

ABSTRACT

Title of Dissertation: A COMPARISON OF THE EFFECTS OF
THREE INSTRUCTIONAL ACTIVITIES ON
ELEMENTARY STUDENTS' RETENTION
OF INFORMATION

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The purpose of this study was to compare the effects of three supplementary instructional activities on young students' retention of information. The study was based on Dewian and Piagetian theory regarding the central role active involvement plays in cognitive development. The three supplementary instructional activities were a verbal review, an art-related activity, and a coloring sheet activity.

Subjects were the second grade population (178 students in seven intact classes) of two schools representative of the urban/suburban school district in terms of test scores, racial mix, and student mobility rates. There was a control group and two experimental groups in each school, with an additional control group without pretest, to study pretest effect. A lesson about the American flag and one about deciduous trees was designed to utilize active questioning. After participating in each lesson, students in the first

treatment group completed a coloring sheet; the second group, an art-related activity; and the control group, a verbal review. The treatments were designed to supplement regular classroom instruction, not as creative art activities. The study explored possible relationships between students' art-related activities and knowing, a reversal of traditional art education studies of the effect of knowing on students' art work.

Multiple-choice and drawing tests were administered as pre and posttests. The ANCOVA procedure was used for data analysis to eliminate the effect of preexisting differences between groups. Flag lesson data analysis revealed no significant differences in information retention according to method, except on the drawing tests. The control groups outperformed the coloring sheet group to a significant extent indicating a negative effect of the rote coloring sheet activity on retention of information. Data analysis from the tree lesson revealed no significant differences between treatment groups. Students' tree schema appears to have played an unexpected but important role. Suggestions are made that will enable future researchers to avoid the problem this researcher encountered, in that the art-related activity group did not have time to complete their drawing activity.

On three tests, females outperformed males to a statistically significant degree.

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ACTIVITIES ON ELEMENTARY STUDENTS'
RETENTION OF INFORMATION

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DEDICATION

To my parents, Ruth and Hyman Cunin,
who enjoyed sharing their aesthetic awareness,
love of the arts, teaching and learning experiences, and
their belief in the goodness of mankind.

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CHAPTER I INTRODUCTION

Introduction and Problem Statement

Art educators such as Efland (1976) have long observed that there seems to be an artistic style which he has called "school art" that is fostered and encouraged not by the art teacher, but by the elementary classroom teacher. When challenged as to the lack of aesthetic or creative content in that art work, elementary classroom teachers will often respond that they are not providing creative activities but instead are using an "art" activity to reinforce instruction and facilitate retention of information (Efland 1976). Jeffers (1991) has observed that pre-service elementary education majors consider "school art" projects to be valid activities because they have been used for generations and have become familiar to teachers as "the way it is supposed to be". Are these activities justifiable in terms of education? Since one of the rationale those teachers give is that they are not teaching art but developing cognitive and perceptual skills, we should conduct research to see if that in fact is happening. Early research in art education (Claparede, 1907; Luquet, 1913; Goodenough, 1926) explored the effects of students' retention of information or "knowing" on drawing. This study will reverse earlier formats and study the effects of students' art-related activities upon

information retention, or knowing.

Theoretical Rationale

A continuing challenge to the field of art education has been to discover and explore the relationships between art, visual imagery, and cognition (Arnheim, 1983; Broudy, 1979). This study was conceived within the general philosophical point of view (Dewey, 1934; Piaget, 1969) that there is a positive relationship between doing and knowing.

The position that Dewey (1934) argued for in Art and Experience, that learning requires interaction between the individual and the environment, has provided one of the essential frames of reference for art education theory in relation to the use of art in the education of the young child. Piaget (1969) and Lowenfeld (1968) shared similar theories of young children's cognitive development as being dependent upon the child's interaction with the real world. Many art and progressive educators have been devoted to Dewey and Piaget's position that aesthetic interaction with the environment is vital for cognitive growth (Kilpatrick, 1918; Winslow, 1939; McFee, 1961; Cohen & Gainer, 1984). However, few empirical studies have been conducted in elementary school settings that examine the relationship between involvement in art-related activities and students' ability to retain

information. Most of the research related to this area was conducted using students who were asked to complete tasks on an individual basis. Schacter (Posner, 1989) notes that a number of researchers in recent years "have argued for an ecological or naturalistic orientation in which empirical studies examine the role that memory plays in real-life environment...(p. 705) as opposed to controlled laboratory experiments. For that reason the decision was made to use intact classes in a real life public school setting.

Purpose

The purpose of this study was to compare the effects of a verbal review, a coloring, and an art-related activity on young students' retention of information from two classroom units of study. Students received one of the three treatments as reinforcement for two lessons that had encouraged student involvement through the use of active questioning.

Organization Statement

This dissertation is organized into five chapters. In the first chapter, the problem, purpose, theoretical basis, and hypotheses are presented; key terms are defined; and study limitations described. The review of the theoretical literature and related empirical studies comprise the second chapter. The description of subjects,

study procedures, research methods, assessment measures, and test reliability and validity, are described in the third chapter. Chapter four includes the descriptive statistics and results of the data analysis. The fifth chapter includes a discussion of the study, interpretation of the results, and implications for future research, for elementary school instruction, and for elementary art education. An Appendix includes samples of all materials used during the study and other statistical data.

As stated above, this first chapter presents the problem that was studied and the rationale for its selection, the theoretical background, the study hypotheses, terms, and limitations. The theoretical background has been organized into three parts. Part one will focus upon the theoretical bases for the study that relate to the dependent variable, the "knowing" that we will call the retention of information. The theories address the way people process, encode, and store information. Part two will focus upon theories related to children's drawings as perception and cognition, a focus that relates to the independent variable of students' participation in an art-related activity. Part three will focus upon theories relating to coloring sheet activities and cognitive development, a focus that relates to the independent variable of students' participation in a

coloring sheet activity. Theories related to the third independent variable, a verbal review, have not been discussed since American education has emphasized verbal modes of facilitating the retention of information. The relationship between verbal drill and practice and retention of information is familiar to readers.

Theoretical Basis

This study was concerned with the relationship between "knowing and doing", a topic that has interested a diverse set of thinkers such as Arnheim (1954), Dewey (1934), Piaget (1947/1973), McFee (1961), Bruner (1966), Sternberg (1985), and Gardner (1987). In his book, Art as Experience, Dewey discussed the necessity of making the aesthetic experience an active one that involves and affects the intellect. Dewey stated:

The senses are the organs through which the live creature participates directly in the ongoings of the world about him. In this participation the varied wonder and splendor of this world are made actual for him in the qualities he experiences. This material cannot be opposed to action, for motor apparatus and "will" itself are the means by which this participation is carried on and directed. It cannot be opposed to "intellect," for mind is the means by which participation is rendered fruitful through

sense; by which meanings and values are extracted, retained, and put to further service in the intercourse of the live creature with his surroundings. (p. 22)

Piaget (Gruber and Voneche, 1977) discussed a major phase of child development, the "concrete operational" stage, when children possess techniques of reasoning which are dependent upon objects, events, and people around them. They have difficulty generalizing concepts, and applying them to hypothetical situations, but they are able to respond to their world through language, mental imagery and drawing. Active involvement with their environment is vital to learning during this phase of child development (Furth, 1970).

June McFee speculated on the relationship between knowing, seeing, perceiving, and drawing. McFee's Perception-Delineation (P-D) theory (1957) presents the four critical points that describe the creative act of drawing. These include a readiness to respond, a social-cultural screen that affects drawing, individual information processing approaches, and the individual's response to the perceptual/creative experience which McFee calls "delineation". The value of the McFee P-D theory for this study lies in the fact that it accounts for the perceptual/spatial/creative act as a set of learned

responses which are related to developmental as well as to cognitive factors. Thus it is one of the few theories of art education that is a learning theory rather than a developmental theory. Within this model the child draws both what he sees and what he knows.

Other art educators (McWhinnie, 1965; Salome, 1965; and Efland, 1965) studied the relationship between specific perceptual learning strategies upon specific behavioral referents such as aesthetic preference, creativity, perception of detail, and ability to process visual information. These studies, the so-called "Stanford Studies in Perceptual Learning in Art" explored the concept that children draw what they see rather than drawing what they know.

As a part of the general studies of how children learn, Bruner (1966) argued that children process and store information three ways. First, the "enactive" way, describes processing that occurs as children participate in activities. They notice the effects of their efforts, and they develop mental models to represent their experiences. The "iconic" way describes the processing that occurs as children discover patterns and form summarizing images in their minds in response to visual or other sensory stimuli. The third way children process and store information is the "symbolic" way, when they

represent their experiences through words, letters, and numbers. Based on the Bruner studies, and given the specific age level employed in this study, it seems that second grade students process information iconically and symbolically through enactive tasks. Again the theory is that doing facilitates knowing.

Sternberg (1985), speculated about the relationships between the cognitive processes that influence behavior (p. 97). He describes "metacomponents" as strategies for processing information the individual must select and use. "Performance components...tend to organize themselves into stages of task solution that...include encoding of stimuli, combination of or comparison between stimuli, and response" (p. 105). "Knowledge acquisition components" function in the acquisition, retrieval, and transfer of information (p. 109). Sternberg's theories relate to McFee's and were employed in this study as a link between McFee's work and the recent developments in cognition that seem to allow for a more comprehensive view of the inter-relationships between seeing, perceiving, knowing, and drawing. In this general area the most comprehensive study of the inter-relationships between children's intellectual development and their creative/symbolic development can be found in the research by Gardner and his co-workers at Harvard University's Project Zero.

Gardner (1987) argued that people possess seven different types, or domains, of intelligences including linguistic, logical mathematical, musical, spatial, bodily kinesthetic, interpersonal, and intrapersonal intelligence. He argues that broadening instruction so it meets more students' intellectual strengths, helps them become more effective learners in their weaker areas as well (Olson, 1988). The broad range of what is available for students "to do" to learn allows them freedom to learn according to their intellectual strengths.

From this overview, we can see that the trend among cognitive psychologists and educators is to view the ability to remember or recall as an outcome of processing, encoding, storing, and retrieving information received through the senses and mediated by action.

The researcher wanted to study the effects of various activities upon students' retention of information. She believed that this could be studied most effectively by including a variety of visual resources in the lessons, by involving students in various art-related activities, and by measuring students' retention of information through drawings as well as written tests. The researcher reviewed the theoretical literature to determine if others had studied that relationship between students' art work and knowing.

Children's Art Work as Perception and Cognition

This researcher attempted to review theories related to the effect of art-related activities upon students' cognitive development and their ability to recall information. She found that past studies explored the reverse relationship, the effect of intellect upon drawing. Harris (1963) conducted an extensive review of the literature on the study of children's drawings. He found that drawing tests, initially popular in psychological analyses, became psychometrically linked to the study of intelligence, and were thought to measure concept attainment. This is iconically a reflection of the theory that "a child draws what he knows" (Luquet, 1913).

Claparede (1907) developed a plan for studying the relationship between children's drawings and their general intellectual ability as measured by schoolwork. Ivanoff (1909) developed a scoring method for Claparede's plan and found a positive correlation in nearly all instances between children's drawings and their schoolwork (Harris, 1963, p. 12). This early study is consistent with art education history and formed the basis for some of the early research on children's symbolic and motor development.

Florence Goodenough's Draw-A-Man Test (1926) has been

used extensively as a measure of intelligence (Harris, 1963, p. 11). The drawings children produce through it are considered to be a reliable index of their concept of a man. Goodenough used Luquet's (1913) phrase in concluding that "the child draws what he knows, not what he sees" (Harris, 1963, p. 193). While coming from a different theoretical base, Lowenfeld and Brittain (1975) found that, through their drawings, children reveal their mental images and the information they have received, interpreted, and understood (p. 185).

Coloring Sheet Activities

This researcher also attempted to examine the effect of coloring sheet activities upon students' cognitive development, since these activities are commonly used in schools today (King, 1991). Russell and Waugaman (1952) and Heilman (1954) documented the loss of artistic skills that occurred when students were exposed to workbook coloring experiences. Based upon these studies and their own work, Lowenfeld and Brittain (1968) found that children became dependent and inflexible in their thinking after being exposed to the imitative procedures in coloring and workbooks. However these studies and theories have been criticized (King, 1991) as lacking empirical evidence obtained from double-blind studies.

Most educators argue that participating in any art-

related activity, including coloring, helps students develop their fine motor skills, and provides them with an activity that they enjoy. However, most educators want their students to develop cognitively as well as affectively and physiologically.

Research Questions and Hypotheses

The research questions which this study addressed were:

1. Will there be a difference in students' retention of information as measured by multiple-choice and drawing tests for students who are taught concepts and then are involved in a coloring sheet activity than for students in the control group who participate in a verbal review?
2. Will there be a difference in students' retention of information as measured by multiple-choice and drawing tests for students who are taught concepts and then are involved in an art-related activity than for students in the control group who participate in a verbal review?
3. Will there be a difference according to sex in students' retention of information as measured by multiple-choice and drawing tests?

Hypotheses related to the research may be stated as follows:

1. There will be no difference in the level of students' retention of information as measured by multiple-choice and drawing tests for students who are taught concepts and then are involved in a coloring sheet activity than for students in the control group who participate in a verbal review.
2. There will be no difference in the level of students' retention of information as measured by multiple-choice and drawing tests for students who are taught concepts and then are involved in an art-related activity than for students in the control group who participate in a verbal review.
3. There will be no difference according to sex in the level of students' retention of information as measured by multiple-choice and drawing tests.

Definitions of Terms

The definitions of terms that are used in this study include:

Art-related activities are those visual/cognitive/motor activities planned by the teacher to involve students in creating certain images for the purpose of reinforcing instruction in other curriculum areas.

