliefs, and allow for modification of his logico-deductive structures. Therefore, alteration in perceptions, through multi-sensory learning experiences, has an implication for cognitive understanding at all cognitive levels. Piaget summarized his findings by stating:

> In the end, the relative adequacy of any perception to any object depends on a constructive process and not on an immediate contact. During this constructive process the subject tries to make use of whatever information he has, incomplete, deformed or false as it may be, and to build it into a system which corresponds as nearly as possible to the properties of the object. He can only do this by a method which is both cumulative and corrective, and which, in perception, is based on decentration or on a consideration of successive centrations which correct one another's deformations. It is of great interest to find this event of decentration occurring even at the perceptual level, because it appears in one form or another as a necessary condition for cognitive adaptation at all levels of the elaboration of knowledge.[54]

Students' increase in cognitive understanding, therefore, appeared to be the students' increased ability to hypothesize cause and effect

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[53] Jean Piaget, Mechanics of Perception, (New York: Basic Books, Inc., 1969).

[54] Ibid., p. 365.

relationships from the information presented in the classroom.

A measurement of students' cognitive understanding of curriculum content being taught required measuring students in the act of free expression. Bloom, in the Taxonomy of Educational Objectives: Cognitive Domain, discussed the means and methods of using cognitive taxonomies, when he stated:

> One may take the Gestalt point of view that the complex behavior is more than the sum of the simpler behaviors, or one may view the complex behavior as being completely analyzable into simpler components. But either way, so long as the simpler behaviors may be viewed as components of the more complex behaviors, we can view the educational process as one of building on the simpler behavior. Thus, a particular behavior which is classified in one way at a given time may develop and become integrated with other behaviors to form a more complex behavior which is classified in a different way. In order to find a single place for each type of behavior, the taxonomy must be organized from simple to complex classes of behavior. Furthermore, for consistency in classification, a rule of procedure may be adopted such that a particular behavior is placed in the most complex class which is appropriate and relevant.[55]

Bloom felt that his taxonomy of education objectives in the cognitive domain would help clarify and create an understanding of known types of behaviors in education. The Bloom's Taxonomy of Educational Objectives: Cognitive Domain has been used as a ranking instrument in the classroom even though it was not designed for this purpose. Bloom stated:

> Some research workers have found the categories of use as a framework for viewing the educational process and analyzing its workings. For instance, the AERA Committee on

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[55]Bloom, op. cit., p. 16.

Criteria of Teacher Effectiveness suggests its use in analyzing the teacher's success in classroom teaching. Bloom used them in analyzing the kinds of learning that take place in class discussions. Equally important, the psychological relationships employed by the classification scheme are suggestive of psychological investigations which could further our understanding of the educational process and provide insight into the means by which the learner changes in a specified direction.

But any of these uses demands a clear understanding of the structure of the taxonomy, its principles of construction, and its organization.[56]

V. THE TAXONOMIC APPROACH

In Mirrors for Behavior, by Simon and Boyer,[57] taxonomic models are presented which were designed to indicate changes in classroom behavior as they occurred as a result of a curriculum process. Through a measurement of the frequency of occurrence of a certain type of classroom behavior over time, changes in specific types of behavior could be noted.

Simon and Boyer,[58] members of the Research for Better Schools, Inc., outlined twenty-six such observational models in Volume One of Mirrors for Behavior.

Simon and Boyer stated:

Classroom interaction analysis systems are a relatively new data collection technique. The lengthy bibliographical section of this volume is an indication of the rapidly growing interest of the educational researcher and not the antiquity of the technique. This volume contains an overview of

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[56]Bloom, op. cit., p. 3.

[57]Anita Simon and Gil Boyer, Mirrors for Behavior, (Philadelphia: Research for Better Schools, Inc., 1967).

[58]Ibid.

the field, a synthesis of the developments to data, a prognosis of future use, an annotated compilation of twenty-six instruments representing a variety of approaches both in the affective and cognitive domains, and an extensive bibliography of reports of research and teacher training activities using classroom observation instruments.

It should be noted that this collection is not intended as a book of readings, but rather as a reference for the researcher and student concerned with the development and application of these instruments.[59]

The Mirrors for Behavior now contains seventy-nine classification models, most of which have been extensively tested in actual field use. Each taxonomy presented was designed to analyze a specific classroom behavioral occurrence.

The Florida Taxonomy of Cognitive Behavior,[60] as designed by Brown was designed to measure the level of both the teachers' and students' cognitive oral behavior in the classroom. Brown's premise was that his taxonomy would measure the levels of cognitive understanding existing in any classroom setting, and would describe at what level this classroom behavior occurred:

It has long been assumed that the school's main task has been to promote intellectual activity, yet the problem in the analysis of the cognitive behavior in the classroom have been difficult to solve. The search for a system which would enable an observer efficiently and effectively to view and to record the cognitive behavior of teacher and students in relevant terms has been an arduous one. This is the contribution which the developers of the Florida Taxonomy of Cognitive Behavior have made--to take a widely used and accepted theory of cognition and develop a system designed to measure the cognitive behavior

[59]Simon and Boyer, op. cit., Vol. 1, "Preface."

[60]Simon and Boyer, op. cit., Vol. 8, pp.37:1-2 to 37:2-9.

of both students and teachers in a classroom. Based upon the Taxonomy of Educational Objectives: Cognitive Domain, it is a sign system comprised of items organized in a somewhat hierarchial order, from the more simple to the more complex of cognitive activities.[61]

Brown's Florida Taxonomy of Cognitive Behavior provided the best approach for measuring changes in students' cognitive understanding of ecological concepts. Brown's reflection of Bloom's taxonomy of the cognitive domain assured that results could be translated into meaningful educational objectives. Brown modified Bloom's taxonomy into a classroom observational instrument:

> The items which comprise the Taxonomy reflect seven levels of thinking or cognitive behavior. They are labeled Knowledge, Translation, Interpretation, Application, Analysis, Synthesis, and Evaluation. These levels follow the system developed by Bloom and others in their handbook, with the exception of the translation and interpretation levels which Bloom included under the heading of comprehension. However, translation and interpretation represent distinct kinds of thinking and are treated as separate levels in this instrument.
>
> These levels of cognitive behavior are assumed to represent increasingly complex intellectual skills and are somewhat hierarchial in the sense that the learner must acquire knowledge (the lowest level) and be able to comprehend it (the second and third levels), before he can deal with it in some manner (represented by upper levels). The assumption that these intellectual abilities grow increasingly complex in nature does not suggest that the upper levels are only present in the cognitive behavior of the mature individual, but rather that they can occur in some form at each developmental stage, although the younger child will deal with more concrete information as he participates in these activities. Thus the Florida Taxonomy subscribes to the theory that intellectual development involves both the acquisition of knowledge and its utilization; there are distinct and discreet intellectual abilities which must be employed in this utilization;

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[61]Simon and Boyer, op. cit., Vol. 8, pp. 37:1-2.

> these abilities can be discriminated and many may occur in some form at each developmental stage of the child.[62]

A copy of Brown's Florida Taxonomy of Cognitive Behavior will be found in Appendix A, page 66.

VI. SUMMARY

The purpose of the review of the related literature was to investigate how an outdoor experience, called an exploratory field trip, produced a change in students' cognitive understanding of curriculum content, and to investigate the Gestaltist approach for evaluating students' cognitive understanding. The use of a cognitive taxonomy to measure change in students' cognitive oral behavior in the classroom was also discussed. This chapter specifically researched the existing literature with respect to pre-planning and follow-up experiences to ascertain a way to clarify and evaluate meaningful cognitive understanding resulting from an innovative outdoor experience. Students' increased ability to interact in an outdoor setting and the instructor's ability to plan and direct the types of experiences the students should encounter in the out-of-doors were found to be central issues in increasing students' understanding of curriculum content being taught.

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[62] Simon and Boyer, op. cit., Vol. 8, pp. 37:2-4.

CHAPTER III

METHODOLOGY

This research project was designed to study the effects of an outdoor education sensory experience on changing the level of students' cognitive understanding of ecology. Specifically, this research project was limited to the study of the effects of the exploratory field trip curriculum process on a class of sixth grade elementary school students. It was expected that the subjects would perform at higher cognitive levels in their study of ecological communities as the result of this exploratory field trip experience. It was further recognized that no experimental controls could be provided to change the cultural and socio-economic background of the students; therefore, the following description of the population is provided.

I. DESCRIPTION OF POPULATION

The sixth grade class under investigation consisted of eleven boys and nine girls of lower socio-economic background as determined by the school's grant of federal funds under Title I of the Elementary and Secondary School Act of 1965. Nine of the students had Spanish surnames.

II. SELECTION OF THE SITE AND INSTRUCTIONAL PROGRAM

Albuquerque Public Schools' Exploratory Field Trip consisted of an outdoor experience at the Environmental Education Laboratory and pre- and post-field trip experiences. Albuquerque Public Schools' Environmental

Education Laboratory was selected for the following reasons:

1. The Laboratory provided an established outdoor education setting which was used daily by the school system.

2. The Laboratory provided a setting where the outdoor exploratory field trip experience was in use.

3. The objectives of the program tried to enrich students' understanding of abstract concepts in ecology through concrete experiences in the out-of-doors.

4. The program already had a curriculum guide which included suggested pre-field trip and follow-up experiences.

5. The program had specific curriculum content. The classroom and Laboratory provided a constant setting in which many extraneous variables would remain constant during the observation period.

III. SELECTION OF THE RESEARCH DESIGN

The study of the change in the level of students' cognitive understanding of the ecological concepts being taught required the recording of data over a sufficient time period to minimize the possibility that measured changes were the result of spurious factors and not the hypothesis under investigation. Periodic measurements over a sufficient time period were needed to denote change in the cognitive complexity of students' dialogue in the classroom.

The research design was a modification of the Campbell and Stanley Research Design Number Seven, (O_1 O_2 O_3 O_4 X O_5 O_6 O_7 O_8). The Albuquerque Public Schools' Exploratory Field Trip had three

pre- and post-field trip lesson plans. The Campbell and Stanley design called for four such plans; therefore, the Campbell and Stanley research design was modified to fit the research setting under investigation ($O_1\ O_2\ O_3\ X\ O_4\ O_5\ O_6$) and to further control the effects of history.

Stanley and Campbell stated:

> The essence of the time-series design is the presence of a periodic measurement process on some group or individual and the introduction of an experimental change into the time series of measurements, the result of which are indicated by a discontinuity in the measurements recorded in the time series.
>
> It can be diagrammed thus:
>
> $O_1\ O_2\ O_3\ O_4\ X\ O_5\ O_6\ O_7\ O_8$.[63]

According to Campbell and Stanley the "time series" design provided adequate control for internal and external validity of the data collected, except for history; that is, in "time series" research studies there was a greater possibility for intervening and uncontrolled experiences to effect the results of the study, particularly as the measured events were further removed from the experimental treatment.[64]

The effects of history in this study were accounted for in several ways. The fact that the subject matter under investigation by the class was adaptation, change, and interdependency in ecological communities somewhat limited other possible sources of information regarding these topics of environmental awareness. Most of the knowledge

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[63]Campbell and Stanley, op. cit., p. 37.

[64]Ibid., p. 39.

regarding these ecological concepts would have to come through the classroom discussion periods and the investigation in the out-of-doors. Television and radio programs were monitored during the nine-day observation period (O_1 O_2 O_3 X O_4 O_5 O_6) which spanned from Monday, May 9, 1972, to the following Tuesday, May 16, 1972.

No radio or television programs were noted which dealt specifically with adaptation, change or interdependency in ecological communities or in the explanation of what constituted an ecological zone. A significant increase in higher level cognitive oral behavior during the observation before the outdoor experience would indicate that some extraneous stimuli other than the outdoor experience influenced the students' behavior and thus the effects of the outdoor experience would be difficult to justify. Experimental isolation was declared, however, due to the safeguards inherent in the consistency of the setting and in the control of extraneous variables which, if uncontrolled, might provide support for a rival hypothesis.

IV. USE OF THE OBSERVATIONAL INSTRUMENT

The classroom dialogues from six tape-recorded classroom sessions were translated into frequency marks and tabulated according to the seven weighted categories of Brown's <u>Florida Taxonomy of Cognitive Behavior</u>, see Appendix A, page 66. Brown stated:

> The <u>Florida Taxonomy of Cognitive Behavior</u> is an observational instrument consisting of fifty-five items which describe cognitive behavior that can be evidenced by both pupils and teachers in classroom situations. The observer's

regarding these individual lessons which were to come through the classroom discussion periods and the investigation in the school homes. Television and radio programs were monitored during the seven-day observation period (M, T, W, Th, F, M, T) which spanned from Monday, May 8, 1972, to the following Tuesday, May 16, 1972.