Creative art experiences involve students in creating their own images in response to individual desires or as

part of specific assignments that challenge their divergent thinking skills and problem solving abilities.

Retention of information means that the information has been processed and encoded in a way that allows it to be fixed in the mind and available for future use.

Divergent thinking skills are those skills that enable one to think of varied responses to a given situation, to evaluate their relative merits, and to select the one that best serves the specified purpose.

Problem solving abilities are those abilities that enable one to consider various solutions to a given problem, and to select the one that best solves the problem.

Participation means taking part in an activity.

Ecological validity refers to a setting for research that is normal for students. All aspects of this study were implemented with entire classes of students in their regular classrooms. This research setting can be contrasted to that used frequently in research, where students are studied in an isolated setting.

A coloring sheet activity is one that provides students with an outline drawing and asks that they add color to it.

A drawing activity is one that engages students in using an appropriate tool to record or create images on a

blank sheet of paper.

Limitations of the Study

Due to school system policies, the researcher was limited to the use of intact classes that she was told had been randomly formed. Thus she used an availability sample, and conducted an exploratory study.

One factor that some would consider a limitation of the study was that the instructor/researcher was an experienced art teacher, not a classroom teacher. However, the instruction provided to students in this study did not require specialized training in classroom or art teaching. Most educators could duplicate the study if they possessed a general knowledge of students' cognitive development, interests, and needs, and were able to help students observe their environment. They would also need to be able to coordinate simple hands-on activities with paper, chalk, colored pencils, glue, scissors, and colored paper. (All instructional materials and methods used in the study are described in detail, and copies of the visuals used are included in the Appendix.)

Another limitation was the possibility of test effect since the same instruments were used with all treatment groups for pre-, post- and follow-up tests. A control group without pretest was included in this study to measure pretest effect. Other limitations included the

restriction of the study to one grade level and the time restraints associated with the study. The study involved only students in second grade and for only two 30 minute periods of instruction. These restrictions were placed upon the researcher by the school system in accordance with their policies and procedures.

A further limitation was the researcher's role as the teacher. The decision was made for the researcher to do the teaching to assure that all the lessons would be identical and students' performance would not be affected by their attitude towards their teacher. While this decision served these purposes, it reduced the ecological validity of the study setting. Students were not being taught by their regular teachers. A final limitation was that the time constraints required for this study did not permit the researcher to measure the effects of truly creative art activities upon students' retention of information.

Summary

Theories of children's symbolic and cognitive development suggest that a close relationship exists between the act of doing and knowing. Several theorists argued that empirical data is needed to support claims that art-related activities are valuable ways to reinforce instruction. For this reason, the researcher decided to

compare the effects of three independent variables (a verbal review, a coloring, and an art-related activity) on young students' retention of information from two classroom units of study. The next chapter includes a review of the literature related to this study.

CHAPTER II REVIEW OF THE LITERATURE

The purpose of this study was to compare the effects of a verbal review, a coloring, and an art-related activity on young students' retention of information from two classroom units of study. Students received one of the three treatments as reinforcement for two lessons that had encouraged student involvement through the use of active questioning.

The research questions which this study addressed were:

1. Will there be a difference in students' retention of information as measured by multiple-choice and drawing tests for students who are taught concepts and then are involved in a coloring sheet activity than for students in the control group who participate in a verbal review?
2. Will there be a difference in students' retention of information as measured by multiple-choice and drawing tests for students who are taught concepts and then are involved in an art-related activity than for students in the control group who participate in a verbal review?
3. Will there be a difference according to sex in students' retention of information as measured by multiple-choice and drawing tests?

One of the greatest challenges that has faced art educators for some time is that of discovering and exploring the relationship between art, visual imagery, and cognition (Arnheim, 1983; Broudy, 1979). Renown art and general educators have espoused the virtues of using the arts to facilitate learning in other subject areas (Kilpatrick, 1918; Winslow, 1939; Wolf, 1985; Cohen & Gainer, 1984). Philosophers including Dewey (1934) and Piaget (1947/1973) have argued that there is a positive relationship between doing and knowing, yet few empirical studies have been conducted to test that hypothesis as it relates to artistic processes such as drawing or coloring.

The focus of the first portion of this literature review is upon theories about how people process, encode, and utilize information, or how people achieve the state of "knowing". The focus of the second portion is upon the theoretical literature related to the use of art-related activities to reinforce instruction in other curriculum areas. The final portion of this chapter is a review of empirical studies related to the topic of this research, the effects upon knowing of active participation in art-related activities.

Foundations in Cognitive Development Theory

Piaget (Gruber and Voneche, 1977) refers to four stages of intellectual development (p. 456), three of

which are dependent upon the involvement of the child in perceptual/motor activities. From birth until age two, babies are in a "sensorimotor" period when they learn through sensory motor activities. During the stage of "preoperational thought", from age two to age seven, children's perceptions affect their logic, but they are able to represent the world through language, mental imagery and drawing. At the "concrete operational" stage, from age seven to eleven, children develop techniques of reasoning which are dependent upon objects and people around them. They have difficulty generalizing concepts, and applying them to hypothetical situations. Only during the most advanced stage, that of "propositional or formal operations", from ages 11 or 12 to 14 or 15, do children develop "hypothetico-deductive reasoning" that enables them to synthesize the observable with the possibilities (p. 462). At this stage, children can understand abstract concepts and represent them symbolically.

As mentioned in chapter one, the Piagetian model for child development was not inconsistent with McFee's (1957) Perception-Delineation (P-D) theory. McFee speculated on the relationship between knowing, seeing, perceiving, and drawing. Her (P-D) theory (1957) presents the four critical points that describe the creative act of drawing. These include a readiness to respond, a social-cultural

screen that affects drawing, individual information processing approaches, and the individual's response to the perceptual/creative experience which McFee calls "delineation". McFee's P-D theory accounts for the perceptual/spatial/creative act as a set of learned responses which are related to developmental as well as to cognitive factors. Thus it is one of the few theories of art education that is a learning theory rather than a developmental theory. Within this model the child draws both what he sees and what he knows.

McWhinnie (1992) has recently argued that the three major accounts of how and why children draw as they do are all equally valid and yet necessarily incomplete accounts of the symbolic/drawing act. He has proposed a "Unified Field Theory of Children's Symbolic Development" which holds that the three prevailing subtheories all have validity. The child draws what he knows (Goodenough, 1926), what he sees (Arnheim, 1954 and McFee, 1961), and what he feels (Kellogg, 1967).

Sternberg (1985) presents three subtheories of intelligence that bear a strong resemblance to McFee's P-D theory. One, the "contextual", regards intelligence as an individual's ability to adjust, alter, or fit into his or her environmental context (p. 47). Each culture's environment may require distinctly different adaptive

skills, so members of each culture may define intelligence differently. Another Sternberg subtheory, of "experiential" intelligence, reflects each person's ability to "deal with novel kinds of task and situational demands and the ability to automatize the processing of information (p. 68). This ability involves task comprehension, task execution, or both (p. 71) and is thought to occur along a continuum, depending upon the novelty of the task. Thinking task novelty can be directly related to the problem under study in this project, the relationship of art to cognition.

The third Sternberg subtheory of intelligence, "the componential", specifies the cognitive processes that influence behavior (p. 97). He describes "metacomponents" as strategies for processing information the individual must select and use. "Performance components...tend to organize themselves into stages of task solution that...include encoding of stimuli, combination of or comparison between stimuli, and response" (p. 105). "Knowledge acquisition components" function in the acquisition, retrieval, and transfer of information (p. 109).

Sternberg believes that intelligence is malleable and can be increased by appropriate teaching and learning (Sternberg, 1989). [He is developing a test to assess all

three aspects of intelligence. Christened the Sternberg Triarchic Abilities Test (STAT), it was to have been published in 1991.] The advantage of Sternberg's classification is that intelligence is no longer viewed as a single factor and that the three major areas are manageable in terms of research studies. Our extension of Sternberg's classification to McFee's P-D theory seems to offer direct utility to the art educator.

On the other hand, Gardner (1987) argues that people possess seven different types of intelligences including linguistic, logical mathematical, musical, spatial, bodily kinesthetic, interpersonal, and intrapersonal intelligence. Arts-related teaching strategies should be viewed as potential ways to reach students whose intelligence lies in the musical, spatial, bodily kinesthetic, or interpersonal domains. This would help them become more effective learners (Olson, 1988). The problem with the Gardner model is that it presents a more complex matrix of behaviors for the researcher. The advantage of his seven fold classification is that it expands upon the more limited Sternberg categories.

In contrast to Sternberg and Gardner are the ideas of Anderson (1983). Adaptive Control of Thought (ACT) is the name Anderson has given to his theory of cognition. He believes that the mind is a unitary system that consists

of "a general pool of basic structures and processes" (p. 5). He believes that information received by the senses in various forms including images (p. 62) is encoded into a network of cognitive units (p. 208). According to Lohman (1989), a major implication of Anderson's learning theory is that aspects of thinking previously thought to be innate are actually knowledge that has become automatized through practice. "Thus, understanding abilities means understanding individual differences in learning and development" (p. 359).

When discussing Dehn and Schank's (1982) work on Artificial Intelligence (AI) Lohman noted that researchers have a new respect for the way human intelligence operates. Humans..."balance effort and time against expected payoff..." (p. 365).

Bruner's (1966) focus was upon the way people process, encode, and store information. He argued that adults with normal intelligence utilize all three information processing strategies they developed as children. First, he described the "enactive" way, a process that happens when children participate in an activity, notice the effects of their efforts, and develop a mental model to represent their experience. "Iconic" representations are created as children discover patterns and form summarizing images in their minds in response to

visual or other sensory perceptions. Later children develop "symbolic" ways to represent their experiences through words, letters, and numbers.

Foundations in Art and General Education Theory

Respected theorists and practitioners in art and general education have argued for and against the use of art-related activities to reinforce instruction in other curriculum areas. John Dewey (1902) and other "progressive" educators argued that drill and practice methods teachers used to educate their students were ineffective, and that traditional subjects should be taught by incorporating the arts and other meaningful activities in the teaching process (1938). In his 28 years as a leading educational philosopher at the Teachers College, Columbia University, Kilpatrick published a handbook (1918) and trained more than 35,000 (Lazerson, 1971) graduate students to use "the project method" that included the arts in teaching other curriculum areas. Aikin (1942) conducted an eight year study that found these nontraditional modes of teaching were equally effective as earlier methods of educating students.

Many respected art and general educators have questioned the educational value of coloring sheet activities which some classroom teachers call "art". According to Jefferson (1969), adults must be concerned

about the long-term effects coloring sheet activities have on student thinking, deciding, and behaving. She reminded teachers that they are responsible for providing students with educationally sound activities.

Robert Saunders (1972) stated that the scribble type movements required for filling in prepared outline drawings are a regression from more advanced stages of artistic development. These activities force the child "into a disability which makes later manuscript and cursive writing difficult..." (p. 58). Saunders was one of the first art educators to address the consequences of such questioned practices on the child's symbolic development.

At the Annual Meeting of the Communications/Reading Conference, Mills (1975) spoke about the message conveyed through coloring assignments. He said, "...when you give the child a ready made drawing to fill-in, you are telling him, in a non-verbal way, that you have no confidence in his ability to do his own drawing" (p. 3). This action also communicates a lack of confidence that the student has the prerequisite skills needed to create a drawing, information about his subject.

King (1991) presents the opposing view that coloring books create favorable attitudes towards learning. He argues that students' participation in coloring sheet

activities provide them with emotional relief while furthering their artistic and intellectual development.

Review of Related Empirical Studies

The focus of the final portion of this chapter is upon previous empirical studies of the effects upon knowing of active participation in art-related activities.

One program that attempted to link student achievement in terms of knowledge with their participation in arts-infused instruction lacked the controls required for it to be considered an empirical study. The "Learning to Read Through the Arts" (LTRTA) program was directed by Bernadette O'Brien in New York City and evaluated by Walker and others (1982). The program involved students in grades two through five in an arts based curriculum.

LTRTA students were given the California Achievement Test in reading as pre- and posttests in October, 1981 and May, 1982. Without treatment, a student's normal curve equivalent (N.C.E.) scores were expected to remain the same, which would place him/her in the same relative position to others in their grade. If the posttest N.C.E.'s were higher, gain could be attributed to treatment. Gains for students involved in LTRTA were from 9 to 14 N.C.E.'s in grades two, three and five.

A report by Olson (1988) of the preliminary results of a study of Project Spectrum, a pilot project involving

teachers and students in utilizing educational strategies and innovative approaches to learning based upon the work of Howard Gardner and others at Harvard's Project Zero, seem to show some support for innovative methods. The Key School in Indianapolis was the first school organized around Gardner's theory. From among five hundred applicants, one hundred fifty K-6 grade students were selected by lottery to attend the new school. Students received daily instruction in music, art, physical education, Spanish, and computers as well as in the "regular" academic subjects. Olson reported that teachers involved in the program were able to "find a child's 'intrinsic motivation' and capitalize on it" (p. 18). Some students who had previously been considered at risk were enjoying recognition for particular talents. These findings suggest that allowing students many avenues to internalize new information may improve their ability to retain information as a part of a complex intelligence system.

A pilot study of preschool students (Gardner & Hatch, 1989) at one Project Spectrum site revealed that each student's performance varied in 10 activities (story telling, drawing, singing, music perception, creative movement, social analysis, hypothesis testing, assembly, calculation and counting, and number and notational logic)

and on the Stanford-Binet Intelligence Scale, Fourth Edition. Results of this study suggest that students do have distinct intellectual profiles. Of 20 children in the study, 15 demonstrated strength in at least one area, and 12 demonstrated a weakness in at least one area. Only one child was identified as having no area of strength or of weakness. Gardner reported less obvious success in finding strengths and weaknesses among children in a second study of eight kindergarten and seven first grade students. He attributed the confounding results of the study to the small sample size and large age span between subjects.

A study by Pratton and Hales (1986) revealed the positive effects which active participation had upon students' ability to retain information. The study involved fifth grade subjects in learning about probability through a lecture only mode or through active participation. According to the researchers, the study helped move active participation from the theoretical to the realm of the empirical, because quantitative methods were used to assess the level of students' understanding, and active participation was found to have made a significant difference. They urge others to undertake further study to measure the accumulative effects of active participation upon learning. This seems to be good

advice since the subject of probability is not usually studied in elementary school. It also did not involve students in art-related tasks, such as those that were attempted in this study.

A few researchers have conducted studies related to the hypothesis that information received both as language and as image is retained more effectively than information presented verbally. One study by Ellen Vasu and Ann Howe (1989) used first and fourth grade students as subjects. The task involved students in examining a kiwi fruit. Immediately afterwards, the fruit was removed and students were asked to draw it and describe it verbally from memory.

Students took their time examining the fruit, but none needed more than one minute. While they looked, students in the visual-verbal treatment group heard the researcher describe in detail all the properties of the fruit that would later be used in scoring the tasks. When they were finished looking they were asked to draw the fruit from memory, and describe it to the experimenter. Two weeks later, all students were asked to recall the fruit, describe it to the experimenter, and draw it again from memory.

The data showed that for students in both grades, on both immediate and long-term tasks, students assigned to a

visual/verbal treatment group scored higher on a verbal description task than those in a purely visual control group. For long-term retention, children in both age and treatment groups retained more information in pictorial form than in verbal form. The researchers concluded that teachers should use children's natural ability to form images, recall and represent them, instead of relying exclusively upon verbal measures to test retention of information.

A study reported by Hilts in the November 11, 1991 edition of the New York Times documented the strong relationship in the brain between visual perception and memory. When subjects were asked to recall words while their brains were being photographed, the perception area of the brain interacted positively with many of the memory functions. The value of the New York Times study was that the conclusion was based upon pictures of the brain itself as it functioned in memory tasks and not upon more remote forms of data collection such as tests.

Battle and Labercane's study (1985) examined the relationship of spelling, reading, and arithmetic achievement and visual memory and association. Eighty-seven second through sixth grade students were the subjects. The data showed that reading and spelling achievement is significantly and highly related to visual

association and only moderately related to WISC-R I.Q. test results. Moderate correlations were noted between reading and spelling achievement and visual memory tests. Arithmetic achievement was moderately related to visual association, slightly less related to I.Q., and not related to visual memory.

The study by Richard Mayer (1989) shows that allowing students to study models (diagrams) before teaching them new material improves their ability to recall conceptual information, decreases their verbatim retention, and increases their ability to solve related problems creatively. Further, Mayer's research showed that models can help lower aptitude learners think systematically about the scientific material they study. Mayer's research suggests that involving students, by presenting them with an opportunity to look at material that has been organized visually for them, improves their ability to understand new information. It did not explore, as this study attempted to do, the effects upon retention of information of active student participation in motor/visual/cognitive activities.

Mayer reviewed 20 studies involving 31 separate tests conducted in his laboratory where students were shown conceptual models to aid them in understanding scientific explanations. These were intended to help learners build

"mental models" of the system being studied, to foster "meaning learning" of the material. Model group learning was compared to that of another group of students (control group) which had been presented with the same material without a conceptual model.

According to Mayer, "meaningful learning requires that students attend to relevant information, build internal connections among the pieces of information, and build external connections between the information and relevant existing knowledge." He argues that the results of his review encourage continued development of theory and practice for using models to promote understanding.

Hayes and Henk (1986) compared the effects of analogic and pictorial illustrations upon high school students' ability to understand and remember complex instructional text. This study was built upon a body of literature that showed that pictures and analogies serve a similar and perhaps overlapping function (Mayer, 1975; Royer & Cable, 1976; Rigney and Lutz, 1976), and that people sometimes personify what is not human, animate the inanimate (Khatena, 1983). The researchers found that pictures helped students understand and remember information, both immediately after reading the text and two weeks later. The effect of analogy on understanding and retention of information was apparent on delayed

performance but only slightly more helpful on immediate performance.

During post-experimental interviews, subjects reported having only vague recollections of the text content, and having relied exclusively upon the pictures. Those who had not received written text to accompany the pictures tended to invent their own. They reported examining the pictures and transforming their perceptions into verbal steps such as, first I make a loop, then I bring the bottom end up. The researchers concluded that students put both pictures and analogies to good use when having to understand and remember complex information. Pictures are apparently useful for sorting out complexity. Active student involvement in following written and/or pictorial directions and tying a knot was not part of this study. Thus we are not able to draw conclusions about the effect motor involvement would have had upon students' ability to remember the text.

McWhinnie and Lascarides-Morgan (1971) studied drawings created by four and five year old students, before and after they had been taken on "field trips designed to increase their awareness of people, trees, houses, and birds" (p. 48). Although all students had been "actively involved" from a physical standpoint, the researchers found that significant differences existed

between first and second drawings of people and birds, but not of houses and trees. As in the lesson designed for this research, the trees students observed and drew were bare in winter. McWhinnie and Lascarides-Morgan hypothesized that indoor or outdoor location, degree of distraction, length of field trip, familiarity of subject, or amount of sensory stimuli may have explained the difference between students' performance on tasks related to the four subjects. It would be interesting for future researchers to study students' ability to change their tree and house drawings by altering each of the possibilities suggested by McWhinnie and Lascarides-Morgan.

There are no recent studies within art education related to the effects of filling-in prepared outline drawings upon students' artistic skills or their ability to understand and remember information. An early study by Heilman (1954) documented the loss of artistic skills that occurred when students were exposed to workbook coloring experiences. Another early study by Russell and Waugaman (1952) showed that "63 percent of all children exposed to coloring book birds lost their initially established sensitivity to birds and changed their concepts to resemble the stereotype". Based upon these studies, Lowenfeld and Brittain (1968) argued that imitative

procedures in coloring and workbooks make children dependent and inflexible in their thinking. King (1991) found that researcher bias influenced these early studies and concluded that no unbiased research has been conducted to date that supports or refutes these claims.

Summary

From this review of the literature, it seems that there is a growing body of knowledge that suggests that students understand and remember information more effectively when they are involved in some form of visual/motor experiences than they do without such experiences. No recent quantitative studies were found to support or refute claims that students' participation in art-related or coloring sheet activities facilitated understanding or recall of information from other curriculum areas. Within the last two decades, research in art education has focused attention on other concerns, and interest in these two once lively issues has been dormant. However, the questions addressed in the earlier literature have not been reconciled, and they continue to interest a new generation of art educators.

CHAPTER III METHODOLOGY

The purpose of this study was to compare the effects of a verbal review, a coloring, and an art-related activity on young students' retention of information from two classroom units of study. Students received one of the three treatments as reinforcement for two lessons that had encouraged student involvement through the use of active questioning.

The research questions which this study addressed were:

1. Will there be a difference in students' retention of information as measured by multiple-choice and drawing tests for students who are taught concepts and then are involved in a coloring sheet activity than for students in the control group who participate in a verbal review?
2. Will there be a difference in students' retention of information as measured by multiple-choice and drawing tests for students who are taught concepts and then are involved in an art-related activity than for students in the control group who participate in a verbal review?
3. Will there be a difference according to sex in students' retention of information as measured by multiple-choice and drawing tests?

Design of the Study

A 3 x 2 between subjects factorial design with repeated measures was used for this study, and tasks were counterbalanced to control for order. There was one control group with pretest in each school and two experimental groups. A fourth second grade class in one of the schools provided a pre-test control group. Intact classes in each school were assigned as the control or experimental groups using a random process. Since principals and teachers agreed to let students participate in the study, this was an availability sample.

Selection of Subjects

Subjects for this study were the entire second grade population of two public elementary schools in a large urban/suburban school district on the eastern seaboard. There were 178 subjects in the study, in seven intact, heterogenous classes. One school provided 57% of the subjects, while the remaining 43% attended the other. There were 25 students in the control group without pretest, 52 students in the control group with pretest, 51 students in the experimental group with the coloring sheets and 50 students in experimental group with the art-related activity. Forty-nine percent of the subjects were female and fifty-one percent male. Females outnumbered males 14 to 11 in the control group without pretest, and

28 to 24 in the control groups with pretest. Males outnumbered females 28 to 23 in the coloring sheet group, and 27 to 23 in the art-related activity group.

Procedures

To increase the study's ability to be generalized to a broader population, the two schools selected by the researcher closely resembled the school district's population in terms of reading test scores earned by students who were tested in May of the preceding year, minority enrollment, and student mobility rates. (See Appendix A). Since she was limited by the school system to the use of intact classes, the researcher contacted the principals of both schools to determine if placement of students into classes at the beginning of the school year had been done on a random basis. She was assured that it had been. The researcher gained the principals' and teachers' approval for the study, and scheduled a planning meeting (see Appendix A).

The researcher met with the second grade teachers in each school and had each of them select one unmarked envelope from among three in one school and four in the other that determined their class' assignment to a treatment or control group. Thus assignment of groups to treatments was done on a purely random basis. The researcher discussed the study procedures with the

teachers, and scheduled each session required for the study. Significant pre-experimental differences in groups' achievement on criterion-referenced reading tests was not known to the researcher until the study was completed and the test data scored (see Chapter IV).

On the first day of the study implementation, the researcher introduced herself to each class following a prescribed script (see Appendix A), then read aloud the test directions and each test item, while students completed the pretest. The pretests involved all students in answering a few questions related to information that would be presented during the lesson (See Appendix C). A drawing test was part of the pretest to measure students' visual/motor/cognitive knowledge before instruction was administered. One control group did not receive the pretest so that pretest effect could be studied.

In an alternating sequence between the two schools to control for order, instruction related to the American flag lesson or the tree lesson was administered to all classes using the researcher's natural teaching style of involving students through active questioning. Lesson descriptions for each group are in Appendix B. As part of the two experimental groups' lesson, either the coloring or the art-related activity was presented, while the control groups were involved in a verbal review of the

lesson (see Appendix B). The time length for all classes was to be equal. The researcher tape recorded each lesson so lessons could be compared for consistency.

To determine the effect of each treatment method, the next day, students in each class were given the same tests used as a pretest, this time as a posttest. Two weeks later, a time length other researchers have used to define "long-term" for elementary aged student (Vsau and Howe, 1989) all students were given the same test this time to measure long-term learning. These tests are referred to as follow-up tests in this dissertation.

The assignment of classes to treatments was held constant throughout the study. If assignments had been changed, students' participation in previous study treatments may have created a confounding variable. In addition, the researcher was interested in knowing if students responded similarly to treatments across subject matter.

The pretests related to the second lesson in the study were read aloud to all students in groups receiving the pretests, and time was allotted for them to complete the tests. After a few days, the second lesson was presented to all classes in both schools. As part of the lesson, students in the two treatment groups were given either the coloring or the art-related activity. The

researcher spent extra time reviewing information with the control group. The time lengths consumed by all phases of instruction were intended to be equal to eliminate time as a confounding variable in the study. The day after instruction, students in each class were given the same test used as the pretest, this time as the posttest. Two weeks later, all students were given the same test used before, this time as the follow-up test to measure long-term retention of information.

As part of this study, all students were shown a real flag and many pictures, photographs, and diagrams that related to both the flag and the tree lessons (see Appendix B). All groups responded to the researcher's questions and discussed these visuals in detail during the instructional portion of their lessons. All groups had been able to refer to these visuals as they participated in their review of the lesson or in their art-related activities. However, the visuals were not displayed for any group during the testing phases of the study.

Scoring Methods

As tests were completed by a group, the researcher inserted them into a manila envelope. She recorded the name of the teacher and the date the tests were administered on the envelope. Multiple-choice tests were scored as soon as time was available and returned to their

envelopes.

To avoid the possibility of researcher bias during the scoring of the drawing tests, several steps were followed to conceal the identity of students, the group to which they were assigned, and the date each test was administered. These steps were:

1. During the study, each student was assigned a number to use instead of his/her name on all drawing tests.
2. After all the drawings required for the study had been completed, the researcher had an assistant draw a different bar type code on the back of each set of drawings using colored pens and markers. The same bar code was drawn on the manila envelope that held the drawing tests and the scored multiple-choice tests. The drawing tests were removed from the envelopes and mixed with all other drawings in random order for scoring.
3. The researcher selected a graduate student and trained her to use the drawing test score sheets. Discussions were held and the score sheets were refined until an interrater reliability of 94.75% was reached for the flag drawing test, and of 92% was achieved for the tree drawing test. (See

sample scoring instruments, and interrater reliability information, Appendix C).

4. The drawing tests were scored using the checklist to eliminate the possibility of researcher bias.
5. Once scored, the drawings were sorted according to bar codes and returned to their matching envelopes. The researcher used the information written on the envelopes to identify the school, treatment group, and date the test was administered. The researcher recorded the scores earned by each student in the appropriate blanks on the data record sheets.

Selecting the Lessons

The researcher wanted to relate at least a part of this study to trees or people, two traditional subjects in art education research (Goodenough, 1926; Efland, 1965; McWhinnie & Lascarides-Morgan, 1971). It was decided that learning about people happens almost daily in most second grade classrooms, so the researcher would have difficulty attributing changes in students' retention of information to the treatments in the study, if she selected people as the subject. In addition, given second graders' strongly established schema for drawing people, it would be difficult to attribute the resulting drawings exclusively to the instruction that was part of this study.