No radio or television programs were noted which dealt specifically with migration, changes in interdependency in ecological communities or in the maintenance of life contributions to a particular area. A significant increase in higher level cognitive oral behavior during the observations before the academic experience would indicate that some extraneous stimuli other than the actual experience influenced the students' behavior and thus the efficacy of the academic experience would be difficult to justify. Experimental isolation was realized, however, due to the safeguards inherent in the consistency of the setting and in the control of extraneous variables which, if uncontrolled, might provide support for a rival hypothesis.

IV. USE OF THE OBSERVATIONAL INSTRUMENT

The classroom dialogues from the tape-recorded lessons were translated into frequency counts, and tabulations according to the seven selected categories of Brown's Florida *Taxonomy of Cognitive Behavior*, see Appendix A, page 165. Brown states:

> The Florida Taxonomy of Cognitive Behavior is an observational instrument consisting of [illegible] items which describe cognitive behaviors that can be exhibited by both pupils and teachers in classroom situations. The category is

> task is to identify and record these behaviors as they occur within specified time periods. The mechanics of using the instrument are simple. There are five separate six-minute recording periods in each thirty-minute observation. The observer records behavior as it occurs, checking each item of teacher behavior as it occurs, checking each item of teacher behavior and students' behavior in the appropriate column as it happens. Items which describe behaviors that did not occur or for which a discrimination cannot be made are left unmarked. A particular item is marked only once in a given six-minute period, no matter how often that specific behavior occurs. If a behavior is represented by more than one item, all items that are unmarked are checked. If a behavior does not fit into the framework of the instrument, it is ignored. At the end of the thirty-minute period, the recorded teacher behaviors and pupil behaviors are tallied to produce a record of the cognitive activities which have taken place during the observation.[65]

The seven categories of the _Florida Taxonomy of Cognitive Behavior_ were:

1. (1.10) Knowledge of Specifics

   (1.20) Knowledge of Ways and Means of Dealing with Specifics

   (1.30) Knowledge of Universals and Abstractions

2. (2.00) Translation

3. (3.00) Interpretation

4. (4.00) Application

5. (5.00) Analysis

6. (6.00) Synthesis

7. (7.00) Evaluation

Below are some pertinent examples taken from the six classroom tape recordings:

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[65]Simon and Boyer, _op_. _cit_., pp. 37:2-9.

1. (1.10) KNOWLEDGE OF SPECIFICS (recall)

Teacher

"What was one of the things we were talking about yesterday?" (1.10)

Student A

"Change." (1.10)

(1.20) KNOWLEDGE OF WAYS AND MEANS OF DEALING WITH SPECIFICS (recall in sequential order, or pattern)

Teacher

"When we were on our field trip to the mountains, what did we see first, before we saw the squirrel?" (1.20)

Student B

"Vanilla trees." (Ponderosa Pine) (1.20)

(1.30) KNOWLEDGE OF UNIVERSALS AND ABSTRACTIONS (states general principle or law)

Teacher

"Why wouldn't we find trees in the desert?" (1.30)

Student C

"Trees need water to live." (1.30)

Student A

"It's too hot in the desert." (1.10)

Student D

"Birds don't plant trees in the desert." (1.30)

2. (2.00) TRANSLATION (part-for-part retention)

Teacher

"Remember yesterday we were talking about similarities and differences. What did we say?" (1.10)

Student B

"Some people were taller and shorter, and some kids were fat and skinny." (2.00)

3. (3.00) INTERPRETATION (reordering knowledge - new viewpoint)

Teacher

"John, can you tell us, in your own words, what we mean by adaptation." (3.00)

Student E

"It's like adjusting to the weather. Like wearing a heavy coat in the winter." (3.00)

4. (4.00) APPLICATION (use of abstractions to solve concrete problem)

Teacher

"When we were on our field trip to the mountains, what things did we find living in the Sonorian zone?" (1.10) "Why?" (2.00)

Student C

"Cactus." (1.10) "Because it was dry up there." (4.00)

5. (5.00) ANALYSIS (breaking problem into parts)

Teacher

"What would happen if we shot all the woodpeckers in the forest?" (3.00)

Student F

"The woodpeckers eat bugs, so the bugs would become overpopulated and eat up the forest." (5.00)

6. (6.00) SYNTHESIS (putting together parts to find a solution to a problem.)

Teacher

"What are the things we could do to get rid of our trash problem?" (6.00) "What's wrong with that?" (7.00)

Student G

"Burn it." (6.00) "Oh! You would have air pollution because of the smoke from the fire." (6.00)

7. (7.00) EVALUATION (judges a situation according to a set of criteria.)

Teacher

"Is there anything else you think is important, and we should talk about?" (1.10)

Student E

"I would like to know more about how the leaves got bigger as we went up the trail, because of more moisture." (7.00)

Students' responses could not have been as accurately ranked without knowing in what context the teacher's question was asked. Questions, by their nature, anticipate an answer. Questions were ranked at the level it would take to provide minimally correct answers.

The use of the teacher-student interaction interval as the recording unit rather than the five time units cited permitted more sensitivity to change than was possible in the suggested time unit recording method. This method permitted the plotting of cognitive mean scores of students based on the actual frequency of occurrence in the classroom. Brown stated that:

> The Taxonomy, used by trained observers in classroom situations, will provide data which indicates the kinds of intellectual behavior both students and teachers are producing and, to some extent, the frequency with which they occur. By using the Florida Taxonomy in systematic observation, one can discover if the acquisition of information is the central focus of the teachers and students he is observing or if they are engaged in cognitive behavior which go beyond the memorization and recall of facts and information.[66]

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[66]Simon and Boyer, op. cit., p. 37:22.

The present study did not use the six-minute intervals as did Brown. Rather this study investigated teacher solicitations and the resulting student responses as a basic unit of study. The students' responses were categorized after comparing the response with the teacher's solicitation. The teacher's cognitive oral behavior in the classroom did not enter directly into the testing of the null hypotheses, but the teacher's questions became indicators as to what level students' answers should be categorized. Answers from students could be the result of rote recall or the result of analysis, synthesis or evaluation. Only by analyzing the students' answers with the structure of the teacher's questions was an accurate assessment of the students' cognitive level possible. Often, students' responses regarding the teacher's questions exceeded the teacher's expectations. See pages 42 and 43.

V. METHODOLOGY AND STATISTICAL TREATMENT

1. The study had six observation periods in all. Observation periods O_1, O_2, and O_3 occurred before the experimental treatment X (the field trip) and periods O_4, O_5, and O_6 occurred after the experimental treatment.

2. The experimental sequence of observation-treatment-observation took place on consecutive days. Observation periods O_1, O_2, and O_3 took place on Monday, Tuesday, and Wednesday. Thursday was the day of the experimental field trip. Observation periods O_4, O_5, and O_6 took

place on Friday, Monday, and Tuesday. The observations and treatment occurred between May 9 and May 16, 1972.

3. During each observation period the classroom discussion was recorded. The teacher's questions and students' responses were later ranked according to the categories of the Florida Taxonomy of Cognitive Behavior.

4. The responses for each thirty-minute time period received a weighted rank order, one (Nx1) through seven (Nx7), and were treated mathematically (ΣN) to find the mean scores for each observation period. The formula used to determine the Cognitive mean (Cm) was:

$$Cm = \frac{(Nx1)+(Nx2)+(Nx3)+(Nx4)+(Nx5)+(Nx6)+(Nx7)}{\Sigma N}$$

5. The Cognitive mean scores for each of these six half-hour time periods were later graphed to show any change in students' and teacher's mean cognitive level of understanding during each classroom discussion period. Changes in cognitive mean scores are noted and analyzed in Chapter IV.

6. To test the null hypothesis for significant difference in students' cognitive understanding of the ecological concepts, before and after being exposed to the outdoor experience, all frequency distributions for the six time periods were not weighted. All pre-trip and post-trip frequency marks were treated as individual ratio of exhibited high and low cognitive skills. Responses in categories 1, 2, and 3 were grouped together as low level cognitive skills. Response categories 4, 5, 6, and 7 were grouped together as high level cognitive

phase of the discussion, [illegible] the teacher and students [illegible]

[illegible] between the [illegible] and the [illegible].

3. During each observation period the classroom discussion was recorded. The teacher's questions and students' responses were later rated according to the seven categories of the *Florida Taxonomy of Cognitive Behavior*.

4. The responses for each thirty-minute time period were then weighted: each answer, one (n=1) through seven (n=7), and were tabulated mathematically (CM) to find the mean scores for each observation period. The formula used to determine the cognitive mean (CM) was:

$$CM = \frac{(n_1)(1)+(n_2)(2)+(n_3)(3)+\dots+(n_7)(7)}{N}$$

5. The cognitive mean scores for each of these six half-hour time periods were later graphed to show any change in students' and teacher's mean cognitive level of understanding during each classroom discussion period. Changes in cognitive mean scores are noted and analyzed in Chapter IV.

6. To test the null hypothesis for significant differences in students' cognitive understanding of the ecological concepts, before and after being exposed to the outdoor experience, all frequency distributions for the six time periods were not combined. All pre-trip and post-trip frequency scores were treated as individual ratio of exhibited high and low cognitive ability. Responses in categories 1, 2 and 3 were grouped together as low level cognitive ability. Responses categories 4, 5, 6, and 7 were grouped together as high level cognitive

skills. The assumption behind this statistical procedure was that students respond to classroom questioning by reorganizing previously experienced knowledge into more advanced cause and effect relationships, one can assume that an increase in students' cognitive understanding of the curriculum had taken place. The increase frequency of exhibited high level cognitive skills 4, 5, 6, and 7 would indicate that the ecological concepts of adaptation, change, and interdependency had taken on a more functional meaning for the students, i.e., curriculum enrichment had occurred.

7. By creating pre- and post-test ratios $\frac{1}{N} \sum_{1}^{N} \frac{X_i}{Y_i} = \frac{\bar{X}\cdot}{\bar{Y}\cdot}$,

based on frequencies of exhibited high (Y_i) and low (X_i) cognitive skills, pre ($\frac{\bar{X}\cdot}{\bar{Y}\cdot}$) and post ($\frac{\bar{X}\cdot}{\bar{Y}\cdot}$) to the outdoor educational experience, it was possible to convert ratio means into "pre" and "post" decimal means and subject them to an "F" test to test for significant difference in students' cognitive understanding at the .05 level of significance.

8. A Pearson Product Moment correlation coefficient was used to check intra-rater reliability of the use of the test instrument coefficient of stability of the "rater" and the test instrument over time. This was achieved by "re-ranking" observation tape O_1 to check for internal consistency of ranking procedures after the last tape O_6 had been ranked. See Appendix C, page 92.

VI. RATIONALE FOR THE METHODOLOGY AND STATISTICAL TREATMENT USED

The use of a ratio mean on data collected from an ordinal scale is not an unusual method of statistical treatment, but is foreign to the field of education which relies more on interval data. Ratios were used to test for significant differences between pre- and post-test data. Ratios are based on proportions rather than on equal interval scales.

Glasser and Stanley stated:

> Ratio measurement differs from interval measurement only in that the zero point is not arbitrary but indicates total absence of the property measured. The measurer can perceive the absence of the property, and he has a unit of measurement with which he records differing amounts of the property. Equal differences between the numbers assigned in measurement reflect equal differences in the amount of the property possessed by the things measured. Furthermore, since the zero point is not arbitrary but absolute, it is meaningful to say that A has two, three, or four times as much of the property as B.
>
> . . . . Most measurement in educational research and in the behavioral sciences occurs at the nominal, ordinal, and interval levels. Few important variables in these fields as yet lend themselves to ratio measurement; in fact, one must search diligently to find scales of measurement that will satisfy the conditions of an interval scale. Occasionally, ratio-scale variables such as time (to solve a problem or learn a list of words), height, weight, or distance will be of interest, but such occasions arise infrequently. You must undertake to recognize measurement at the nominal and ordinal levels and prepare for the problems that the analysis and interpretation of such data present.[67]

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[67]Gene V. Glasser and Julian C. Stanley, Statistical Methods in Education and Psychology, (Englewood Cliffs, New Jersey: Prentice Hall, Inc., 1970), p. 11.