The researcher believed that a lesson based upon the subject of how deciduous trees grow would be an acceptable alternate choice. Most second graders are in the schematic stage according to Lowenfeld (1964) and schematic drawings of trees, like people (p. 141), are usually composed of simple, geometric shapes. A deciduous tree image, as it appears in winter, is composed of parts that taper progressively from bottom to top. The researcher believed that this image would be sufficiently different from the schema most young children have established for drawing trees. In addition, most second grade classroom teachers do not discuss trees on a daily basis, as part of their ongoing program. Thus, it was believed that the information reflected in the drawings which students created of deciduous trees in winter could be attributed directly to the instruction from this lesson.

The American flag was selected as the subject for the second lesson because it is entirely different from the tree and thus would serve to generalize the findings to other units of study. The American flag relates to the social studies curriculum, is usually thought of as flat, is asymmetrical, mathematical, geometric, man-made, and represents a wealth of information symbolically. The deciduous tree is a subject from the science curriculum,

is usually thought of as occupying space, usually looks similar from most sides, and is organic in nature.

The researcher found that the American flag and the deciduous tree were appropriate subjects for students to study, according to curriculum guides for second graders in the school district (Montgomery County Public Schools [MCPS], 1987, p. 2:3; MCPS, 1988, p.3). She found similar lessons in workbooks that were available commercially for teachers (Forte, 1989; Hoerber, 1988).

Rationale for Development of New Measures

The researcher developed new measures for the following reasons:

1. The researcher was interested in measuring the effect of art-related activities on students' retention of information regardless of ability level, and existing instruments were not designed to do this.
2. The researcher was interested in assessing students' retention of information through iconic as well as verbal methods, and existing instruments were not designed to do this.
3. The researcher found that existing drawing tests that used trees as subjects (Efland, 1965; Kline-Carey, 1922; McCarty, 1924) were intended to measure personality traits, intelligence, or

innate artistic ability, ends that did not relate to this study.

Reliability and Validity of Test Instruments

Item analyses were conducted to assess the validity of the instruments as measures of students' comprehension (See Appendix C). The flag multiple-choice test was found to be a fairly reliable instrument, with Cronbach's Alpha = .75 and the Standard Error of Measurement = 1.52. The tree multiple-choice test was found to be a highly reliable instrument for measuring students' comprehension, with a Cronbach's Alpha = .96 and a Standard Error of Measurement = .80.

Students' scores on school system Criterion Referenced Tests (CRT) in reading were used in the study to enable the researcher to determine if students' achievement on tests in this study was related to their reading ability, and if groups were similar according to their reading test scores. The CRT's are highly reliable instruments for measuring reading ability both in comparison with commercial reading comprehension tests and in an absolute sense, with K-R 20 values ranging from .84 to .90 (MCPS, 1986). The CRT tests were given by the school system approximately one month after the completion of this study. Therefore, the test results were not available for the researcher to use prior to the study, to

determine whether or not the control and experimental groups were evenly matched groups according to their reading test scores.

Some students who participated in this study were given CRT tests that were a full grade level above or below their second grade placement, and scores from all grade level tests were reported in terms of percentile ranks within the grade level tested. To be meaningful for this study, the researcher had to recode students' scores. The researcher met with a school system statistician and adopted a recode system similar to what is used within the school system for their analyses of students' test scores. A recoded score of 2.00 was used to indicate a student whose score was in the 60 - 80 percentile on the second grade test. (A more complete description of how students' CRT scores were recoded can be found in Appendix C).

All of the research procedures described in this chapter were followed in an attempt to create an empirical study that would generate data regarding the effect of using art-related activities to help students learn in other curriculum areas. The researcher attempted to create internally valid research conditions that would allow data to be gathered without researcher bias. She was interested in attempting to conduct a study that had internal validity and was generalizable to a broad

population of elementary school students.

CHAPTER IV RESULTS

The purpose of this study was to compare the effects of a verbal review, a coloring, and an art-related activity on young students' retention of information from two classroom units of study. Students received one of the three treatments as reinforcement for two lessons that had encouraged student involvement through the use of active questioning.

This chapter reports the results of the study and cites statistical data related to the research questions and hypotheses. The research questions which this study addressed were:

1. Will there be a difference in students' retention of information as measured by multiple-choice and drawing tests for students who are taught concepts and then are involved in a coloring sheet activity than for students in the control group who participate in a verbal review?
2. Will there be a difference in students' retention of information as measured by multiple-choice and drawing tests for students who are taught concepts and then are involved in an art-related activity than for students in the control group who participate in a verbal review?
3. Will there be a difference according to sex in

students' retention of information as measured by multiple-choice and drawing tests?

Hypotheses related to the research may be stated as follows:

1. There will be no difference in the level of students' retention of information as measured by multiple-choice and drawing tests for students who are taught concepts and then are involved in a coloring sheet activity than for students in the control group who participate in a verbal review.
2. There will be no difference in the level of students' retention of information as measured by multiple-choice and drawing tests for students who are taught concepts and then are involved in an art-related activity than for students in the control group who participate in a verbal review.
3. There will be no difference according to sex in the level of students' retention of information as measured by multiple-choice and drawing tests.

Descriptive Statistics - Variables

Table 1 presents the descriptive statistics for all variables in the study. Abbreviations that are used on the ANCOVA tables later in this chapter are shown in parentheses. See Appendix D for additional statistics.

Table 1

Descriptive Statistics for all Variables			
Variable	Subjects	Mean	S. D.
Sex (1=female, 2=male)	178	1.5056	.5014
Criterion Referenced Test in Reading (CRT)	151	2.1656	.6512
Flag Multiple-Choice Pretest (FMC1)	132	6.9621	2.8051
Flag Multiple-Choice Posttest (FMC2)	160	11.6875	3.4444
Flag Multiple-Choice Follow-up Test (FMC3)	154	11.0065	3.5415
Tree Multiple-Choice Pretest (TMC1)	142	6.1268	2.8605
Tree Multiple-Choice Posttest (TMC2)	156	9.2115	3.4901
Tree Multiple-Choice Follow-up Test (TMC3)	158	8.7278	3.3111
Flag Drawing Pretest (FD1)	133	6.1147	1.8896
Flag Drawing Posttest (FD2)	159	8.1698	2.0530
Flag Drawing Follow-up Test (FD3)	154	7.8127	2.0666
Tree Drawing Pretest (TD1)	137	7.3869	2.2237
Tree Drawing Posttest (TD2)	158	8.3354	2.0983
Tree Drawing Follow-up Test (TD3)	165	7.6364	2.0985

The number of subjects described in Table 1 varied

from a low of 132 to a high of 178. This variation can be explained by the fact that some students were absent for each test, and one control group had no pretests.

Criterion Referenced Tests - Reading

Scores earned by subjects in each group a few months later on the public school system's Criterion Referenced Tests (CRT) in reading are shown in Figure 1. The CRT test scores were used to increase the study's internal validity, and to increase the information available to the researcher and others about the subjects.

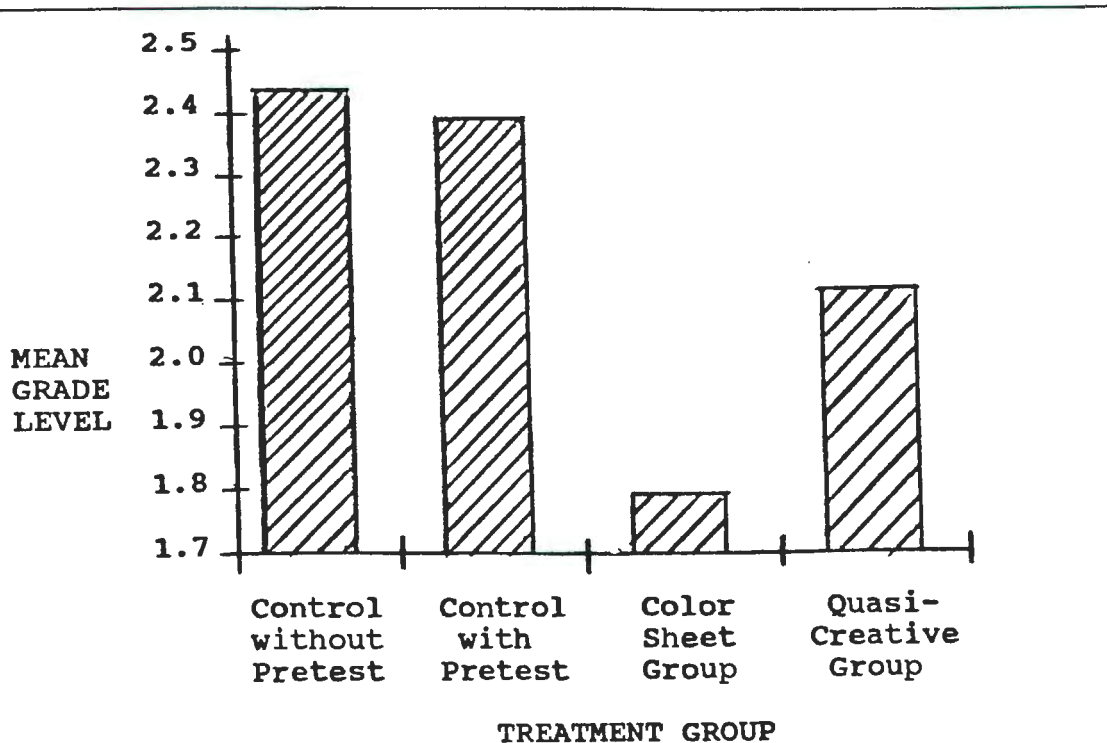


FIGURE 1. Recoded Student Scores on Criterion Referenced Reading Tests.

The mean scores shown in Figure 1 for each of the

four treatment groups were recoded from the raw scores (see Appendix C) so they would be meaningful in terms of students' grade level. The two control groups were found to have significantly higher reading test scores than the two experimental groups. This difference was believed to have affected the course of the study and the data analyses.

Figure 2 is a graph of each group's scores on the pre-, post, and follow-up phases of the flag multiple-choice and drawing tests. Mean scores are shown in parenthesis according to sex. Pretest scores are not shown for the control group without the pretests.

Figure 3 is a graph of each group's scores on the pre-, post, and follow-up phases of the tree multiple-choice and drawing tests. Mean scores are shown in parenthesis according to sex. Pretest scores are not shown for the control group without the pretests.

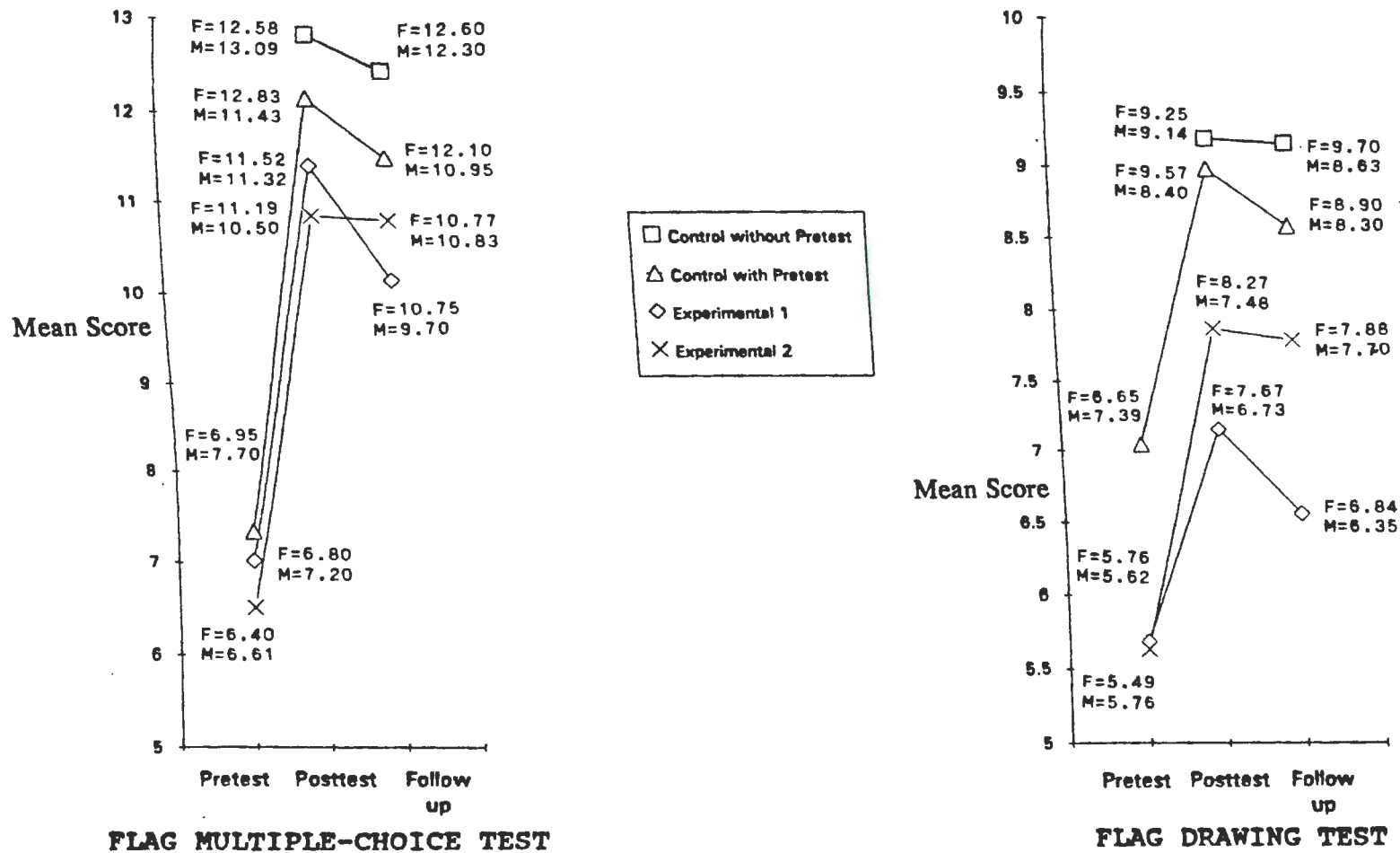
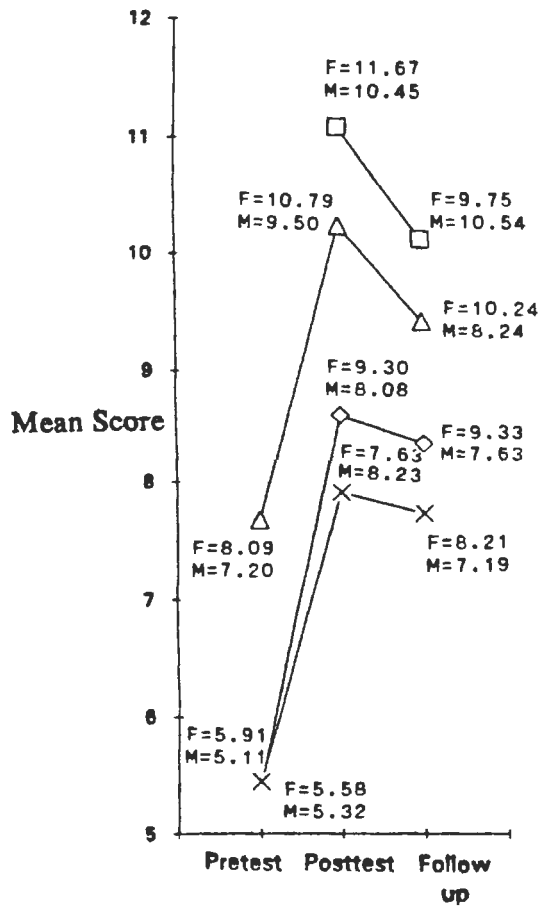
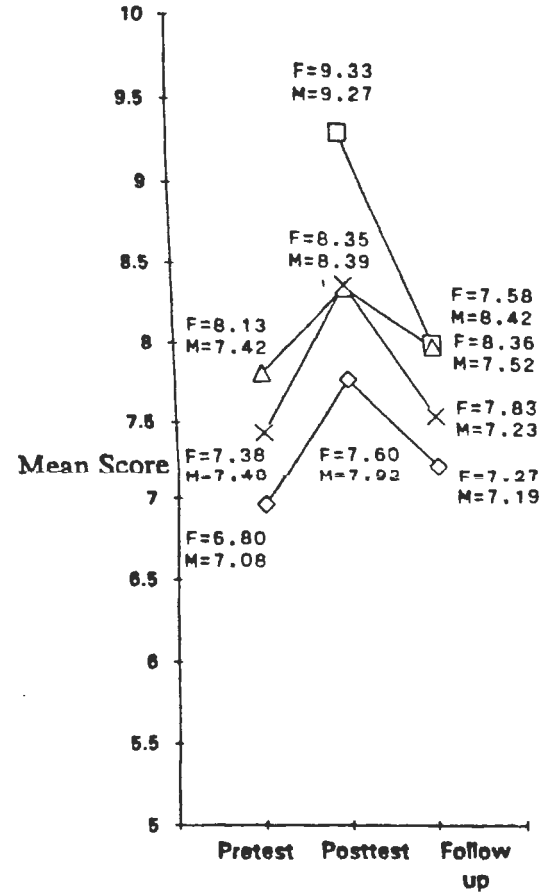
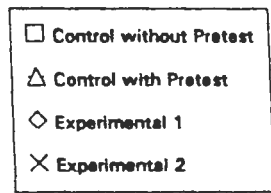