STATISTICAL TREATMENT

The use of a ratio scale on data collected from an ordinal [illegible] is not an uncommon method of statistical treatment, but is [illegible] to the field of education [illegible] in [illegible] study. Ratios were used as tests for significant differences between pre- and post-test data. [illegible] on [illegible] [illegible] [illegible] [illegible].

Ratio and Interval Scales

Ratio measurement differs from interval measurement only in that the zero point is not arbitrary but indicates total absence of the property measured. The measure can perceive the absence of the property, and he has a unit of measurement with which to measure differing amounts of the property. Equal differences between the numbers assigned in measurement reflect equal differences in the amount of the property measured by the ratings measures. Furthermore, since the zero point is not arbitrary but absolute, it is meaningful to say that A has two, three, or four times as much of the property as B.

. . . Most measurement in educational research and in the behavioral sciences occurs at the nominal, ordinal, and interval levels. The important variables in these fields as yet lend themselves to ratio measurement; in fact, one must search diligently to find scales of measurement that will satisfy the conditions of an interval scale. Occasionally, ratio-scale variables such as time (to solve a problem or learn a list of words), height, weight, or distance will be of interest, but such occasions arise infrequently. The [illegible] to [illegible] at the nominal and ordinal levels and [illegible] for the analysis and interpretation of such data present.[1]

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[1] Gene V. Glass and Julian C. Stanley, Statistical Methods in Education and Psychology (Englewood Cliffs, New Jersey: Prentice Hall, Inc., 1970), p. 11.

This research project dealt with the statistical comparison of the level of students' cognitive-oral behavior in the classroom. The amount and duration of students' exhibited high-level cognitive responses to the teacher's questions and statements were statistically compared through the use of cognitive mean ratios. This was statistically possible because ratio means were based on a comparison of a specific amount of some quantity in a given space over specific, comparable, time periods.

In this study, an ordinal scale of seven stratified variables, with fifty-five sub-variables, was used to measure students' cognitive-oral behavior in a specific classroom setting and over specific time periods. These seven categories of Brown's _Florida Taxonomy of Cognitive Behavior_ provided an ordinal scale similar to the types of ordinal scales used in sociology to separate specific observed socio-economic traits into a hierarchical scale of socio-economic groupings. All such types of ordinal scales can be subjected to ratio-statistical treatment, if the data produced by these scales are clustered into two categories after the initial collection of data. Ordinal scales, although necessary for classification of observed traits, or behavior, tend to distort the frequency of occurrence, when converted to weighted group mean scores and are not beneficial when testing for significance. To eliminate this within-factor level-combination distortion, and to achieve a more true reading of the frequency of occurrence of high level cognitive skills, ratio means were used as a test of significance difference in students'

cognitive understanding before and after the field trip experience.

This process provided for greater sensitivity in comparing students' change in cognitive-oral classroom behavior based on a time interval, rather than distortions brought about by mixing weighted categories with frequencies of occurrences. Therefore, the use of a ratio mean reduced the chances that the null hypothesis was rejected because of the influences from weighted categories rather than on the number of specific occurrences observed within a specific stipulated time period.

Glasser and Stanley pointed out that the process of reducing distortion in classification systems, due to within-treatment variables caused by weighted categories, can be reduced by regrouping previously collected data into an "all or none" classification system based on comparison of the basic experimental unit used when the total categories were used. Glasser and Stanley stated:

> We call an ordinal scale variable used as an explicit factor in the experimental design, such as a socio-economic status of each experimental unit, a STRATIFYING VARIABLE. There might be five levels, such as high, upper middle, middle-middle, lower middle and low socio-economic status, creating a five level classificatory (i.e., not manipulated) factor.
>
> An interval or nearly interval scale or a ratio scale can be used to yield what is called a leveling variable. To reduce within-factor level-combination variability, one may group the experimental units before the experiment begins on something, such as measured reading comprehension or height, that is expected to correlate well within treatments with the outcome measure of the experiment. If there are T levels of a treatment factor and LT experimental units, one would arrange the experimental units from highest to

lowest on the pre-measured factor into L levels. Within each such level, one experimental unit would be assigned at random to each of the T treatments (i.e., the T levels of the manipulated variable), creating one replicate of an L X T design. If the measures of the leveling factor do correlate significantly greater than zero with the outcome measures, then (as in the twin design outlined above) the within-treatment variability will be reduced significantly.

Alternatively, one might choose to use N = nLT experimental units, where n is greater than 1. (In the above paragraph, n = 1.) Then one would group the N experimental units, from highest to lowest, into L = N/nT sets, and would assign at random n experimental units to each treatment within each level. This would permit testing the interaction of levels with treatments, which the n = 1 design does not allow directly.[68]

A statistical system based on measurement of the frequency of occurrence of a single group of traits (high level cognitive skills) was more pre-disposed to the use of the ratio means in testing for significant differences between two different group scores, than interval statistical procedures traditionally used in education. The "F" test was used to test the significant difference between pre-trip and post-trip data. This provided the most logical procedure for testing for significance (i.e., testing a ratio mean, with a ratio mean).

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[68] Ibid., pp. 493-495.

CHAPTER IV

PRESENTATION AND ANALYSIS OF THE DATA

The data in this study was presented in the form of cognitive mean and ratio mean scores. The graphic comparison of students' cognitive mean scores is presented in Figure 1, page 54, through Figure 3, page 57, to provide a basis for analysis of students' increased understanding of the ecological concepts being presented during the research period.

The null hypothesis was, as indicated earlier, there would be no significant difference between the mean cognitive level of sixth grade students' understanding of ecology before and after being exposed to a one-day exploratory field trip. The test of the null hypothesis was achieved by comparing the change in the frequency of exhibited high level cognitive skills before and after the students were exposed to this outdoor exploratory experience.

This was achieved through the use of pre- and post-trip ratio means

$$\frac{1}{N} \sum_{1}^{N} \frac{X_i}{Y_I} = \frac{\bar{X}'}{\bar{Y}'} .$$

See Table 2, page 59.

I. PRE-OUTDOOR EXPOSURE DATA

The three pre-outdoor exposure periods had cognitive mean scores which were somewhat homogeneous. Observation periods O_1 to O_3 represent

the level of students' cognitive understanding of ecological concepts previous to their exposure to the exploratory field trip experience. Figure 1, page 54, indicated that students' cognitive level of classroom dialogue moved from the cognitive mean of 1.413 to 1.551. This was a difference of .134.

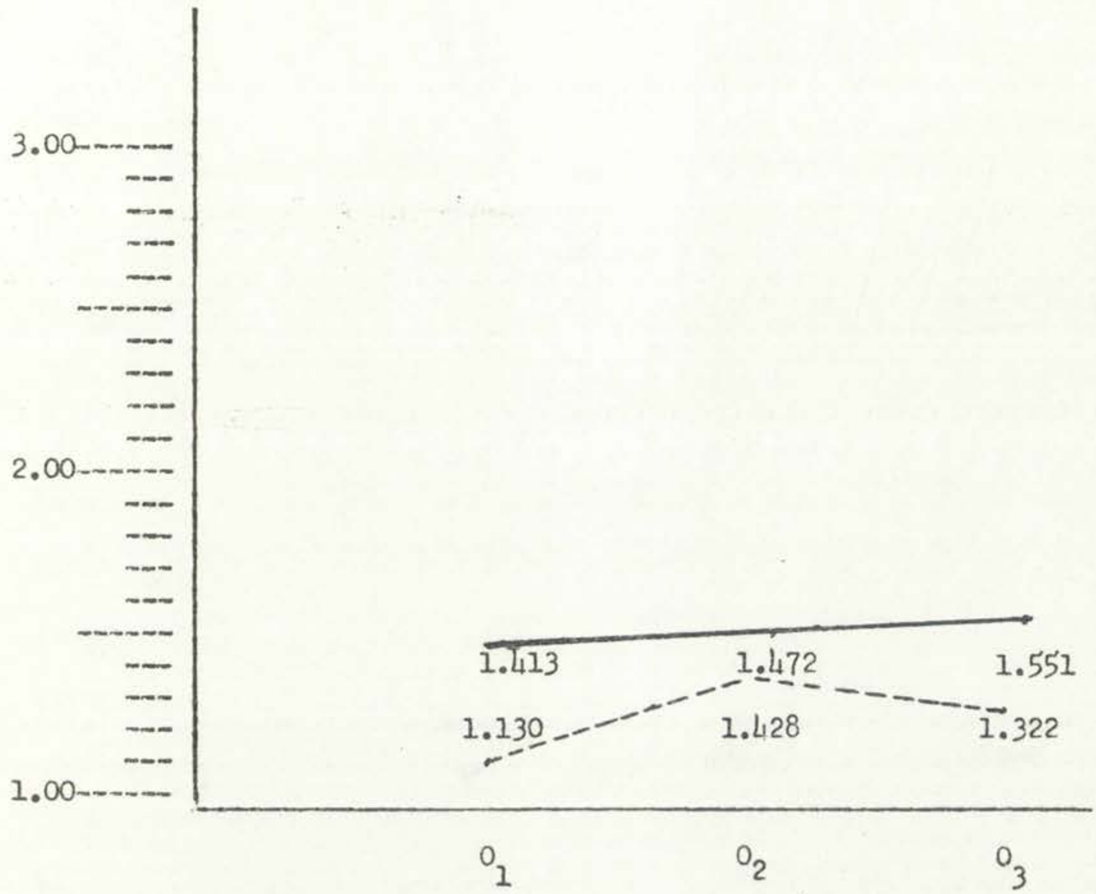
The rate of students' increase in cognitive understanding of the ecological concepts remained rather constant, regardless of the fluctuations in the teacher's level of presentation during each observation period. See Figure 3, page 57.

This would tend to indicate that students' progress in understanding the ecological concepts depended more on what the students did as a group in response to the teacher's message, rather than on the cognitive level of the teacher's presentation.

II. POST-OUTDOOR EXPOSURE DATA

During the post-outdoor exposure periods O_4 to O_6 students' cognitive mean scores showed an increased amount of fluctuation. Figure 3, page 57, indicates the students' cognitive understanding of the ecological concepts jumped from 1.551 during the O_3 observation period to a cognitive mean score of 2.541 during the O_4 observation period. This was a difference of .990 as compared to the .134 difference achieved over the three observation periods previous to the outdoor exposure.

During the post-outdoor exposure period there was a greater frequency of exhibited high cognitive skills as a result of students'

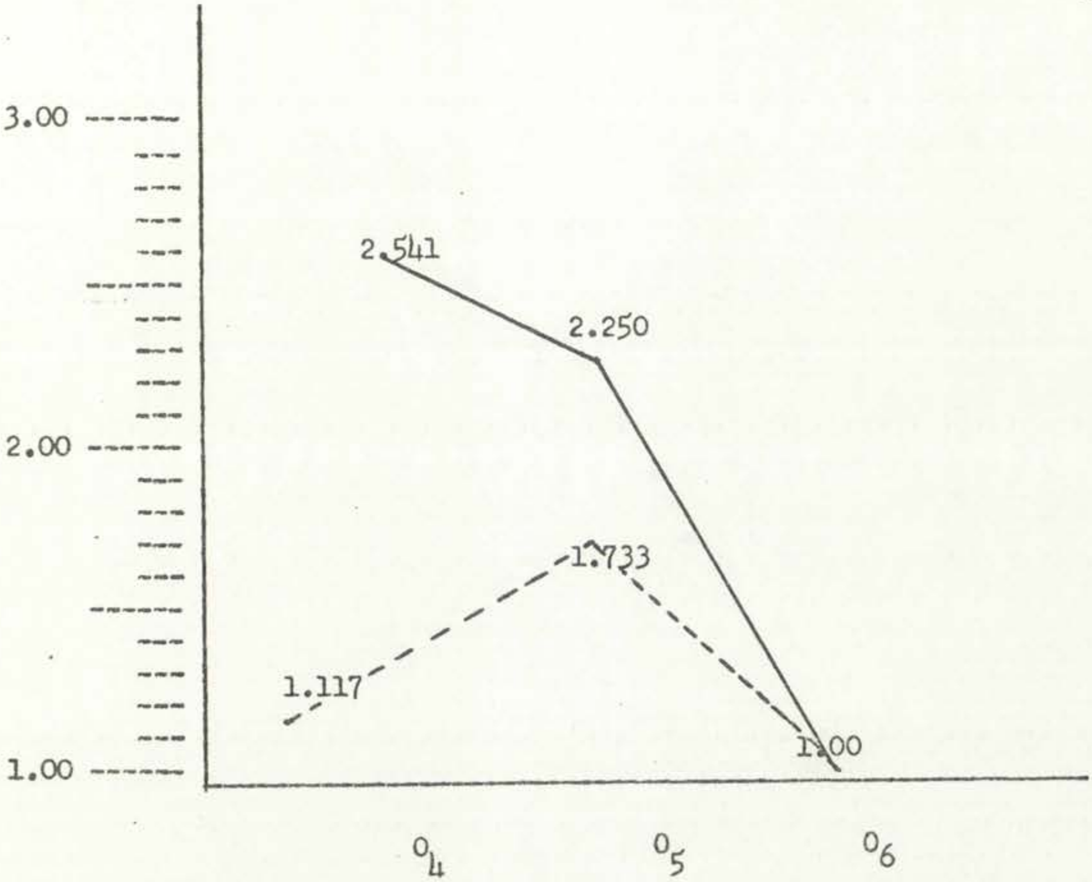


——— Students' Means	1.413	1.472	1.551
- - - - - - Teacher's Means	1.130	1.428	1.322
Mean Difference	0.084	0.044	0.229

FIGURE 1. PRE-OUTDOOR EXPOSURE COGNITIVE MEANS

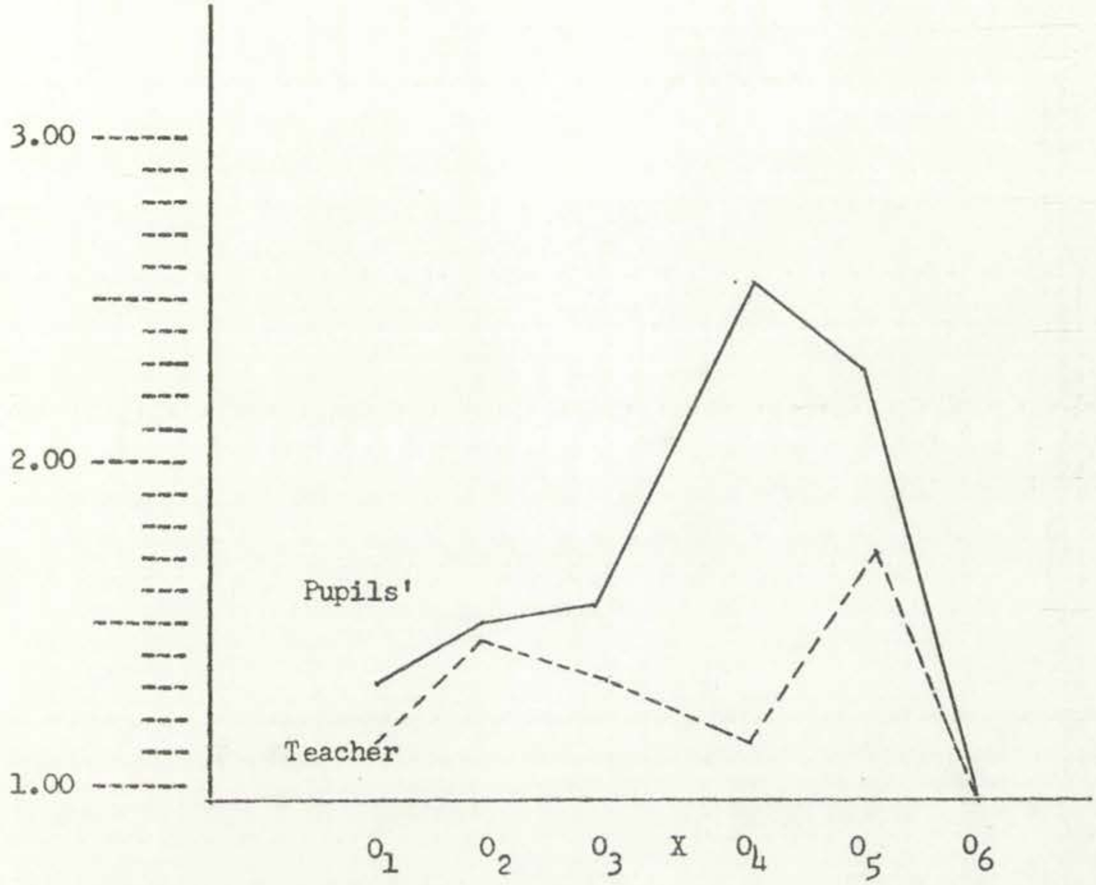
investigation of three ecological communities located on the Sandia Mountains. The teacher's cognitive mean score during the O_4 observation period lagged far behind the level of the students' cognitive mean scores. Figure 2, page 56, illustrated a slight decrease in students' cognitive understanding of the ecological concepts which occurred between observation period O_4 and O_5. The O_4 observation period had a reading of 2.541 and the O_5 reading was 2.250. This tended to indicate that the influence of the outdoor experience on cognitive understanding diminished as the amount of time lapsed between the students' exposure to the out-of-doors and the follow-up experiences.

Observation period O_6 indicated a sharp decline in the post-outdoor exposure slope line. This was felt to be due to the change in both the topic under discussion and the classroom procedure. Period O_6 included a 17-minute slide presentation by the Coors Beer Company on the recycling of aluminum cans, followed by a discussion period. The topic had changed from adaptation, change, and interdependency in ecological communities to the concept of recycling, and specifically to the recycling of aluminum cans. Students' cognitive mean scores dropped from 2.250 during the O_5 observation period to 1.00 during the O_6 observation period. This was a radical change in method, procedure, and topic; therefore, observation period O_6 was considered to be a part of a new curriculum series and a radical departure from the old curriculum pattern. Such a departure was felt to be ultimately beneficial to this study by yielding additional clues



	O_4	O_5	O_6
______ Students' Means	2.541	2.250	1.00
------ Teacher's Means	1.117	1.733	1.00
====== Mean Difference	1.424	.517	0.00

FIGURE 2. POST-OUTDOOR EXPOSURE COGNITIVE MEANS



	O_1	O_2	O_3	O_4	O_5	O_6
Students' Means	1.321	1.472	1.551	2.541	2.250	1.000
Teacher's Means	1.130	1.428	1.322	1.117	1.733	1.000
Cognitive Mean Differences	.191	.044	.229	1.424	.517	.000

FIGURE 3. PRE- AND POST-OUTDOOR COGNITIVE MEAN SCORES

regarding the exploratory field trip process. The conclusion was that the increase in students' cognitive understanding of ecological concepts occurred only when outdoor experiences were closely related to topics which had been previously discussed in the classroom during the pre-planning stages and that the follow-up experiences must be linked to both the pre-planning and the outdoor experience.

III. TESTING OF THE NULL HYPOTHESIS

The null hypothesis, that there would be no significant difference in students' cognitive understanding of three ecological concepts before and after being exposed to a one-day exploratory field trip experience of three ecological communities on the Sandia Mountains, was tested by the use of a pre- and post-trip ratio means. Comparing the number of high and low cognitive skills exhibited by students before and after being exposed to the outdoor exploratory experience, allowed for the computation of fractional ratios. See Table 2, page 59.

The pre-outdoor exposure ratio mean of $\frac{97}{1}$ was compared to the post-outdoor exposure ratio mean of $\frac{72}{12}$ which separated rote recall skills (1-2-3) from problem solving skills (4-5-6-7) based on the seven-point scale of Brown's Florida Taxonomy of Cognitive Behavior.

Students exhibited problem solving skills only once during the pre-field trip period, as compared to twelve times during the post-outdoor exposure periods. The pre-field trip period, the ratio

Cognitive Skill Levels		Pre-Trip Ratio $\frac{\bar{X}\cdot}{\bar{Y}\cdot}$ Sg_2 (97.000)			Post-Trip Ratio $\frac{\bar{X}\cdot}{\bar{Y}\cdot}$ Sl_2 (6.000)		
Low (Recall Skills) X_i	1.00 Knowledge	20	25	19	18	25	7
	2.00 Translation	7	5	8	2		
	3.00 Interpretations	1	6	6	3	17	
- - - - - - - - - - - -		$\frac{\bar{X}\cdot}{\bar{Y}\cdot} = (97.000) = \frac{97}{1}$			$\frac{72}{12} = (6.000) = \frac{\bar{X}\cdot}{\bar{Y}\cdot}$		
High (Problem Solving Skills) Y_i	4.00 Application	1			3	2	
	5.00 Analysis				1		
	6.00 Synthesis				1	4	
	7.00 Evaluation				1		
Time Periods		O_1	O_2	O_3	X O_4	O_5	O_6

DEFINITIONS OF SYMBOLS

X_i = low level cognitive skills
Y_i = high level cognitive skills
N = frequency of students' cognitive oral responses

$\frac{X^1}{Y^1}$ = Sg_2 = pre-trip ratio mean

$\frac{X^{\cdot}}{Y^{\cdot}}$ = Sl_2 = post-trip ratio mean

TABLE 2. PRESENTATION OF THE DATA AND THE TEST OF THE NULL HYPOTHESIS

mean of 97.00 was compared to the post-field trip period ratio mean of 6.00. Through the use of an "F" test, a significant difference between the two group mean scores was found to be significant at the .05 level.

$$F = \frac{Sg^2}{Sl_2}, \; F = \frac{97.00^2}{6.00^2}, \; F = \frac{9409}{36}$$

$$F = 261.333.$$

The null hypothesis, that no significant difference in the cognitive level of students' understanding of the ecological concepts would occur as a result of the students' exposure to an outdoor exploratory field trip experience, was rejected at the .05 level. The alternate hypothesis, that the outdoor exploratory field trip experience did make a difference in students' cognitive understanding of the ecological concepts being taught, was accepted.

IV. SUMMARY

In this chapter, the data regarding the participation of a class of sixth grade elementary school students in the Albuquerque Public Schools' Environmental Education Laboratory was presented and analyzed. The study was designed to see if students obtained higher levels of cognitive understanding of ecological concepts regarding ecological communities, as a result of a one-day exploratory field trip of Albuquerque Public Schools' Environmental Education Laboratory in the Sandia Mountains.

A modification of Campbell and Stanley's Time Series Research Design[69] and the use of Brown's Florida Taxonomy of Cognitive Behavior[70] revealed that the students did achieve a deeper cognitive understanding of the ecological concepts being taught as a result of exposure to an exploratory field trip experience.

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[69]Campbell and Stanley, *op. cit.*, Chapter I.

[70]Simon and Boyer, *op. cit.*, Chapter II.

CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

This study was concerned with the use of cognitive enrichment of ecological concepts through the use of the out-of-doors. Specifically, this study applied the exploratory field trip curriculum process to a class of sixth grade elementary school children to ascertain if an experience in the out-of-doors would significantly influence the level of students' cognitive understanding of the ecological concepts being taught by their instructor.

The Review of Related Literature, Chapter II, indicated that outdoor cognitive enrichment was due to an increase in students' interactions with concrete objects while in the out-of-doors and to the linking of these outdoor encounters to the classroom curriculum content.

A time series design, consisting of six observation periods (O_1, O_2, O_3 X O_4, O_5, O_6) was used to note changes in students' classroom dialogue, after an outdoor exploratory field trip experience. Brown's *Florida Taxonomy of Cognitive Behavior* was used to rank each of these six tape recorded sessions into a hierarchical classification system separating rote recall skills from problem solving skills.

Analysis of the data revealed that an increase in the cognitive level of students' understanding of the ecological concepts had occurred as a result of being exposed to the exploratory field trip of three ecological communities located at Albuquerque Public Schools' Environmental

Education Laboratory. The Florida Taxonomy of Cognitive Behavior was used to re-rank pre- and post-cognitive mean scores into ratio mean scores which indicated a significantly greater increase in problem-solving ability in the class after being exposed to the outdoor experience under investigation. This increase in the cognitive understanding of the ecological concepts was based on the increased exhibition of problem-solving skills, after the outdoor experience. This increase was found to be significant at the .05 level.

I. CONCLUSIONS

1. The exploratory field trip, which was used to increase the level of sixth grade elementary school students' cognitive understanding of the ecological concepts, was found to be effective in raising the level of the sixth grade students' cognitive understanding of ecological communities.

2. The outdoor education experience had a positive influence on the students' cognitive understanding of the ecological concepts being taught when follow-up experiences were closely related to the outdoor experience, and a negative influence when the follow-up experience was unrelated to the pre-planning experience.

3. Students' cognitive skills appeared to be based on a sequential order of previously understood concepts, reinforced by outdoor experiences.