FIGURE 2. Mean Scores on all Phases of the Flag Multiple-Choice and Drawing Tests.



TREE MULTIPLE-CHOICE TEST



TREE DRAWING TEST

FIGURE 3. Mean Scores on all Phases of the Tree Multiple-Choice and Drawing Tests.

ANCOVA Analyses of Tests

Students' scores on all tests were examined using ANCOVA, Analysis of Covariance, to see if the method used with any group, the students' sex, or an interaction between method and sex, was responsible for significant differences in students' retention of information that could not be explained by preexisting differences accounted for by the pretests. SPSS/PC+ Studentware analyzed the data through multiple regression. Students' pretest scores were the covariable.

It should be noted that, whenever analyses were being run that required students' pretest scores, SPSS/PC+ Studentware omitted the control group without pretest's results. For this reason, future references in this dissertation to students in the control group refer to students in the control groups with the pretest.

The researcher created the following ordered regression summary tables from the SPSS/PC+ Studentware analyses of the data.

Analyses of Flag Multiple-Choice Tests

The figures shown in Table 2 were derived from the ANCOVA analysis of students' scores on the Flag Multiple-Choice Posttests (FMC2) with the Flag Multiple-Choice Pretest (FMC1) entered as the covariable.

Results of the analysis support hypothesis one and

two. No significant difference was found to exist in the level of students' retention of information as measured by this multiple-choice test for students who were taught concepts and then were involved in a coloring or an art-related activity than for students in the control group who participated in a verbal review.

Table 2

Ordered Regression Summary Table Flag Multiple-Choice Posttest (FMC2)				
Source	df	SS	MS	F
Cov. (FMC1)	1	515.02	515.02	65.28*
Method	2	9.30	4.65	.59
Sex	1	28.08	28.08	3.56*
Interaction (M x S)	2	11.86	5.93	.75
Slopes (Meth)	2	50.45	25.23	3.20*
Slopes (Sex)	1	1.06	1.06	.13
Slopes (M x S)	2	33.98	16.99	2.15
Residual	115	907.43	7.89	

* - Significant at .05 level

The data did show a significant ($p < .05$) difference in students' performance according to sex, with the F ratio = 3.56. This finding does not support hypothesis number three. On this test phase, a significant difference was found to exist in students' retention of information according to their sex. Adjusted marginal means were used

for comparing students' scores according to sex. These means are calculated from information obtained during the ANCOVA procedures. They reflect the statistical control afforded by ANCOVA, since preexisting differences between students have been effectively removed via. the pretest.

Calculations of the adjusted marginal means revealed that girls scored significantly higher than boys. (The means for the two groups were girls = 11.9736, boys = 10.9760.) The significant difference in slopes related to method discovered through this ANCOVA procedure does not affect our ability to interpret the finding of a significant difference according to sex. The slopes for sex were not significantly different.

The figures shown in Table 3 were derived from the ANCOVA analysis of students' scores on the Flag Multiple-Choice Follow-up tests (FMC3) with the Flag Multiple-Choice Pretest (FMC1) entered as the covariable. This analysis revealed a significant difference between slopes according to the interaction between method and sex. Thus the assumption of homogeneity of regression required for the use of the ANCOVA procedure was not met in this phase of testing and the ANCOVA procedure could not be considered appropriate for analyzing the data. Hence, the data from this phase of testing could not be used to support or to reject the research hypotheses.

Table 3

Ordered Regression Summary Table
Flag Multiple-Choice Follow-up Test (FMC3)

Source	df	SS	MS	F
Cov. (FMC1)	1	466.13	466.13	54.39*
Method	2	29.16	14.58	1.70
Sex	1	19.71	19.71	2.30
Interaction (M x S)	2	12.99	6.50	.76
Slopes (Meth)	2	31.29	15.65	1.83
Slopes (Sex)	1	10.24	10.24	1.19
Slopes (M x S)	2	74.82	37.41	4.36*
Residual	112	959.87	8.57	

* - Significant at .05 level

Analyses of Flag Drawing Tests

The ANCOVA analysis of the Flag Drawing Posttests (FD2), with the pretest entered as the covariable (FD1), is reported in Table 4. A significant ($p < .05$) difference was found to exist in students' performance on the Flag Drawing Posttest according to method, with the F ratio = 3.76 and according to sex, with the F ratio = 10.07. According to the analysis of students' scores on this phase of testing, in at least one case, method and sex had a significant effect upon students' ability to retain specific information.

Table 4

Ordered Regression Summary Table Flag Drawing Posttest (FD2)				
Source	df	SS	MS	F
Cov. (FD1)	1	118.68	118.68	39.30*
Method	2	22.77	11.38	3.76*
Sex	1	30.41	30.41	10.07*
Interaction (M x S)	2	5.69	2.85	.94
Slopes (Meth)	2	3.46	1.73	.57
Slopes (Sex)	1	.40	.40	.13
Slopes (M x S)	2	1.22	.61	.20
Residual	115	347.54	3.02	

* - Significant at .05 level

Adjusted cell and marginal means were obtained for each group and Bonferroni-Dunn t tests were employed to determine where the significant difference existed according to method. A significant difference ($t_{obs} = 3.276$, $t_{crit} = 2.00$, $df = 60$) was found to exist between the adjusted marginal mean score (8.58) of the 52 students in the control group and the adjusted marginal mean score (7.46) of the 51 students in the coloring sheet group. Scores of students in the control group were significantly higher than those of students in the coloring sheet group.

The second Bonferroni-Dunn t test found no significant difference between the adjusted marginal means

of the art-related activity group and the combined mean of the other two groups. No significant difference ($t_{obs} = .0868$, $t_{crit} = 2.00$, $df = 60$) was found to exist between the adjusted marginal mean score (8.58) of the control group and the adjusted marginal mean score (8.02) of the 50 students in the art-related activity group. Thus the data from this phase of testing do not support hypothesis number one, but do support hypothesis number two.

The examination of adjusted marginal means for sex (girls = 8.57, boys = 7.51) revealed that girls had learned significantly more as measured by this drawing test than boys. Thus, the data generated through this phase of testing do not support hypothesis number three.

Students' scores on the Flag Drawing Follow-up tests (FD3) were analyzed using the ANCOVA procedure to see if the method used with any group, the students' sex, or an interaction between method and sex, was responsible for significant differences in students' retention of information that could not be accounted for by the pretests. The results are reported in Table 5. Results of the analysis, show a significant ($p < .05$) difference in students' performance according to method, with the F ratio = 7.24. According to the data from this phase of testing, the method used had a significant effect upon students' retention of information in at least one case.

Table 5

Ordered Regression Summary Table Flag Drawing Follow-up Test (FD3)				
Source	df	SS	MS	F
Cov. (FD1)	1	102.82	102.82	33.60*
Method	2	44.27	22.14	7.24*
Sex	1	7.52	7.52	2.46
Interaction (M x S)	2	6.89	3.45	1.13
Slopes (Meth)	2	6.92	3.46	1.13
Slopes (Sex)	1	1.15	1.15	.38
Slopes (M x S)	2	13.37	6.69	2.19
Residual	113	346.34	3.06	

* - Significant at .05 level

Adjusted cell and marginal means were obtained for each group and Bonferroni-Dunn t tests were employed to determine where the significant difference existed according to method. A significant difference ($t_{obs} = 4.413$, $t_{crit} = 2.00$, $df' = 60$) was found to exist between the adjusted marginal mean score (8.056) of the 52 students in the control group and the adjusted marginal mean score (6.53) of the 51 students in the coloring sheet group. Scores of students in the control group were significantly higher than those of students in the coloring sheet group. The second Bonferroni-Dunn t test found no significant difference between the adjusted

marginal means of the art-related activity group and the combined mean of the other two groups. No significant difference ($t_{obs} = 1.614$, $t_{crit} = 2.00$, $df = 60$) was found to exist between the adjusted marginal mean score (8.0558) of the control group and the adjusted marginal mean score (7.78) of the 50 students in the art-related activity group. As with the data from the posttest, these data do not support hypothesis number one, but do support hypothesis number two.

There was a significant difference between the level of students' retention of information as measured by this drawing test for students who were taught concepts and then were involved in a coloring sheet activity than for students in the control group who participated in a verbal review. Students in the control group learned significantly more than those in the coloring sheet group.

The data from this phase of testing supported the second research hypothesis. No difference was found to exist in the level of students' retention of information as measured by this flag drawing test for students who were taught concepts and then were involved in an art-related activity and students in the control group who participated in the verbal review. The data from this analysis also supported the third research hypothesis. No difference was found to exist according to sex in the

level of students' retention of information as measured by this drawing test.

Analyses of Tree Multiple-Choice Tests

The ANCOVA procedure was implemented to see if the method used with any group, students' sex, or interaction between method and sex, accounted for significant differences between groups on the Tree Multiple-Choice Posttest that could not be explained by the pretests. Table 6 reports the result of this analysis.

Table 6				
Ordered Regression Summary Table Tree Multiple-Choice Posttest (TMC2)				
Source	df	SS	MS	F
Cov. (TMC1)	1	619.64	619.64	75.38*
Method	2	22.85	11.43	1.39
Sex	1	.21	.21	.03
Interaction (M x S)	2	8.73	4.37	.53
Slopes (Meth)	2	16.96	8.48	1.03
Slopes (Sex)	1	.02	.02	.00
Slopes (M x S)	2	3.72	1.86	.23
Residual	117	961.87	8.22	

* - Significant at .05 level

The data reported in Table 6 revealed no significant difference between groups that could not be explained by the covariable. Thus the data from this phase of testing

supported all three research hypotheses. There was no difference in the level of students' retention of information as measured by multiple-choice tests for students who were taught concepts and then were involved in either a coloring or an art-related activity than for students in the control group who did not participate in those activities. No difference was found to exist according to sex in the level of students' retention of information as measured by this multiple-choice tests.

The figures shown in Table 7 were derived from the ANCOVA analysis of students' scores on the Tree Multiple-Choice Follow-up Tests (TMC3). The results supported the research hypotheses one and two. No significant difference was found to exist in the level of students' retention of information for students who were taught concepts and then were involved in a coloring sheet activity or an art-related activity than for students in the control group who participated in the verbal review. This ANCOVA test showed a significant ($p < .05$) difference in students' performance according to sex, with the F ratio = 5.56. According to the data collected as part of this phase of testing, students' sex did have a significant effect upon their retention of information. The data do not support research hypothesis number three. Calculations of the adjusted marginal means revealed that

girls' scores were significantly higher than boys' scores.
 (The means for girls = 9.03 and for boys = 7.93.)

Table 7

Ordered Regression Summary Table Tree Multiple-Choice Follow-up Test (TMC3)				
Source	df	SS	MS	F
Cov. (TMC1)	1	517.14	517.14	74.62*
Method	2	10.83	5.42	.78
Sex	1	38.57	38.57	5.56*
Interaction (M x S)	2	1.43	.72	.10
Slopes (Meth)	2	21.86	10.93	1.58
Slopes (Sex)	1	1.74	1.74	.25
Slopes (M x S)	2	23.02	11.51	1.66
Residual	119	824.22	6.93	

* - Significant at .05 level

Analyses of Tree Drawing Tests

The figures shown in Table 8 were derived from the ANCOVA analysis of students' scores on the Tree Drawing Posttest (TD2). As in all ANCOVA procedures that were part of this study, students' scores on the pretest (TD1) were entered as the covariable.

The analysis shows no significant differences in students' performance according to method, sex, or an interaction between method and sex.

Table 8

Ordered Regression Summary Table
Tree Drawing Posttest (TD2)

Source	df	SS	MS	F
Cov. (TD1)	1	225.26	225.26	76.62*
Method	2	6.28	3.14	1.07
Sex	1	1.00	1.00	.34
Interaction (M x S)	2	2.25	1.13	.38
Slopes (Meth)	2	6.71	3.36	1.14
Slopes (Sex)	1	1.23	1.23	.42
Slopes (M x S)	2	14.73	7.37	2.51
Residual	114	334.98	2.94	

* - Significant at .05 level

Thus the data gathered as part of this phase of testing supported all three research hypotheses. No significant differences were found to exist in the level of students' retention of information as measured by these drawing tests between students according to the method used or according to students' sex.

Table 9 reports the results of the ANCOVA procedures used to analyze data from the Tree Drawing Follow-up Test (TD3), once again with the Tree Drawing Pretest (TD1) entered as the covariable.

The ANCOVA procedure revealed a significant difference between slopes according to sex, and according

to the interaction between method and sex. Thus the assumption of homogeneity of regression required for the use of the ANCOVA procedure was not met in this phase of testing and the results could not be considered reliable. The researcher could not use the data gathered through this phase of testing to either support or reject the research hypotheses.

Table 9

Ordered Regression Summary Table
Tree Drawing Follow-up Test (TD3)

Source	df	SS	MS	F
Cov. (TD1)	1	171.02	171.02	53.44*
Method	2	6.57	3.29	1.03
Sex	1	5.33	5.33	1.67
Interaction (M x S)	2	3.30	1.65	.52
Slopes (Meth)	2	9.57	4.79	1.50
Slopes (Sex)	1	22.83	22.83	7.13*
Slopes (M x S)	2	27.81	13.91	4.35*
Residual	118	377.79	3.20	

* - Significant at .05 level

Summary

The data gathered through this study did not support the first hypothesis. On two of the six tests that were analyzed using ANCOVA, a significant difference was found to exist in the level of students' retention of

information for students who were taught concepts and then were involved in a coloring sheet activity as compared to students in the control group who participated in the verbal review. Students in the control group retained more information as measured by the tests. Some of the data gathered through this study supported the second hypothesis. In tests where it was possible to use ANCOVA procedures, no significant difference was found to exist in the level of students' retention of information as measured by multiple-choice and drawing tests for students who were taught concepts and then were involved in an art-related activity than for students in the control group who participated in a verbal review. However, there were differences worth noting in mean and gain scores for students in this group when compared to the control group on the flag multiple-choice follow-up test that could not be analyzed using ANCOVA.

The data gathered through this study, in three testing phases of the six analyzed using ANCOVA, did not support the third hypothesis. A significant difference was found to exist according to sex in the level of students' retention of information as measured by multiple-choice and drawing tests, with girls scoring significantly higher than boys. Results from the other three testing phases supported the third hypothesis. On

those tests, no significant difference in students' students' retention of information was found to exist according to sex.

CHAPTER V SUMMARY, DISCUSSION, AND CONCLUSIONS

The purpose of this study was to compare the effects of a verbal review, a coloring, and an art-related activity on young students' retention of information from two classroom units of study. Students received one of the three treatments as reinforcement for two lessons that had encouraged student involvement through the use of active questioning. In this chapter, a summary of the study is followed by a discussion of research findings, students' reading ability, tests and order effects, tree lesson findings, students' tree schema, and factors affecting the study. The chapter concludes with implications for future research, for elementary education, and for art education.

Summary of the Study

Dewey's ideas (1934) about the relationship between doing and knowing, and Piaget's research (1947/1973) on the relationship of multi-modal instructional procedures and learning formed the theoretical basis for this study. The researcher examined the relationship and influences of involvement in art-related activities on knowing, a reversal of traditional studies in art education that focused on the relationship between the child's knowing and his art. Instead of "the child draws what he knows", this study explored the idea that "the child knows what he

draws". In this sense, the perception-delineation theory of June McFee (1957) has been extended to consider the interaction of perceiving, knowing, and delineating.

Subjects in this study were the entire second grade population of two schools in a large urban/suburban school district. The schools were representative of the district in terms of test scores, racial mix, and student mobility rates. Seven intact classes (178 students) participated in the study. There was a control group and two experimental groups in each school, with a fourth class in one school serving as a control group without pretest, so pretest effect could be studied.

Two lessons were designed and administered in an alternate sequence to control for order. A lesson about the American flag and one about deciduous trees related to students' studies in history, math, and science. As part of the basic lessons, students in each group were involved in a discussion through the use of active questioning. Students in the control groups were involved in a verbal review. Students in the first experimental treatment group completed a coloring sheet, and those in the second group participated in an art-related activity. Multiple-choice and drawing tests were administered as pre- and posttests, and two weeks after instruction as follow-up tests to measure long-term effects.

Research Findings

In this section answers are given to the research questions with references to the theoretical rationale that served as the basis for this research.

Question 1: Will there be a difference in students' retention of information as measured by multiple-choice and drawing tests for students who are taught concepts and then are involved in a coloring sheet activity than for students in the control group who participate in a verbal review?

Our data indicated that the only treatment group that retained significantly less information as measured by two of the tests in this study was the coloring sheet group. Their level of retention, as measured by their scores on flag drawing post- and follow-up tests, was significantly less than that of the control group. It appears that participating in the coloring sheet activity decreased students' retention of information about the flag as reflected by their drawing tests, or reduced their ability to recall such information as a memory task. If we refer to Bruner's information processing theories to help us interpret this finding, we might hypothesize that participating in the coloring sheet activity prevented students from retaining the iconic representation they had encoded for the flag during the lesson. Since the

students did not "own" the image referent, in other words had not established a strong perceptual, cognitive, and emotional connection with the image, that connection in memory may have faded.

Another possibility is that, as Mills (1975) suggested, students in this group experienced a reduced level of confidence in their ability to access and use the information they needed to create a drawing of the flag. A third possibility, based upon Dehn and Schank's (1982) work on artificial intelligence, is that students were unwilling to make the effort required to draw the flag when faced with a blank sheet of paper after having been given a ready-made image to color.

While the theories of Bruner, Mills, and Dehn and Schank offer differing explanations for this observed phenomena, the data from our study does seem to reinforce traditional art education claims that coloring sheet activities have a negative effect on students. For the art educator the idea of "owning the image" which derives from the observations of Gardner (1983), is probably the most appealing explanation. In this sense one might hypothesize that the more an individual "owns an image" the stronger are those neurological impulses which lead to memory.

Question 2: Will there be a difference in students'

retention of information as measured by multiple-choice and drawing tests for students who are taught concepts and then are involved in an art-related activity than for students in the control group who participate in a verbal review?

In terms of immediate recall, the data collected and analyzed using ANCOVA did not show that providing students with art-related activities as part of a lesson caused them to retain significantly more or less information than did members of the control group who had spent additional time reviewing the information discussed in the lesson. The two methods were equally effective from a statistical point of view. The researcher attributed this fact to the richness of the basic lesson, the short time lapse between the lesson and the posttest, and to problems she encountered in administering the tree lesson to the art-related activity group, a factor that will be discussed later in this chapter.

For long-term recall, the researcher noted mean and gain scores on the flag multiple-choice follow-up tests suggested that prolonged use of art-related strategies may make a significant difference in students' retention of information. Although the assumption of homogeneity of regression required for the use of the ANCOVA procedure was not met for the flag multiple-choice follow-up test,

and the ANCOVA procedure could not be considered relevant in analyzing the data from this phase of testing, it should be noted that two weeks after the flag lesson, students in the art-related activity group retained more information in terms of gain scores than students in the other groups. On the flag multiple-choice follow-up tests, students' scores in the experimental group with the art-related activity maintained a 4.29 point, 66% gain from their pretest scores, while students' scores in other groups dropped from their posttest levels. Students in the experimental group with the coloring sheet maintained only a 45% gain, while students in the control group maintained a 57% gain (see Figure 2). The proportionately greater gain made by students in the experimental group with art-related activities and the lack of a decrease from posttest scores suggest the long-term impact these experiences have upon learning.

On the flag drawing tests too, there appears to have been a difference in the three group's gain scores that is of interest from an educational standpoint. Through the art-related activity, that group was able to raise their scores 2.16 points from a pretest low of 5.63 to a follow-up score of 7.79, a 38% gain. The highest scoring pretest group, the control group's score was raised by only 1.56 points, a 22% gain. The lack of proportional gains

between the two groups suggests that the art-related activity helped those students make more impressive gains in their mean scores than the students with the most prior knowledge as measured by pretest scores. However the fact that students in the art-related activity group spent additional time on task created a confounding variable that will be discussed later in this chapter.

These findings support Piaget's and Dewey's theories that students process information most effectively when they become actively involved in experiences and are allowed to receive information through several of their senses. The research data also supports McFee's P-D theory. Students' readiness to respond to the perceptual task, the cultural screen in the form of varied instructional activities, individual information processing approaches, and response to the perceptual/creative experience seem to have been affected most positively by the art-related activity. Similarly, these findings seem to support Gardner's theory about multiple intelligences and ways to reach students whose strengths may lie in different domains. Finally, the findings are not surprising given the recent research on the relationship between perception and memory cited in the science section of The New York Times on November 11, 1991. In that research, visual perception was found to

have played an important and heretofore under appreciated role in the storage of memory traces within the brain.

Question 3: Will there be a difference according to sex in students' retention of information as measured by multiple-choice and drawing tests?

A statistically significant difference was found to exist according to sex on the flag multiple-choice posttests, the flag drawing posttests, and the tree multiple-choice follow-up tests, but not on the three remaining tests that could be analyzed using ANCOVA. Adjusted marginal means were calculated on the three tests, and females' scores were found to be higher than males. The research hypothesis was that there would be no difference between scores according to sex. Both the instruction and the testing were designed to interest all students and to encourage complete encoding by involving them on the enactive, iconic, and verbal/symbolic levels. However it appears that on half of these tests, second grade females outperformed their male counterparts. Since results were split evenly, these finding can be interpreted either as partially supporting or refuting the research hypothesis. The finding also partially agrees with the results Goodenough (1926) obtained from her Draw-A-Man tests, that girls slightly but consistently outperformed boys. Goodenough hypothesized that this was

due to their perseverance, care with details, and docility. Harris (1963) attributed the same phenomenon to cultural influences. He hypothesized that American girls practice drawing more frequently or are more interested in people and clothing than boys.

Students' Reading Ability and Study Tests

A moderate correlation was found to exist between students' scores on the school system's Criterion Referenced Tests in reading (CRT's) and their multiple-choice test scores (see Appendix D). This was an expected finding since these tests required students to encode and access information verbally/symbolically. The correlation between CRT scores and students' drawing test scores were less, an expected finding that supports Gardner's theories of differentiated intelligences, since the drawing tests measure students' ability to encode information visually, spatially, and iconically as well as through verbal/symbolic means. Students scores on the CRT tests were more highly correlated to their flag drawing follow-up tests than to their tree drawing follow-up test, .4490 as compared to .2713. This interesting finding suggests that a child's ability to encode and process information verbally is not highly related to his/her ability to encode and process iconic information, particularly if the child has established in his/her mind a preexisting schema

for the subject.

Discussion of Tests, Pretest and Order Effects

Means and ranges of students' test scores (see Appendix D) were good indications that the tests and the instruction had been appropriate for students, and that most students did not encounter a ceiling effect. In addition, examination of the data failed to reveal any difference between groups that could be attributed to pretest effects or to the order in which the lessons had been presented.

Tree Lesson Findings

The assumption of homogeneity of regression required for the use of the ANCOVA procedure was not met in the tree drawing follow-up test. This meant that the ANCOVA procedure could not be considered relevant in analyzing the data from this test. The researcher believed that the lack of significant differences found to exist on other tree lesson tests was fully explained by the lack of time for the art-related activity (discussed later in this chapter), the ample visual resources used as part of the lesson, and the use of active questioning with all groups.

Role of Students' Tree Schema

Students' schema for trees may have created another confounding variable of interest to educators and future researchers. The difference across all groups in

increases of the mean scores between the tree drawing and the tree multiple-choice tests (Figure 3) suggests that through instruction, students were able to understand the concepts related to the growth of trees but were not able to change the image they had encoded for a tree in winter. The scores on the tree drawing posttest earned by students in the art-related activity group nearly matched those of students in the control group that had outperformed all groups on the pretest. This is of special interest given the very limited time these students actually spent drawing the tree as part of the lesson. However, two weeks later on the tree drawing follow-up tests, all groups' mean scores returned to within one quarter of a point of their pretest scores. This result differs significantly from that of the flag drawing post and follow-up tests (Figure 2) where no corresponding drop occurred in students' scores on follow-up tests. This suggests that students' tree schema played an unexpected but important role. This finding resembles that from earlier research by McWhinnie & Lascarides-Morgan (1971). It seems that in the absence of actual tree drawing instruction, when children are asked to draw trees, they revert to a learned schema which does not indicate either their symbolic developmental level nor their degree of knowledge about specific subjects.