4. The level of the teacher's verbal presentation in the classroom had little effect on the level of students' responses in the

Education Laboratory. The [illegible] was used to compare [illegible] and non-[illegible] were [illegible] with [illegible] which indicated a significantly greater increase in problem-solving ability in the [illegible] after being exposed to the outdoor experience under investigation. This increase in the cognitive understanding of the biological concepts was based on the increased application of problem-solving skills, after the outdoor experience. This increase was found to be significant at the .05 level.

C. CONCLUSIONS

1. The exploratory field trip, which was used to increase the level of sixth grade elementary school students' cognitive understanding of the ecological concepts, was found to be effective in raising the level of the sixth grade students' cognitive understanding of ecological conceptions.

2. The outdoor education experience had a positive influence on the students' cognitive understanding of the biological concepts being taught when follow-up experiences were closely related to the outdoor experiences, and a negative influence when the follow-up experience was unrelated to the pre-planning experience.

3. Students' cognitive skills appeared to be based on a sequential order of previously understood concepts, reinforced by outdoor experiences.

4. The level of the teacher's formal preparation in the classroom had little effect on the level of students' achievement in the

classroom. The verbal statements coupled with visual illustrations may have had a greater influence on students' cognitive understanding than the verbal presentation alone.

II. RECOMMENDATIONS

1. Teachers who were oriented at the Albuquerque Public Schools' Environmental Education Laboratory should be directed to use more visual aids in their pre-planning and follow-up sessions.

2. Additional research is necessary in other subject matter areas to classify and clarify what particular elements of the outdoor experience are responsible for the achievement of students' deeper insight and greater understanding of the curriculum content presented.

3. Carefully controlled experimental research is needed in the area of outdoor education so the amount and the types of students' interactions in the out-of-doors may be correlated with high and low gains in students' cognitive understanding of the curriculum content being presented.

4. The role of pre-planning and follow-up experiences in outdoor education should have priority in curriculum planning. In this study, the nature of the pre-planning and follow-up experiences appeared to be the crucial factor in the success or failure of the achievement of meaningful cognitive gains in the students' deeper understanding of the curriculum content, and needs further investigation.

5. An ongoing environmental education program is needed in the Albuquerque Public Schools to prevent the rapid loss of environmental awareness gained by the Environmental Education Laboratory. See Figure 3, page 57.

6. Much of the relevant literature presently in the area of outdoor education had dealt with descriptive research and in the measurement of changes in students' affective behavior. There was minimal research undertaken in the area of measuring the effects of outdoor education experiences on cognitive learning. Additional studies are needed in a variety of outdoor education settings to note what effect short and long term exposure to the out-of-doors has on students' learning a specific curriculum content. This would help educators in selecting the desired outdoor setting which would meet curriculum goals.

7. Brown's *Florida Taxonomy of Cognitive Behavior* and Bloom's *Taxonomy of Educational Objectives: Cognitive Domain* should be used as a basis for research in the cognitive areas of outdoor education. This would provide a common method of comparison between research studies in this area.

5. [illegible] the ... [illegible] of [illegible] skills, [illegible] related to the [illegible] (cognitive domain). See Figure 3, page 25.

6. Most of the reported literature presently in the area of nutrition education has dealt with descriptive research and the measurement of changes in students' affective behavior. There are minimal research experiments in the area of measuring the effects of various education experiences on cognitive learning. Additional studies are needed in a variety of nutrition education settings to show what effects short and long-term exposure to the curriculum has on students' learning a specific curriculum content. This would help educators in selecting the desired content setting which would meet curriculum goals.

7. Brown's _Florida Taxonomy of Cognitive Behavior_ and Bloom's _Taxonomy of Educational Objectives: Cognitive Domain_ should be used as a basis for research in the cognitive areas of nutrition education. This would provide a common method of comparison between research studies in this area.

APPENDIX A

FLORIDA TAXONOMY OF COGNITIVE BEHAVIOR

FLORIDA TAXONOMY OF COGNITIVE BEHAVIOR

Directions

The Florida Taxonomy of Cognitive Behavior provides a framework for observing and recording the cognitive behavior of the teacher and students in a classroom. Your role as an observer is to watch and listen for signs of the behavior described and to record the behavior as it occurs.

There are five (5) separate 6-minute observation and marking periods in each 30-minute visit to the classroom. These are indicated by the column headings I, II, III, IV, and V. During period I, as you observe the behavior of the teacher and students, go down the list of items and place a check (✓) in the T column (teacher behavior) and/or P column (pupil behavior) beside all items you saw occur. Leave blank all the items that did not occur or for which you cannot make a discrimination. A particular item is marked only once in a given column, no matter how many times that behavior occurs within the 6-minute observation period.

Repeat this process for the second 6-minute period, marking in Column II. Repeat again for the third, fourth, and fifth 6-minute periods, marking in Columns III, IV, and V. Please add the total number of (✓) recorded in Columns I through V for each teacher or pupil behavior and record in the columns headed TOT. There may be from 0 to 5 ✓'s for each item.

____
Name of Teacher

____
Date

____
School

____
Name of Observer

____
Grade & Subject

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

FLORIDA TAXONOMY OF COGNITIVE BEHAVIOR

TOT						
T	P	T/ P	T/ P	T/ P	T/ P	T/ P	1.10 KNOWLEDGE OF SPECIFICS
							1. Reads
							2. Spells
							3. Identifies something by name
							4. Defines meaning of term
							5. Gives a specific fact
							6. Tells about an event
							1.20 KNOWLEDGE OF WAYS AND MEANS OF DEALING WITH SPECIFICS
							7. Recognizes symbol
							8. Cites rule
							9. Gives chronological sequence
							10. Gives steps of process, describes method
							11. Cites trend
							12. Names classification system or standard
							13. Names what fits given system or standard
							1.30 KNOWLEDGE OF UNIVERSALS AND ABSTRACTIONS
							14. States generalized concept or idea
							15. States a principle, law, theory
							16. Tells about orgnztn or structure
							17. Recalls name of prin, law, theory
							2.00 TRANSLATION
							18. Restates in own words or briefer terms
							19. Gives cncrt exmpl of an abstract idea
							20. Verbalizes from a graphic rprsntatn
							21. Trans vrblztn into graphic form
							22. Trans fig stmnts to lit stmnts, or vice v
							23. Trans for lang to Eng, or vice versa

FLORIDA TAXONOMY OF COGNITIVE BEHAVIOR

TOT T	TOT P	T/ P	T/ P	T/ P	T/ P	T/ P	
							3.00 INTERPRETATION
							24. Gives reason (tells why)
							25. Shows similarities, diffrncs
							26. Summarizes or concludes frm obs of evdnce
							27. Shows cause and effect rltnshp
							28. Gives analogy, simile, metaphor
							29. Performs a directed task or process
							4.00 APPLICATION
							30. Applies previous learning to new sitn
							31. Applies principle to new situation
							32. Apply abstrct knldg in a prctcl sitn
							33. Idntifs, selects, and carries out process
							5.00 ANALYSIS
							34. Distngshs fact from opinion
							35. Distngshs fact from hypothesis
							36. Distngshs cnclsn frm stmnts wch suppt it
							37. Points out unstated assumption
							38. Shows interaction or relation of elements
							39. Points out prticlrs to jstfy cnclsn
							40. Checks hypthss with given info
							41. Dstngshs rel frm irrelvnt stmnts
							42. Detects error in thinking
							43. Infers prpse, pt of view, thghts, feelings
							44. Recog bias or propaganda
							6.00 SYNTHESIS (Creativity)
							45. Reorganizes ideas, materials, process
							46. Produces unique cmmnctn, divergent idea
							47. Produces a plan, prpsd set of oprtns
							48. Designs an apparatus
							49. Designs a structure
							50. Devises scheme for classifying info
							51. Formulates hypothesis, intelligent guess
							52. Mks ddctns frm abstrct smbls, propostns
							53. Draws inductive generalizatn frm specifcs
							7.00 EVALUATION
							54. Evaluates something from evdnce
							55. Evaluated something from criteria

FLORIDA TAXONOMY OF COGNITIVE BEHAVIOR

How do students and teachers spend their time in the classroom? What goes on there? These are the kinds of questions that systematic observation of classroom behavior attempts to answer. The classroom behavior of students and the teacher is exceedingly complex and defied analysis until the concept of systematic observation has been brought to bear on the problem. Systematic observation provides a framework through which teaching-learning behavior can be viewed and assessed. Each system of observation enables the observer to look at a classroom from a different vantage point, enabling him to focus on a particular facet of the situation.

It has long been assumed that the school's main task has been to promote intellectual activity, yet the problem in the analysis of the cognitive behavior in the classroom have been difficult to solve. The search for a system which would enable an observer efficiently and effectively to view and to record the cognitive behavior of teacher and students in relevant terms has been an arduous one. This is the contribution which the developers of the Florida Taxonomy of Cognitive Behavior have made--to take a widely used and accepted theory of cognition and develop a system of observation from it. Thus the Florida Taxonomy of Cognitive Behavior[1] is an observational system designed to measure the cognitive behavior of both students and teachers in a classroom. Based upon the Taxonomy of Educational Objectives: Cognitive Domain,[2] it is a sign system comprised of items organized in a somewhat hierarchical order, from the more simple to the more complex of cognitive activities.

[1]Developed by Bob Burton Brown, Richard Ober and Robert Soar, University of Florida, 1967.

[2]Bloom, Benjamin S. Taxonomy of Educational Objectives: Handbook of Cognitive Domain New York: David McKay Company, Inc., 1956.

The Florida Taxonomy reflects, as does the Bloom Taxonomy, an instructional theory which postulates the teacher's basic task in the classroom as the guidance of students in the acquisition of knowledge and the development of intellectual abilities and skills. This theory demands that the student go beyond the mere ingestion of facts and information, to acquire methods and techniques for using them. The learner's task has been defined as a search for appropriate information and methods from previous experiences which are brought to bear on new problems.[3] This requires (1) a background of knowledge or procedures which can be utilized, (2) some analysis or understanding of the new situation, (3) facility in discerning the appropriate relations between previous experiences and new situations, (4) skills in the design and application of techniques to meet the new situation and finally, (5) critical abilities in judging the worth or value of the outcome of the endeavor. In other words, the student must acquire both knowledge and the intellectual abilities and skills to deal with them.

Few educators would disagree that this is, indeed, the basic task of the schools. Yet it has been argued that the acquisition of knowledge has dominated education, that the majority of our institutions and their teachers emphasize the acquiring of information and neglect the development of cognitive processes which are needed in dealing with knowledge. With the Florida Taxonomy of Cognitive Behavior, it is possible more precisely to define and to measure this allegation. The Taxonomy, used by trained observers in classroom situations, will provide data which indicate the kinds of intellectual behavior both students and teachers are producing and, to some extent, the frequency with which they occur. By using the Florida Taxonomy in systematic observation, one can discover if the acquisition of information is the central focus of the teachers and students he is observing or if they are engaged in cognitive behaviors which go beyond the memorization and recall of facts and information.

[3] Ibid. p. 38.

Criteria for the Development of the Taxonomy

Often observational systems have been developed to meet a specific need in a particular research situation and have been expressly tailored to meet this need. In the case of the Florida Taxonomy, the purpose of development was to design a useful and relevant instrument which would assess the intellectual behaviors of teachers and students in the classroom. To reach this objective, a set of criteria for the development of the system was devised. It was felt that if an observational system is to be relevant to the task and widely useful, it should meet certain requirements.

First, a classroom observational system must be based on some theory of cognition in order that behavior can be viewed within a consistent framework. Without this theoretical framework, the data produced by the instrument would be difficult to interpret in a meaningful way. Second, the system must be comprehensive; the items or categories which comprise the system should be so designed that its theoretical foundation is thoroughly represented and the kinds of cognitive activities which occur in classroom situations be included. It must be comprehensive also in the sense that it can be used at all levels of the educational system, from nursery school through senior high school and in all subject matter areas. A very large order!

Another criteria which must be met is that the system must be communicatable; it should not become so esoteric in language or design that it can only be used by a priesthood of the enlightened few. Thus the system and the items which comprise it must be so devised that it can be understood and used. The data it produces must be in a form that can be interpreted reliably and validly by observers after a reasonable amount of training. Last, the instrument must be practical; practical in terms of efficiency and effectiveness in training observers, practical in terms of cost of data collection, and finally, practical in terms of scoring and treatment of the data produced by the system. Thus, the criteria set for the development of the Taxonomy were (1) a solid theoretical

foundation, (2) comprehensiveness, (3) communicability and (4) practicality.