Factors Affecting the Study

This researcher encountered several phenomena that must be documented to increase readers' understanding of study results and to provide insights for future researchers. First, although the researcher had been assured by the school system representatives that the student subjects had been randomly assigned to classes, she found that this had not been the case.

In one school, the teacher of the control group with the art-related activity was fluent in Spanish. Five Spanish speaking students who were not fluent in English were among her 25 students. Those students may have been placed in her class so she could provide them with special bilingual help when needed. They appeared to be motivated more by peer group interests than by success in school. In the other school, the teacher of the coloring sheet group was male. Apparently, several students who needed to receive special attention had been placed in his class. These students' behavior also seemed to be more motivated by peer group approval than by a personal desire to learn.

Further evidence of unequal groups was obtained when the researcher examined the scores earned by students in each group a few months later on the school system's Criterion Referenced Tests (CRT) in reading (see Figure 1). The scores revealed that students in the two control

groups had significantly higher reading test scores than did students in the two experimental groups. This difference was believed to have affected the course of the study and the data analyses.

Since both principals had assured the researcher that students had been randomly assigned to their classes, she had not anticipated this difference and had not controlled for it experimentally. Had she known in advance, she would have made random assignments to treatments within each class, or she would have selected another group of subjects for this study.

The role of the researcher as the teacher of the lessons succeeded in eliminating teacher effect as a confounding variable, but it reduced the ecological validity of the study. The researcher and her teaching style were unfamiliar to students, so they responded differently to her than they would have to instruction by their regular classroom teacher. Future studies should utilize students' regular classroom teachers who are selected because their teaching styles vary in ways that mirror this study. The teachers would have to cooperatively plan a number of units to be studied, agree upon a total amount of time to devote to all the units, deliver the instruction, and have their students complete uniform assessment measures. If the effect upon students'

retention of information of truly creative art activities were to be included, the researcher would have to identify an additional teacher who routinely used such activities. That teacher would participate with the others in the activities described above.

The researcher was restricted to two 30 minute periods of instructional time per class, an unnatural condition for teaching. The duration of future studies should be increased so the long range effects of each treatment can be measured, and the study should be replicated with students at other grade levels to see if the findings remain the same.

Time on task became a confounding variable in the flag lesson as reported by both teachers of classes assigned as experimental groups with art-related activities. After the researcher left those classrooms, the teachers allowed their students to continue work on their flags for approximately 30 minutes since "students seemed so interested". While this action reduced the internal validity of this study, it is of interest from an educational standpoint in terms of developing positive attitudes towards school work.

Another confounding variable was created during the tree lesson at one of the schools, when the teacher of the class assigned as the experimental group with the art-

related activity left the room soon after the researcher began the lesson. After the 30 minute period was over, the researcher realized that by leaving the room, the teacher had conveyed a damaging message to her students that confounded the outcome of the tree lesson. She had not been interested in the lesson nor in her students' mastering information from the lesson. Teachers in each of the other groups had participated in the lesson as active, interested observers.

Although the researcher had asked all of the teachers to remain in their classrooms during instruction, one had not done so. Future researchers should stress the importance to internal validity of all classroom teachers playing the same role as active, interested observers during instruction.

After the teacher left the room, some students began playing among themselves. The researcher was not able to regain their attention, and they interfered with other students' ability to participate and concentrate. Finally, the researcher dismissed these students from the instructional area, and asked them to write her an apology note. The time lost by their disruptive behavior meant that other students did not have time to become involved in the art-related activity for more than a few minutes. As mentioned earlier, the researcher believes that this

factor explained the low scores earned by this group on the tree lesson post and follow-up tests.

In the second school where the tree drawing activity followed instruction in a more orderly fashion, only ten of the allotted 30 minutes remained for students to draw the tree. Too much time had been consumed by the discussion.

In future replications of the tree lesson, instruction for the art-related activity group should be modified so students can work on their drawings while they listen to the teacher discuss various things about how a tree grows. Students could be reminded to show new branches growing out from the sides and up from the tips of old branches and limbs. Other statements could be planned to facilitate retention of information such as, "Remember, the tree trunk and branches grow up and out and the roots grow down and out". Students could be reminded that the tree grows up from the ground so the bottom of the trunk is older and thicker than the upper parts of the tree, and that the newest parts are very thin.

Implications for Future Research

If the decision is made in future research to maintain an ecologically valid setting, and intact classes are utilized, this researcher suggests that schools with relatively homogeneous populations be selected as sites

for the study. This would increase the likelihood that assignments to classes had been done on a truly random or matched basis. The ability to generalize findings from the study to other populations (external validity) would be limited, but internal validity would be increased. Random assignment within groups to treatment would have relieved the problem of inequality between groups in this study, but the great difference between groups was not known in advance.

Other findings that suggest additional dimensions for future research were related to the effect of the art-related activity on students' attitudes and interest, and the long-term effects of these activities upon students. To assess these aspects, attitude tests could be included, and students' regular classroom teachers could be utilized as instructors to lengthen the duration of the study.

Another finding from this study that has implications for future research was that retention of the tree lesson should be carefully considered. If it is retained, given the schema effect this researcher encountered, the art-related activity must involve students for more time and make more of an impression upon them than it was able to do in this study.

Implications for Elementary Education

Based upon the theoretical literature, and upon

empirical findings reported in this study, we have established that there is a close relationship between perception, art participatory activities, and memory. This finding suggests that elementary classroom teachers should include an enactive/visual/perceptual component in their repertoire of teaching strategies. They should provide students with well illustrated lessons and with learning experiences that allow them opportunities to create their own images so they can encode information iconically/visually as well as symbolically/verbally. Elementary educators should be interested in the findings that suggest appropriate art-related activities may be valid ways to spend time that has been designated for studies in other curriculum areas. These activities seem to have facilitated long-term retention of information, and increased students' interest in learning.

In addition, elementary classroom teachers should become more aware of the negative effect coloring prepared outline drawings had on students' ability to retain and access information independently. The data from this study suggest that students who had colored the ready-made outline drawings were unable to retain the image they had encoded iconically during the lesson. Thus they knew less about the flag than did others who had not been exposed to the coloring sheet activity.

Implications for Art Education

Although facilitating learning in other areas of the curriculum is not their primary goal, art educators should help classroom teachers understand the value of incorporating appropriate art-related activities into their teaching. Art educators should share what they know about Piaget's, Bruner's, and Gardner's theories, and about how instruction can be enhanced by providing students with a variety of stimuli to help them process and encode information visually/iconically as well as verbally/symbolically. Active involvement in creating their own images seems to increase students' retention of information.

Art educators should help classroom teachers understand the effects that the coloring of prepared outline drawings have upon students' retention of information. As reported earlier, students in the coloring sheet group's scores were statistically significantly lower on the flag drawing tests than both the control group and the art-related activity group's scores. This finding suggests that these students were unable to retain the image they had encoded iconically before experiencing the coloring sheet activity, and thus knew less about the flag than did the others.

The conclusion discussed earlier was that

participating in the coloring sheet activity as part of the lesson prevented students from recalling, modifying, and making more accurate the iconic representation they had encoded for the flag. Another possibility discussed was that, as Mills (1975) suggested, students in this group may have experienced a reduced level of confidence. The coloring sheet activity may have led them to believe that they did not know enough about the flag to create a drawing of it. A third possibility, based upon Dehn and Schank's (1982) work on artificial intelligence, was that students in this group were unwilling to make the effort required to think about the flag and to draw it after having been given a teacher-made image to color.

It can be argued that the data from this study lend support to philosophical arguments in the literature of art education that "coloring within the lines" is of limited value. It can also be argued that the characteristics of what Efland called "school art" may be reflecting a gain in cognitive growth through art.

The results of this research are consistent with art education developmental theories such as the P-D theory of June King McFee. This study has provided positive evidence of the relationship between perceiving, being involved in appropriate art-related activities, and memory in a way that has not been demonstrated in previous

research efforts. The study has demonstrated that the P-D theory can be extended to account for memory and for various Piagetian and Brunerian theories about how children process and encode information. When these insights from both Piaget and Bruner are wedded to the earlier P-D theory of McFee, the result will be art education theory which is cognitive and consistent with the more recent studies in cognitive psychology that demonstrate the neurological connections between properly encoded visual perceptions and memory.

APPENDIX A - PRELIMINARY STEPS

Identification of Sites

Schools were selected for this study based upon how closely their profiles matched the countywide profiles.

Criterion	Countywide Profile	School #1	School #2
Reading Tests*	72	69	69
Minority Enrollment	34.3%	34.9%	37.1%
Student Mobility Rate	40.6%	42.3%	40.6%.

*Average scores earned by third graders in each school on countywide criterion referenced test in reading (MCPS, 1989).

Appendix A - Letter to Principals

Dear _____,

I am in the process of securing approval from MCPS to conduct a study as part of my doctoral program at the University of Maryland. I was asked to select two elementary schools as sites for the study whose student body profiles closely resembled the MCPS countywide profile. Your school is one I've identified, and I would be very happy if you and your second grade teachers would be interested in participating in the study.

The purpose of the study is to see how much information students retain from lessons presented three ways. There are two basic lessons, one about the American flag and one about trees. These lessons will be presented separately to each class through a lecture/discussion mode that involves the use of visual resources. The control group will receive the basic lessons and spend extra time discussing the facts in the lesson. One experimental group will receive the same basic lessons but will have color-in activities as follow-up. The other experimental group will have the same lessons with planned art-related follow-up. How much information students retain from these methods of instruction will be compared. I think the results should provide us with some useful data that suggest ways to facilitate learning.

All standard rules of confidentiality will be respected in compliance with research ethics and MCPS regulations. The study will take place during six weeks in February and March. I will be presenting all instruction. Each lesson will consume 30 minutes. There will be three pre and post test sessions for each unit of instruction that take 20 minutes apiece. Your teachers need to be willing to lend me their students for the required time periods, and to accept the group assignment that they will draw from an envelope I'll provide.

I would like to schedule an initial meeting with you and your three teachers to show you the materials. I would be willing to come to your school on two days if one date is not convenient for all of you. If your art teacher is in the building on that day, he/she is welcome to attend so he/she can be informed about the activity as well.

Many thanks for considering this request. I look forward to hearing from you soon! Please call me at _____.

Appendix A - Statements to Students

Hello boys and girls. I'm a student too! Did you know older people are sometimes students? I'm doing my studies in the Education Department at the University of Maryland. As part of one of my courses, I designed two lessons for students your age. I asked your teacher if she (he) thought you would like to try the lessons to see if they help you learn more about the topics, the American Flag and trees. I'm glad your teacher thought you would.

To be sure you don't already know what I'm planning to teach you about flags (or trees) next week, I have prepared a short multiple-choice test that I'll read to you. You should answer it to the best of your ability. You'll know some of the answers, but probably won't know others. If you knew everything there wouldn't be any point in my teaching you the lesson. I'll distribute the tests and pencils. [Pass out tests and pencils].

Put your name, your teacher's name, and today's date, the _____, in the blank spaces at the top of the page.

(Check that all students are ready to begin, read the directions aloud that are printed on the test, and read each test item. Do not answer any questions that students ask that involve definitions of terms, since students will learn unfamiliar terms as part of the lesson. The test should take 10 minutes.) Pass your tests to the end of your row and I'll collect them.

There's a second part of the test, a drawing test. The drawings you make won't be rated in terms of your drawing skills. I just want to know how much you already know about the flag (trees) and your drawings will help me know that. Since I don't want to know who drew which picture, I've asked your teacher to assign you a code number, which I will read to you now. Mark your number on your sheet of drawing paper where it says "Student Number".

(Read students the directions on the drawing instrument. Give them number 2 pencils with erasers. While students are drawing their flag pictures, pass out red and blue colored pencils for them to use to add color to their flags, and tell students what the colored pencils are for. The drawing test should take 10 minutes.)

Bring your pencils and drawings to me when you are finished. I'll look forward to seeing you soon for the lesson!

APPENDIX B - LESSONS
Flag Lesson

During instruction students looked at the flag and at the visual resources shown in Figure 4 and 5. The teacher led a discussion about the flag using this list as a guide:

1. The flag is a rectangular shape.
2. The flag is a symbol of our country.
3. There are red and white horizontal stripes, and a blue field with white stars.
4. There are 7 red stripes and 6 white stripes, a total of 13, a number which represents the 13 original colonies.
5. There is a red stripe at the top and bottom edge of the flag, one in the middle (1/2 way between the top and bottom), two between the red stripe at the top and the one in the middle, and two between the stripe in the middle and the one at the bottom.
6. All the stripes are the same width (thickness).
7. Some stripes don't extend completely across the flag since the field occupies space.
8. The blue rectangle with the stars is called the "field".
9. The field covers the top side of the flag nearest the pole.
10. The field consumes a little less than 1/2 of the distance across the top of the flag.
11. The field consumes a little more than 1/2 of the height of the flag. It covers the first seven stripes.
12. The number of stars is equal to the number of states.
13. There are 50 states now, therefore 50 stars.
14. The stars are separated from one another by equal distances, thus forming a pattern.
15. The stars are arranged in rows and columns. They also appear to be arranged in diagonal lines.
16. Columns go up and down like columns on a building, while rows go from side to side (see Figure 4).
17. There are five rows of six stars (a total of 30), and four rows of five stars (a total of 20 more), to equal 50 stars.