Theoretical Foundation

The items which comprise the Taxonomy reflect seven levels of thinking or cognitive behavior. They are labeled Knowledge, Translation, Interpretation, Application, Analysis, Synthesis, and Evaluation. These levels follow the system developed by Bloom and others in their handbook, with the exception of the translation and interpretation levels which Bloom included under the heading of comprehension. However, translation and interpretation represent distinct kinds of thinking and are treated as separate levels in this instrument.[4]

These levels of cognitive behavior are assumed to represent increasingly complex intellectual skills and are somewhat hierarchical in the sense that the learner must acquire knowledge (the lowest level) and be able to comprehend it (the second and third levels) before he can deal with it in some manner (represented by upper levels). The assumption that these intellectual abilities grow increasingly complex in nature does not suggest that the upper levels are only present in the cognitive behavior of the mature individual, but rather that they can occur in some form at each developmental stage, although the younger child will deal with more concrete information as he participates in these activities. Thus the Florida Taxonomy subscribes to the theory that intellectual development involves both the acquisition of knowledge and its utilization; there are distinct and discrete intellectual abilities which must be employed in this utilization; these abilities can be discriminated and may occur in some form at each developmental stage of the child.

Development and Use of the Florida Taxonomy of Cognitive Behavior

In its present form the taxonomy has undergone several revisions. Initially over ninety items were written in an attempt to include all of the cognitive

[4]A precedent for this distinction was set by Norris Sanders in his book Classroom Questions: What Kinds? in which he has used the Bloom system to categorize the types of questions teachers ask.

behaviors which could possibly occur in the classroom at each of the levels of the hierarchy. This original complication of items was then examined to identify those which tended to overlap or describe the same behaviors. Duplications were removed, the language was clarified, and overlapping items were combined. The instrument was then given a "dry run" by a group of potential observers observing video-taped episodes of classroom behaviors. From experiences growing out of these sessions in which items were discussed, clarified and revised, a form similar to the present instrument was developed to be tested in the field. A group of twelve observers was then trained to use the instrument; training was accomplished in sessions in which video-tapes of classroom teaching was observed and recorded by observer-trainees. The goals of training were to establish mutual understandings of the cognitive behaviors the various items represent and to establish between observer agreement.

The first field test of the instrument was made in a single school system in which one hundred and thirty-two classrooms at all grade levels, first through twelve, and in all subject matter areas were observed. Each teacher was visited for a single, 30-minute period; the observations produced 132 scores which represented the cognitive behavior of both teachers and students. The unique feature of this field trial was that the Taxonomy was used in conjunction and simultaneously with two other observational instruments, the Reciprocal Category System and the Teacher Practices Observation Record. Thus there were three records made of the same classroom situations during each observation period. Factor analyses of the resulting data revealed that the Taxonomy does indeed measure aspects of classroom behavior which were not detected by the other systems. As would be expected, correlations were found between certain pupil and teacher cognitive behaviors and factors of the other two systems, however, there was a clear indication that the Taxonomy reflects in essence aspects of behavior not mirrored by the other systems.

This field test also demonstrated the comprehensiveness of the instrument to

measure behavior at varying developmental stages of children. High level cognitive activities were found at all grade levels, indicating not only that the instrument could be used successfully throughout the school system but also that even very young children are capable of and do perform at the higher levels of thinking. The Taxonomy also proved to be comprehensive in terms of curriculum content. It was found to be applicable in subject areas dealing with the major disciplines as well as the non-academic areas. In fact, one of the surprises that the data yield gave was the high cognitive level found functioning in home-economic classes. However, a logical consideration of the matter might have predicted this to have been an anticipated outcome. Whereas academic subjects have historically dealt with the acquisition of knowledge, the practical arts (such as home-economics, industrial arts, physical education) have tended to stress the application of skills. Thus, a group of girls making pancakes were found to be using application, analysis, synthesis and evaluation skills--performing at a high cognitive level.

From the experiences in using the instrument in live classroom situations, it was found that the Taxonomy seemed to be fairly comprehensive also in terms of representing the complexities of intellectual behavior. It seemed that categorizing specific behaviors, one of the major problems in designing instruments to assess cognition, had been solved. Within a five second interval an individual may in a single verbal response trigger several items at multiple levels. By use of a sign system the problem of categorizing "rapid-fire" behavior has been greatly reduced. The observer does not need to make a judgment as in systems where each single behavior must be categorized. He simply responds to all of the items involved. This does not completely free him of judgments; this system like all others, is not "observer proof". It does, however, free him from having to fit complex behaviors into single pigeon holes. The solution of this problem of categorizing specific cognitive behaviors has been the major contribution of the developers of this instrument. The theory reflected by Bloom's Taxonomy had, up to this time, defied effective utilization as an observational system. The use

of a sign system, in which items that describe behaviors can be checked as they occur within a specified interval of time, has proved to be a useful method of dealing with the problem.

After undergoing this rather extensive field trial, the instrument was altered slightly by the addition, deletion, and further clarification of specific items. This is as it stands now. Scoring procedures were developed which can be calculated quickly, by hand, and require no more than fourth grade mathematical skills. Each observation produces two scores: one for the teacher and one for the students. It is also possible to plot a profile which indicates the range and frequency of the various levels recorded and which provides for ease of interpretation.

Future of the Florida Taxonomy

The Taxonomy is a relatively new "baby" in the field of systematic observation. This is an area which is producing so prolifically that new babies are common and multiple births can be expected. It cannot be considered a finished instrument in the sense that it has been perfected to the extent that it need not be changed. Rather it should be seen, at this stage, as a useful--even powerful--instrument with great possibilities. Presently, more sophisticated training procedures are being developed. Teachers, supervisors, and administrators who are working daily in classrooms have undergone training in the use of the Taxonomy and are using it in their work. Results of these endeavors indicate that the Taxonomy is communicatable and effective in in-service use.

Another possibility for the use of the Taxonomy which holds promise for investigation, is the exploration of the interrelationships between various kinds of cognitive behaviors of teachers and pupils. The results of the field test indicated that a teacher need not perform at the higher levels of the instrument for his pupils to engage in these kinds of cognitive activities. Also, in some cases, the teacher performed at the higher levels of the Taxonomy, but left the students behind. If we subscribe to the theory that learners need to perform at

all cognitive levels, then we need to find out what particular teacher behaviors are related to higher levels of cognitive activity on the part of students. If we want children to learn, for instance, the intellectual skills needed for the analysis of problems, we need to know how the teacher must function cognitively to get them there. It would seem that the Florida Taxonomy is an instrument which can help us find the answers to these questions.

In addition to using the Taxonomy as it currently stands, it offers interesting possibilities as a model for creating similar instruments for use in specific subject matter areas. Items which would fit into the general framework of the system, but are written specifically to reflect the types of cognitive behaviors demanded by the area of knowledge under consideration could be devised. With current emphasis on instructional procedures being developed to meet behavioral objectives, the Taxonomy of Cognitive Behavior can provide information as to the actual behaviors being produced by these instructional procedures. Instruments designed for content areas could lend specifically to the description of these behaviors. Thus a taxonomy could be written for mathematics, physical sciences, language, etc. The developer of such instruments would devote himself to identifying the cognitive behaviors which were demanded by the discipline at each of the cognitive levels.

The Florida Taxonomy is also a highly useful tool in the area of curriculum development. Much of the curriculum content found in the typical school program does not lend itself to providing the kinds of activities which encourage teachers and students to function at the higher cognitive levels. If teachers are committed to the idea that students must utilize the knowledge they acquire, then the Florida Taxonomy can be used as a guide for the development of curriculum materials and instructional methods. The usual procedure of lesson planning becomes reversed. Instead of asking, "What is the best way to get my subject matter across?" the teacher may ask, "I want my students to be able to formulate hypothesis, how can I best use my subject matter to help them develop this ability?" The objectives

of teaching become ways of teaching children to use abilities and skills rather than simply getting across subject matter.

Thus it would seem that the Florida Taxonomy of Cognitive Behavior has indeed met the criteria set by its developers. Based solidly on theory, it has proved to be comprehensive, communicatable, and useful in practice.

The Florida Taxonomy of Cognitive Behavior is an observational instrument consisting of fifty-five items which describe cognitive behavior that can be evidenced by both pupils and teachers in classroom situations. The observer's task is to identify and record these behaviors as they occur within specified time periods. The mechanics of using the instrument are simple. There are five separate six-minute recording periods in each thirty-minute observation. The observer records behavior as it occurs, checking each item of teacher behavior and student behavior in the appropriate column as it happens. Items which describe behaviors that did not occur or for which a discrimination cannot be made are left unmarked. A particular item is marked only once in a given six-minute period, no matter how often that specific behavior occurs. If a behavior is represented by more than one item, all items that are involved are checked. If a behavior does not fit into the framework of the instrument it is ignored. At the end of the thirty-minute period, the recorded teacher behaviors and pupil behaviors are tallied to produce a record of the cognitive activities which have taken place during the observation.

APPENDIX B

RATING SHEETS OF STUDENTS' AND TEACHER'S

COGNITIVE-ORAL BEHAVIOR DURING THE

SIX, HALF-HOUR, TAPE RECORDED OBSERVATION PERIODS

$(O_1, O_2, O_3 \text{ X } O_4, O_5, O_6)$

AS RANKED BY THE FLORIDA TAXONOMY OF COGNITIVE BEHAVIOR

$$Cm = \frac{(Nx1)(Nx2)(Nx3)(Nx4)(Nx5)(Nx6)(Nx7)}{\Sigma N}$$

TAPE REEL #1 (SESSION, O_1)

FLORIDA TAXONOMY OF COGNITIVE BEHAVIOR

TOT T	TOT P	Item
		1.10 KNOWLEDGE OF SPECIFICS
	4	1. Reads
		2. Spells
7	1	3. Identifies something by name
3	3	4. Defines meaning of term
	2	5. Gives a specific fact
3		6. Tells about an event
		1.20 KNOWLEDGE OF WAYS AND MEANS OF DEALING WITH SPECIFICS
		7. Recognizes symbol
		8. Cites rule
		9. Gives chronological sequence
5	5	10. Gives steps of process, describes method
1		11. Cites trend
3		12. Names classification system or standard
2	2	13. Names what fits given system or standard
		1.30 KNOWLEDGE OF UNIVERSALS AND ABSTRACTIONS
2	2	14. States generalized concept or idea
		15. States a principle, law, theory
1	1	16. Tells about orgnztn or structure
		17. Recalls name of prin, law, theory
27	20	
		2.00 TRANSLATION
1		18. Restates in own words or briefer terms
	7	19. Gives cncrt exmpl of an abstract idea
		20. Verbalizes from a graphic rprsntatn
		21. Trans vrblztn into graphic form
		22. Trans fig stmnts to lit stmnts, or vice v
		23. Trans for lang to Eng, or vice versa
2	14	

TAPE REEL #1 (SESSION, O_1)

FLORIDA TAXONOMY OF COGNITIVE BEHAVIOR

TOT T	TOT P	T/ P	T/ P	T/ P	T/ P	T/ P	
							3.00 INTERPRETATION
							24. Gives reason (tells why)
							25. Shows similarities, diffrncs
							26. Summarizes or concludes frm obs of evdnce
	1						27. Shows cause and effect rltnshp
							28. Gives analogy, simile, metaphor
							29. Performs a directed task or process
	3						4.00 APPLICATION
							30. Applies previous learning to new sitn
1	1						31. Applies principle to new situation
							32. Apply abstrct knldg in a prctcl sitn
							33. Idntifs, selects, and carries out process
4	4						5.00 ANALYSIS
							34. Distngshs fact from opinion
							35. Distngshs fact from hypothesis
							36. Distngshs cnclsn frm stmnts wch suppt it
							37. Points out unstated assumption
							38. Shows interaction or relation of elements
							39. Points out prticlrs to jstfy cnclsn
							40. Checks hypthss with given info
							41. Dstngshs rel frm irrelvnt stmnts
							42. Detects error in thinking
							43. Infers prpse, pt of view, thghts, feelings
							44. Recog bias or propaganda
							6.00 SYNTHESIS (Creativity)
							45. Reorganizes ideas, materials, process
							46. Produces unique cmmnctn, divergent idea
							47. Produces a plan, prpsd set of oprtns
							48. Designs an apparatus
							49. Designs a structure
							50. Devises scheme for classifying info
							51. Formulates hypothesis, intelligent guess
							52. Mks dedctns frm abstrct smbls, propostns
							53. Draws inductive generalizatn frm specifcs
							7.00 EVALUATION
							54. Evaluates something from evdnce
							55. Evaluated something from criteria
T 33	P 41						

TEACHER'S COGNITIVE MEAN SCORE = 33/29 = 1.137
PUPILS' COGNITIVE MEAN SCORE = 41/29 = 1.413

TAPE REEL #2 (SESSION, O_2)

FLORIDA TAXONOMY OF COGNITIVE BEHAVIOR

TOT T	TOT P	T/ P	T/ P	T/ P	T/ P	T/ P	1.10 KNOWLEDGE OF SPECIFICS
							1. Reads
							2. Spells
2	9						3. Identifies something by name
3	1						4. Defines meaning of term
1	1						5. Gives a specific fact
7							6. Tells about an event
							1.20 KNOWLEDGE OF WAYS AND MEANS OF DEALING WITH SPECIFICS
							7. Recognizes symbol
							8. Cites rule
							9. Gives chronological sequence
	1						10. Gives steps of process, describes method
							11. Cites trend
4							12. Names classification system or standard
1	8						13. Names what fits given system or standard
							1.30 KNOWLEDGE OF UNIVERSALS AND ABSTRACTIONS
2	3						14. States generalized concept or idea
							15. States a principle, law, theory
1	1						16. Tells about orgnztn or structure
	1						17. Recalls name of prin, law, theory
21	25						**2.00 TRANSLATION**
							18. Restates in own words or briefer terms
2	5						19. Gives cncrt exmpl of an abstract idea
							20. Verbalizes from a graphic rprsntatn
							21. Trans vrblztn into graphic form
							22. Trans fig stmnts to lit stmnts, or vice v
							23. Trans for lang to Eng, or vice versa
4	10						

TAPE REEL #2 (SESSION, O_2)

FLORIDA TAXONOMY OF COGNITIVE BEHAVIOR

TOT T	TOT P	T/ P	T/ P	T/ P	T/ P	T/ P	
							3.00 INTERPRETATION
							24. Gives reason (tells why)
							25. Shows similarities, diffrncs
5	3						26. Summarizes or concludes frm obs of evdnce
	3						27. Shows cause and effect rltnshp
							28. Gives analogy, simile, metaphor
							29. Performs a directed task or process
15	18						**4.00 APPLICATION**
							30. Applies previous learning to new sitn
							31. Applies principle to new situation
							32. Apply abstrct knldg in a prctcl sitn
							33. Idntifs, selects, and carries out process
							5.00 ANALYSIS
							34. Distngshs fact from opinion
							35. Distngshs fact from hypothesis
							36. Distngshs cnclsn frm stmnts wch suppt it
							37. Points out unstated assumption
							38. Shows interaction or relation of elements
							39. Points out prticlrs to jstfy cnclsn
							40. Checks hypthss with given info
							41. Dstngshs rel frm irrelvnt stmnts
							42. Detects error in thinking
							43. Infers prpse, pt of view, thghts, feelings
							44. Recog bias or propaganda
							6.00 SYNTHESIS (Creativity)
							45. Reorganizes ideas, materials, process
							46. Produces unique cmmnctn, divergent idea
							47. Produces a plan, prpsd set of oprtns
							48. Designs an apparatus
							49. Designs a structure
							50. Devises scheme for classifying info
							51. Formulates hypothesis, intelligent guess
							52. Mks dedctns frm abstrct smbls, propostns
							53. Draws inductive generalizatn frm specifcs
							7.00 EVALUATION
							54. Evaluates something from evdnce
							55. Evaluated something from criteria

T	P
40	53

TEACHER'S COGNITIVE MEAN SCORE = 40/28 = 1.428
PUPILS' COGNITIVE MEAN SCORE = 53/36 = 1.472

TAPE REEL #3 (SESSION, O_3)

FLORIDA TAXONOMY OF COGNITIVE BEHAVIOR

TOT T	TOT P	T/ P	T/ P	T/ P	T/ P	T/ P	1.10 KNOWLEDGE OF SPECIFICS
							1. Reads
5	3						2. Spells
	3						3. Identifies something by name
2	3						4. Defines meaning of term
3							5. Gives a specific fact
							6. Tells about an event
							1.20 KNOWLEDGE OF WAYS AND MEANS OF DEALING WITH SPECIFICS
							7. Recognizes symbol
							8. Cites rule
							9. Gives chronological sequence
							10. Gives steps of process, describes method
							11. Cites trend
8							12. Names classification system or standard
7	7						13. Names what fits given system or standard
							1.30 KNOWLEDGE OF UNIVERSALS AND ABSTRACTIONS
							14. States generalized concept or idea
							15. States a principle, law, theory
	2						16. Tells about orgnztn or structure
	1						17. Recalls name of prin, law, theory
25	19						**2.00 TRANSLATION**
							18. Restates in own words or briefer terms
2	4						19. Gives cncrt exmpl of an abstract idea
							20. Verbalizes from a graphic rprsntatn
							21. Trans vrblztn into graphic form
							22. Trans fig stmnts to lit stmnts, or vice v
							23. Trans for lang to Eng, or vice versa
4	8						

TAPE REEL #3 (SESSION, O_3)

FLORIDA TAXONOMY OF COGNITIVE BEHAVIOR

TOT T	TOT P	T/ P	T/ P	T/ P	T/ P	T/ P	
							3.00 INTERPRETATION
							24. Gives reason (tells why)
4	3						25. Shows similarities, diffrncs
	2						26. Summarizes or concludes frm obs of evdnce
							27. Shows cause and effect rltnshp
	1						28. Gives analogy, simile, metaphor
							29. Performs a directed task or process
12	18						**4.00 APPLICATION**
							30. Applies previous learning to new sitn
							31. Applies principle to new situation
							32. Apply abstrct knldg in a prctcl sitn
							33. Idntifs, selects, and carries out process
							5.00 ANALYSIS
							34. Distngshs fact from opinion
							35. Distngshs fact from hypothesis
							36. Distngshs cnclsn frm stmnts wch suppt it
							37. Points out unstated assumption
							38. Shows interaction or relation of elements
							39. Points out prticlrs to jstfy cnclsn
							40. Checks hypthss with given info
							41. Dstngshs rel frm irrelvnt stmnts
							42. Detects error in thinking
							43. Infers prpse, pt of view, thghts, feelings
							44. Recog bias or propaganda
							6.00 SYNTHESIS (Creativity)
							45. Reorganizes ideas, materials, process
							46. Produces unique cmmnctn, divergent idea
							47. Produces a plan, prpsd set of oprtns
							48. Designs an apparatus
							49. Designs a structure
							50. Devises scheme for classifying info
							51. Formulates hypothesis, intelligent guess
							52. Mks dedctns frm abstrct smbls, propostns
							53. Draws inductive generalizatn frm specifcs
							7.00 EVALUATION
							54. Evaluates something from evdnce
							55. Evaluated something from criteria

T	P
41	45

TEACHER'S COGNITIVE MEAN SCORE = 41/31 = 1.322

PUPILS' COGNITIVE MEAN SCORE = 45/29 = 1.551

TAPE REEL #4 (SESSION, O_4)

FLORIDA TAXONOMY OF COGNITIVE BEHAVIOR

TOT T	TOT P	T/ P	T/ P	T/ P	T/ P	T/ P	
							1.10 KNOWLEDGE OF SPECIFICS
							1. Reads
							2. Spells
2	6						3. Identifies something by name
							4. Defines meaning of term
							5. Gives a specific fact
							6. Tells about an event
							1.20 KNOWLEDGE OF WAYS AND MEANS OF DEALING WITH SPECIFICS
1							7. Recognizes symbol
							8. Cites rule
	1						9. Gives chronological sequence
							10. Gives steps of process, describes method
							11. Cites trend
11							12. Names classification system or standard
	8						13. Names what fits given system or standard
							1.30 KNOWLEDGE OF UNIVERSALS AND ABSTRACTIONS
							14. States generalized concept or idea
							15. States a principle, law, theory
							16. Tells about organztn or structure
1	3						17. Recalls name of prin, law, theory
15	18						**2.00 TRANSLATION**
							18. Restates in own words or briefer terms
2	2						19. Gives cncrt exmpl of an abstract idea
							20. Verbalizes from a graphic rprsntatn
							21. Trans vrblztn into graphic form
							22. Trans fig stmnts to lit stmnts, or vice v
							23. Trans for lang to Eng, or vice versa
4	4						

TAPE REEL #4 (SESSION, O_4)

FLORIDA TAXONOMY OF COGNITIVE BEHAVIOR

TOT T	TOT P	T/ P	T/ P	T/ P	T/ P	T/ P	
							3.00 INTERPRETATION
							24. Gives reason (tells why)
							25. Shows similarities, diffrncs
	3						26. Summarizes or concludes frm obs of evdnce
							27. Shows cause and effect rltnshp
							28. Gives analogy, simile, metaphor
							29. Performs a directed task or process
	9						4.00 APPLICATION
	2						30. Applies previous learning to new sitn
	1						31. Applies principle to new situation
							32. Apply abstrct knldg in a prctcl sitn
							33. Idntifs, selects, and carries out process
	12						5.00 ANALYSIS
							34. Distngshs fact from opinion
							35. Distngshs fact from hypothesis
							36. Distngshs cnclsn frm stmnts wch suppt it
							37. Points out unstated assumption
	1						38. Shows interaction or relation of elements
							39. Points out prticlrs to jstfy cnclsn
							40. Checks hypthss with given info
							41. Dstngshs rel frm irrelvnt stmnts
							42. Detects error in thinking
							43. Infers prpse, pt of view, thghts, feelings
							44. Recog bias or propaganda
	5						6.00 SYNTHESIS (Creativity)
							45. Reorganizes ideas, materials, process
							46. Produces unique cmmnctn, divergent idea
							47. Produces a plan, prpsd set of oprtns
							48. Designs an apparatus
							49. Designs a structure
							50. Devises scheme for classifying info
							51. Formulates hypothesis, intelligent guess
							52. Mks dedctns frm abstrct smbls, propostns
	1						53. Draws inductive generalizatn frm specifcs
	6						7.00 EVALUATION
							54. Evaluates something from evdnce
	1						55. Evaluated something from criteria
	7						

T	P
19	61

TEACHER'S COGNITIVE MEAN SCORE = 19/17 = 1.117

PUPILS' COGNITIVE MEAN SCORE = 61/24 = 2.541

TAPE REEL #5 (SESSION, O_5)

FLORIDA TAXONOMY OF COGNITIVE BEHAVIOR

TOT T	TOT P	T/ P	T/ P	T/ P	T/ P	T/ P	
							1.10 KNOWLEDGE OF SPECIFICS
							1. Reads
							2. Spells
2							3. Identifies something by name
							4. Defines meaning of term
	7						5. Gives a specific fact
1							6. Tells about an event
							1.20 KNOWLEDGE OF WAYS AND MEANS OF DEALING WITH SPECIFICS
							7. Recognizes symbol
							8. Cites rule
	6						9. Gives chronological sequence
1							10. Gives steps of process, describes method
							11. Cites trend
6							12. Names classification system or standard
	12						13. Names what fits given system or standard
							1.30 KNOWLEDGE OF UNIVERSALS AND ABSTRACTIONS
9							14. States generalized concept or idea
							15. States a principle, law, theory
							16. Tells about orgnztn or structure
							17. Recalls name of prin, law, theory
19	25						**2.00 TRANSLATION**
							18. Restates in own words or briefer terms
							19. Gives cncrt exmpl of an abstract idea
							20. Verbalizes from a graphic rprsntatn
							21. Trans vrblztn into graphic form
							22. Trans fig stmnts to lit stmnts, or vice v
							23. Trans for lang to Eng, or vice versa

TAPE REEL #5 (SESSION, O_5)

FLORIDA TAXONOMY OF COGNITIVE BEHAVIOR

TOT I	TOT P	T/ P	T/ P	T/ P	T/ P	T/ P	
							3.00 INTERPRETATION
3							24. Gives reason (tells why)
2							25. Shows similarities, diffrncs
							26. Summarizes or concludes frm obs of evdnce
6	17						27. Shows cause and effect rltnshp
							28. Gives analogy, simile, metaphor
							29. Performs a directed task or process
33	51						4.00 APPLICATION
	1						30. Applies previous learning to new sitn
	1						31. Applies principle to new situation
							32. Apply abstrct knldg in a prctcl sitn
							33. Idntifs, selects, and carries out process
	8						5.00 ANALYSIS
							34. Distngshs fact from opinion
							35. Distngshs fact from hypothesis
							36. Distngshs cnclsn frm stmnts wch suppt it
							37. Points out unstated assumption
							38. Shows interaction or relation of elements
							39. Points out prticlrs to jstfy cnclsn
							40. Checks hypthss with given info
							41. Dstngshs rel frm irrelvnt stmnts
							42. Detects error in thinking
							43. Infers prpse, pt of view, thghts, feelings
							44. Recog bias or propaganda
							6.00 SYNTHESIS (Creativity)
							45. Reorganizes ideas, materials, process
							46. Produces unique cmmnctn, divergent idea
	4						47. Produces a plan, prpsd set of oprtns
							48. Designs an apparatus
							49. Designs a structure
							50. Devises scheme for classifying info
							51. Formulates hypothesis, intelligent guess
							52. Mks dedctns frm abstrct smbls, propostns
							53. Draws inductive generalizatn frm specifcs
	24						7.00 EVALUATION
							54. Evaluates something from evdnce
							55. Evaluated something from criteria

T	P
52	108

TEACHER'S COGNITIVE MEAN SCORE = 52/30 = 1.733

PUPILS' COGNITIVE MEAN SCORE = 108/48 = 2.250

TAPE REEL #6 (SESSION, O_6)

FLORIDA TAXONOMY OF COGNITIVE BEHAVIOR

TOT T	TOT P	T/ P	T/ P	T/ P	T/ P	T/ P	1.10 KNOWLEDGE OF SPECIFICS
							1. Reads
							2. Spells
							3. Identifies something by name
							4. Defines meaning of term
18	6						5. Gives a specific fact
4							6. Tells about an event
							1.20 KNOWLEDGE OF WAYS AND MEANS OF DEALING WITH SPECIFICS
							7. Recognizes symbol
							8. Cites rule
2							9. Gives chronological sequence
							10. Gives steps of process, describes method
1							11. Cites trend
	1						12. Names classification system or standard
							13. Names what fits given system or standard
24	7						**1.30 KNOWLEDGE OF UNIVERSALS AND ABSTRACTIONS**
							14. States generalized concept or idea
							15. States a principle, law, theory
							16. Tells about orgnztn or structure
							17. Recalls name of prin, law, theory
							2.00 TRANSLATION
							18. Restates in own words or briefer terms
							19. Gives cncrt exmpl of an abstract idea
							20. Verbalizes from a graphic rprsntatn
							21. Trans vrblztn into graphic form
							22. Trans fig stmnts to lit stmnts, or vice v
							23. Trans for lang to Eng, or vice versa

TAPE REEL #6, (SESSION, O_6)

FLORIDA TAXONOMY OF COGNITIVE BEHAVIOR

TOT T	TOT P	T/ P	T/ P	T/ P	T/ P	T/ P	
							3.00 INTERPRETATION
							24. Gives reason (tells why)
							25. Shows similarities, diffrncs
							26. Summarizes or concludes frm obs of evdnce
							27. Shows cause and effect rltnshp
							28. Gives analogy, simile, metaphor
							29. Performs a directed task or process
							4.00 APPLICATION
							30. Applies previous learning to new sitn
							31. Applies principle to new situation
							32. Apply abstrct knldg in a prctcl sitn
							33. Idntifs, selects, and carries out process
							5.00 ANALYSIS
							34. Distngshs fact from opinion
							35. Distngshs fact from hypothesis
							36. Distngshs cnclsn frm stmnts wch suppt it
							37. Points out unstated assumption
							38. Shows interaction or relation of elements
							39. Points out prticlrs to jstfy cnclsn
							40. Checks hypthss with given info
							41. Dstngshs rel frm irrelvnt stmnts
							42. Detects error in thinking
							43. Infers prpse, pt of view, thghts, feelings
							44. Recog bias or propaganda
							6.00 SYNTHESIS (Creativity)
							45. Reorganizes ideas, materials, process
							46. Produces unique cmmnctn, divergent idea
							47. Produces a plan, prpsd set of oprtns
							48. Designs an apparatus
							49. Designs a structure
							50. Devises scheme for classifying info
							51. Formulates hypothesis, intelligent guess
							52. Mks dedctns frm abstrct smbls, propostns
							53. Draws inductive generalizatn frm specifcs
							7.00 EVALUATION
							54. Evaluates something from evdnce
							55. Evaluated something from criteria

T	P
24	7

TEACHER'S COGNITIVE MEAN SCORE = 24/24 = 1.00

PUPILS' COGNITIVE MEAN SCORE = 7/7 = 1.00

APPENDIX C

TEST OF INTRA-RATER RELIABILITY

TEST-RETEST CORRELATION OF TAPE #1

Rank	X Test #1	Y Test #2	X_2	Y_2	XY
1	20	20	400	400	400
2	7	8	49	64	56
3	1	1	1	1	1
4	1	0	1	0	0
5	0	0	0	0	0
6	0	0	0	0	0
7	0	0	0	0	0
	29	29	451	465	457

$$R = \frac{\Sigma XY - \frac{(\Sigma X)(\Sigma Y)}{n}}{\sqrt{\left(\Sigma X^2 - \frac{(\Sigma X)^2}{n}\right)\left(\Sigma Y^2 - \frac{(\Sigma Y)^2}{n}\right)}}$$

$$R = \frac{457 - \frac{29 \times 29}{7}}{\sqrt{\left(451 - \frac{(29)^2}{7}\right)\left(465 - \frac{(29)^2}{7}\right)}}$$

$$R = \frac{457 - 105.857}{\sqrt{(451 - 105.857)(465 - 105.857)}}$$

$$R = \frac{350.143}{351.833}$$

$$R = .995$$

TAPE REEL #1 (SESSION, O_1) RE-RANKED

FLORIDA TAXONOMY OF COGNITIVE BEHAVIOR

TOT T	TOT P	T/ P	T/ P	T/ P	T/ P	T/ P	1.10 KNOWLEDGE OF SPECIFICS
	4						1. Reads
							2. Spells
7	1						3. Identifies something by name
3	3						4. Defines meaning of term
	2						5. Gives a specific fact
3							6. Tells about an event
							1.20 KNOWLEDGE OF WAYS AND MEANS OF DEALING WITH SPECIFICS
							7. Recognizes symbol
							8. Cites rule
							9. Gives chronological sequence
5	5						10. Gives steps of process, describes method
1							11. Cites trend
3							12. Names classification system or standard
2	2						13. Names what fits given system or standard
							1.30 KNOWLEDGE OF UNIVERSALS AND ABSTRACTIONS
2	2						14. States generalized concept or idea
							15. States a principle, law, theory
1	1						16. Tells about orgnztn or structure
							17. Recalls name of prin, law, theory
27	20						**2.00 TRANSLATION**
1							18. Restates in own words or briefer terms
	8						19. Gives cncrt exmpl of an abstract idea
							20. Verbalizes from a graphic rprsntatn
							21. Trans vrblztn into graphic form
							22. Trans fig stmnts to lit stmnts, or vice v
							23. Trans for lang to Eng, or vice versa
2	16						

TAPE REEL #1 (SESSION, O_1) RE-RANKED

FLORIDA TAXONOMY OF COGNITIVE BEHAVIOR

TOT T	TOT P	T/ P	T/ P	T/ P	T/ P	T/ P	
							3.00 INTERPRETATION
							24. Gives reason (tells why)
							25. Shows similarities, diffrncs
							26. Summarizes or concludes frm obs of evdnce
	1						27. Shows cause and effect rltnshp
							28. Gives analogy, simile, metaphor
							29. Performs a directed task or process
	3						4.00 APPLICATION
							30. Applies previous learning to new sitn
1							31. Applies principle to new situation
							32. Apply abstrct knldg in a prctcl sitn
							33. Idntifs, selects, and carries out process
4							5.00 ANALYSIS
							34. Distngshs fact from opinion
							35. Distngshs fact from hypothesis
							36. Distngshs cnclsn frm stmnts wch suppt it
							37. Points out unstated assumption
							38. Shows interaction or relation of elements
							39. Points out prtclrs to jstfy cnclsn
							40. Checks hypthss with given info
							41. Dstngshs rel frm irrelvnt stmnts
							42. Detects error in thinking
							43. Infers prpse, pt of view, thghts, feelings
							44. Recog bias or propaganda
							6.00 SYNTHESIS (Creativity)
							45. Reorganizes ideas, materials, process
							46. Produces unique cmmnctn, divergent idea
							47. Produces a plan, prpsd set of oprtns
							48. Designs an apparatus
							49. Designs a structure
							50. Devises scheme for classifying info
							51. Formulates hypothesis, intelligent guess
							52. Mks dedctns frm abstrct smbls, propostns
							53. Draws inductive generalizatn frm specifcs
							7.00 EVALUATION
							54. Evaluates something from evdnce
							55. Evaluates something from criteria

T	P
33	39

TEACHER'S COGNITIVE MEAN SCORE = 33/29 = 1.137
PUPILS' COGNITIVE MEAN SCORE = 39/29 = 1.344

APPENDIX D

DESCRIPTION OF ALBUQUERQUE PUBLIC SCHOOLS' ENVIRONMENTAL EDUCATION LABORATORY

ENVIRONMENTAL EDUCATION

ALBUQUERQUE PUBLIC SCHOOLS

I. TITLE: Environmental Education Laboratory

II. PURPOSE: The laboratory's program of instruction is designed to provide direct, first-hand, outdoor and indoor, environmental education learning experiences for the purpose of developing appropriate knowledges and attitudes regarding man's relationship, interdependence, and responsibility to his total living and non-living environment.

III. DESCRIPTION OF PROGRAM

A. Program - High up in the Sandia Mountains the school becomes a tree stump, the ceiling the sky, and a clear mountain trail replaces linoleum tile and concrete. Here, instead of merely talking about lichen's ingenious self-supporting life system, a student can actually see lichen and its related interdependencies spreading over bare rock faces. The importance of leaving the forest floor undisturbed becomes more meaningful than the usual "Stay-off-the-Grass" municipal park sign. Thus, the word humus becomes more than just a word in a book, and its true significance becomes an observable reality.

The program begins in the classroom, pre-site phase, with the discussion of concepts called "strands," which are four basic principles of life and growth presented as change, adaptation, interaction/interdependence, and varieties and similiarities. The student uses the strands as a framework on which to build tangible experience, and as an image through which he can understand the interwinding of all life processes like a rope or the root system of a plant.

After introducing the "strands" and how they relate to the immediate, man-made environment, the class is taken on a one-day field trip to the outdoor laboratory to study the "strands" as they relate to the various forms of life in a pristine environment.

From the knowledge gained in the first two phases it is now the responsibility of the teacher and students to integrate these newly acquired knowledges and attitudes into the total curriculum of the classroom.

IV. PROFESSIONAL AND NON-PROFESSIONAL STAFF:

A. Professional - One director, two staff teachers, two student interns.

B. Non-Professional - One secretary, and one part-time custodian.

V. NUMBER AND LEVEL OF STUDENTS:

A. Basic, Core Program - 8,560 students in the top grade level of the elementary schools (5th and 6th) at the Sandia Site.

B. Self-Conducted Soil Ecology Trail (Sandia Site) - 2,000 students, 70 teachers.

C. Teacher Inservice Training - 150 trained by the staff each year at Sandia Site (400 in 3 years). 300 trained each year by staff and the University of New Mexico via 3 and 1 hour workshops.

D. Resident Summer - 4 day resident experience, 4th, 5th, and 6th grades. 600 students during 6 week period, 35 teachers trained as counselors. (Jemez Site).

VI. SITES:

A. Day Camp - 130 acre site in the Sandia Mountains. 22 miles east of Albuquerque; 5 buildings, 3 classrooms, 4¼ miles of trail, outdoor eating area, pond.

B. Summer Resident Camp - 28 acre site in the Jemez Mountains near Fenton Lake in the Santa Fe National Forest. Butler building, indoor toilet, shower facilities. 25 tents on platforms. 78 miles north of Albuquerque.

VII. EVALUATION: Evaluation is conducted each year by the instruments as shown in objectives. Results show objectives 1 and 2 are being met in a highly satisfactory manner, and test results of objectives 3 and 4 show an unusually high significance of .005.

VIII. FUNDING:

A. Day Camp - Title III ESEA 75%, A.P.S. 25% - Total Budget $55,000.00.

B. Resident Camp - Student fee of $11.00, Budget of $9,800.00.

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