In addition to a real American flag, the materials shown below were used as visual resources during the flag lesson.



FIGURE 4. Magazine Covers Used as Visual Resources for Teaching Students About Columns.

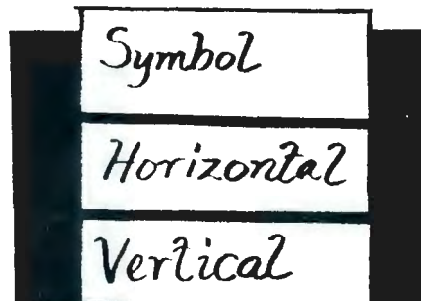


FIGURE 5. Flag Lesson Vocabulary Cards.

Appendix B
Control Group's Flag Instruction

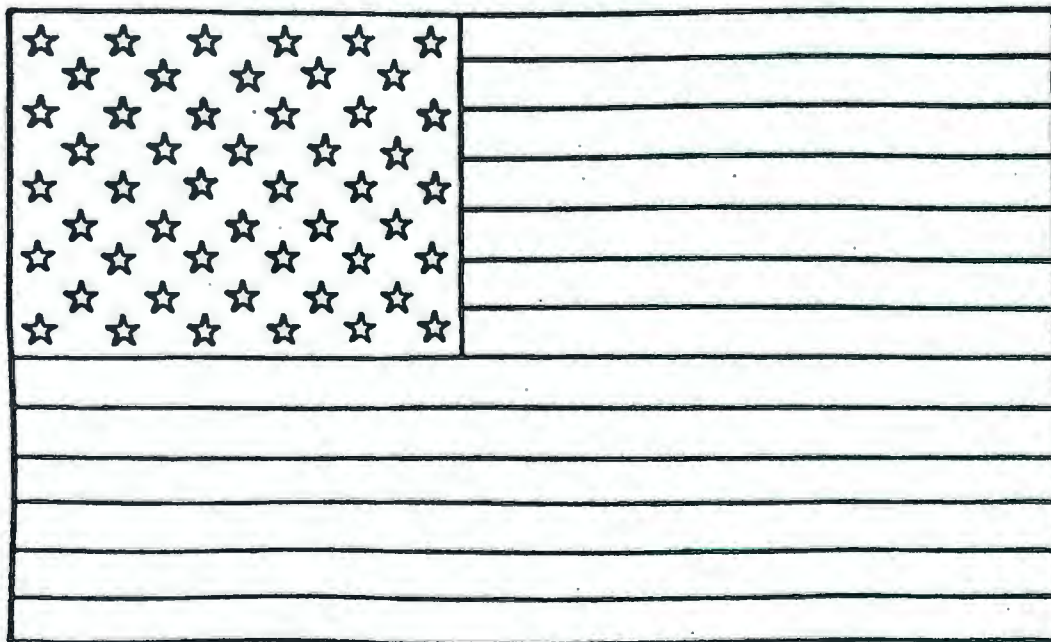
The teacher gathered the students on the floor around her to look at an American flag. The teacher:

1. Asked students how many stripes there were on the flag (13) and asked them if anyone knew what the stripes represented (the 13 original colonies).
2. Asked students how many red stripes there were on the flag (7) and how many white stripes (6).
3. Asked students to notice the horizontal arrangement of stripes, the even spacing between stripes, and the fact that all the stripes were the same width, but not the same length.
4. Discussed the meaning of the words horizontal, vertical, and diagonal (see Figure 5.)
5. Had students check the actual flag to see what color the top and bottom stripes were (red), and to compare their length (one is shorter than the other).
6. Asked students if the white stripes were the same as the red stripes (The same widths, but not the same number).
7. Asked students what part of the flag was on the upper left-hand side (the field). Asked students what other kind of fields they knew, what was on them, and compared those fields to the field on the flag.
8. Asked students how much of the flag was consumed by the field (it covers the top 4 red stripes (a little more than $1/2$ of the flag's height), and is a little less than $1/2$ of the flag's width).
9. Asked students if they knew what the stars represent. Accepted or presented the answer "states", and asked if anyone knew how many there are now. Accepted the answer "50".
10. Asked students to look at the flag and see how the stars were arranged. Asked students if they knew which stars were in rows and which were in columns.
11. Showed students Figure 4, buildings with columns, and asked students if anyone saw a column in the picture. Asked students which way columns go, side to side or top to bottom (top to bottom). Discussed the side to side arrangement of stars as rows and the top to bottom arrangement of columns as columns.
12. Asked students what other pattern they saw in the star arrangement. Discussed the pattern of diagonal lines they found created by the even spacing between stars.
13. Asked students how many long rows there were (5) and how many stars were in each of them (6).
14. Asked students if anyone knew how much 5 times 6 was

- (30).
15. Had students count how many short rows there were (4) and how many stars were in each of these rows (5).
 16. Asked if anyone knew how much 4 times 5 was (20).
 17. Had students add 20 to 30 and come up with the total number of stars (50).
 18. Asked students to review as many facts about the flag as they could remember from the discussion until the 30 minute time period had elapsed.

Coloring Sheet Group's Flag Instruction

Teacher gathered students on the floor around her to look at an American flag, and followed steps 1 - 17 listed for the control group. Then the teacher asked students to color in the prepared outline drawing of the flag shown below (with reduced dimensions) until the 30 minute time period had elapsed.



Adapted from (Hoerber, 1988, p.2) Frank Schaffer Publications, Inc.

FIGURE 6. Flag Coloring Sheet (reduced from 5 1/4" x 9").

Appendix B

Art-related Activity Group's Flag Instruction

Teacher gathered students on the floor around her to look at an American flag and told them they would be making their own flags today. The teacher:

1. Asked students how many stripes there were on the flag (13) and asked if anyone knew what the stripes stand for (the 13 original colonies).
2. Asked students how many red stripes there were on the flag (7) and how many white stripes (6).
3. Asked students to notice if all the stripes were the same size (yes the same width, not the same length).
4. Demonstrated the way students can quickly place 7 red strips of paper horizontally across one 12" x 18" sheet of white paper in a fairly random spacing arrangement (see Figure 7).
5. Discussed briefly the meaning of the words horizontal, vertical, and diagonal (see Figure 5) and the fact that the stripes run horizontally across the flag.
6. Demonstrated the way students should place one dot of glue on both ends of each strip, one in the middle of each strip, and one half-way between each of those 3 dots (see Figure 7).
7. Had students check the actual flag to see where the top and bottom red strips should go to become the top and bottom stripes. Had students flip over the top and bottom strips and glue them to the top and bottom edge of the white paper.
8. Had students flip over the center strip and glue that in the center of the paper (horizontally).
9. Had students flip over and glue down the two strips above the middle strip and the two strips below the middle strip.
10. Asked students how many white stripes were created between the 7 red stripes. (6)
11. Had students lay a sheet of 9" x 12" blue construction paper horizontally across the top left side of the flag and asked students what part of the flag was being made (the field) (see Figure 7). Asked if the field looks right. When students said it looked too big, turned it around the other way (keeping it in the upper left-hand corner) and asked students if that looked right. When students said it was too long, had them look at the real flag and count the number of red stripes that were actually covered by the field (4). Demonstrated the way

- students could fold up the extra paper that extended beyond the fourth red stripe to make the field the right height (see Figure 7).
12. Showed students how to cut off the extra paper that had been folded up, and asked students if the field was the right width. After they referred to the real flag and saw that the field should be a little less than half the width of the flag, demonstrated how to fold and cut off a strip about 1" wide along the right edge of the field (see Figure 7).
 13. Asked students what's missing. When they said "stars" asked them if they knew what the stars represent. Accepted or presented the answer "states", and asked if anyone knew how many there are now. Accepted the answer "50".
 14. Asked students to look at the real flag and see how the stars were arranged. Discussed the even spacing, the rows and the columns.
 15. Showed students a photograph of a building with columns (see Figure 4), asked students if anyone saw a column in the picture, and asked them which way columns go, from side to side or top to bottom (top to bottom). Discussed the side to side arrangement of stars as rows and the top to bottom arrangement as columns. Also asked students what other pattern they saw in the arrangement. Discussed the pattern of diagonal lines created by this arrangement.
 16. Told students they could use chalk and make dots to locate the stars on the field. Had them begin by seeing that there's one star at each corner of the field. Had students watch while teacher placed one dot near each corner of the field (see Figure 7).
 17. Asked students how many stars are there in the top and bottom row (6), and showed them how to think of the two top dots as ears, and to place 2 dots "like nostrils" in the center of the top row and 2 dots "like eyes" on each side of the "nose" to make 6 evenly spaced dots that will become stars (see Figure 7).
 18. Had students watch while she repeated this process for the bottom row and the one in the center horizontally (see Figure 7). Then added one above this, half way between the top and middle row and one below this, half way between the middle and bottom row (see Figure 7). Asked students how many rows you've made (5) and how many "stars" were in each row (6) for a total of 30 "stars".
 19. Had students look at a picture of number 4 and number 5 on a dice and tell how they're different. Had students see that the number 5 had a dot in the

- middle (see Figure 7). Had them find clusters of 4 dots on the field; and add a dot in the center of each cluster.
20. Had students count how many rows they added and how many "stars" (dots) are in each row. (4 rows with 5 dots apiece) a total of 20 more. ($20 + 30 = 50$)
 21. Showed students how the chalk could be rubbed away somewhat if they made a mistake, and how once located each dot could be turned into a star (either by making stars or crossing x's).
 22. Called students in turn to come up to a supply table to take a bottle of glue, scissors, one piece of 9" x 12" blue construction paper, one sheet of 12" x 18" manila or white construction paper, and seven 7/8" wide x 18" long strips of red construction paper. Students counted the number of strips as they took them.

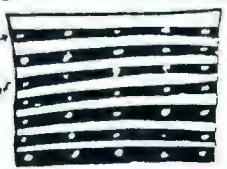
All cutting was done beforehand using a paper cutter. Each stack of supplies was placed in a separate spot so students could get them in an assembly line fashion.

STEPS:

Stripes ① Select 7 red strips.

② Arrange them on the white paper

③ Put a dot of glue on each end of each of the strips. Put a dot in the middle of each strip and one on each side between the others.



④ Flip over the top + bottom strips and glue them to the top + bottom edges of the paper

⑤ Flip over the center strip + glue it in the center

⑥ Flip over the 2 strips above the center + glue them down

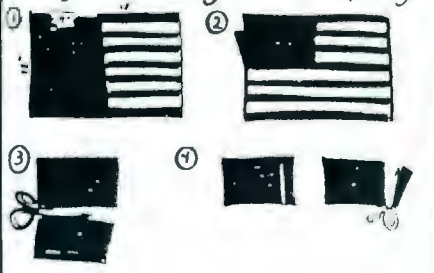
⑦ Flip over the 2 strips below the center + glue them down.

Field: ① Place the blue paper on the flag so it consumes $\frac{1}{2}$ of the top edge of the flag.

② Count down 4 red stripes + fold up the blue paper that extends beyond that stripe.

③ Cut off the part you folded up.

④ Fold the right side of the field in about 1", and cut off that amount to make the field a little less than $\frac{1}{2}$ the length of the flag across the top edge.



Stars

① Make a dot on each of the 4 corners of the field.



② Put 4 more dots in between the 2 at the top and 4 more between the 2 at the bottom.




③ Make a third row of dots in the middle of the other two. Try to line up the dots under the ones in the first row to begin to form columns.




④ Add 1 row of dots $\frac{1}{2}$ way between the top and middle rows and another row $\frac{1}{2}$ way between the middle + bottom rows. Try + keep the dots in columns.


We now have 5 rows with 6 dots ($5 \times 6 = 30$)



⑤ Put a dot between each group of 4 "stars", much like you would do to change a number 4 on a dice to a number 5



You have added 4 rows with 5 dots ($4 \times 5 = 20$) so we now have 50 dots or stars.



Each star represents one state.

FIGURE 7. Visuals Used for the Art-related Activity Group's Flag Lesson.

Appendix B

Tree Lesson

During instruction students looked at art reproductions, drawings (see Figures 8 and 9), photographs (see Figure 10), or real trees and discussed the following:

1. Trees are the largest of all plants.
2. Trees are the oldest things alive.
3. Some trees are over 100 years old.
4. Trees are basically symmetrical, unless they've grown under conditions that prevent symmetrical growth eg. up against another tree, a wall, etc. (see Figure 9).
5. Trees have large root systems to anchor them to the ground, and to absorb water and minerals from the soil.
6. A tree's root system is nearly as large as the part of the tree you see above ground (see Figure 8).
7. Some trees have one main trunk that extends from the ground on up (see Figure 9).
8. Some trees' trunks divide and branch out as they grow (see Figure 9).
9. Trees do most of their growing from the ends of stems or branches.
10. Branches are also called limbs, the same term used for our arms and legs.
11. Each year trees grow new growth both above ground (in the trunk and branches) and below ground (in the root system) (see Figure 8). Old lower branches that can not receive sunlight die and fall off. That's how the trunk gets tall and bare.
12. This growth pattern explains why the trunk is widest towards the base of the tree, and thinner as it goes up towards the top of the tree.
13. The outer layer of the trunk is called bark.
14. If you look at a tree that has been cut down, you can tell how old it was by counting the rings (see Figure 8).
15. Wide rings means the growing conditions were good that year, while thin rings means they weren't.
16. There are two major kinds of trees in North America, trees known as evergreens that have needles which stay on the tree through the winter and trees that lose their leaves in winter, known as deciduous trees.
17. The main job of tree leaves is to make food for the tree trunk, branches, and roots.
18. This process is called photosynthesis.

Appendix B

Visual Resources for Tree Lesson

The illustrations shown in Figures 8 and 9 were introduced and discussed with all groups during this lesson.

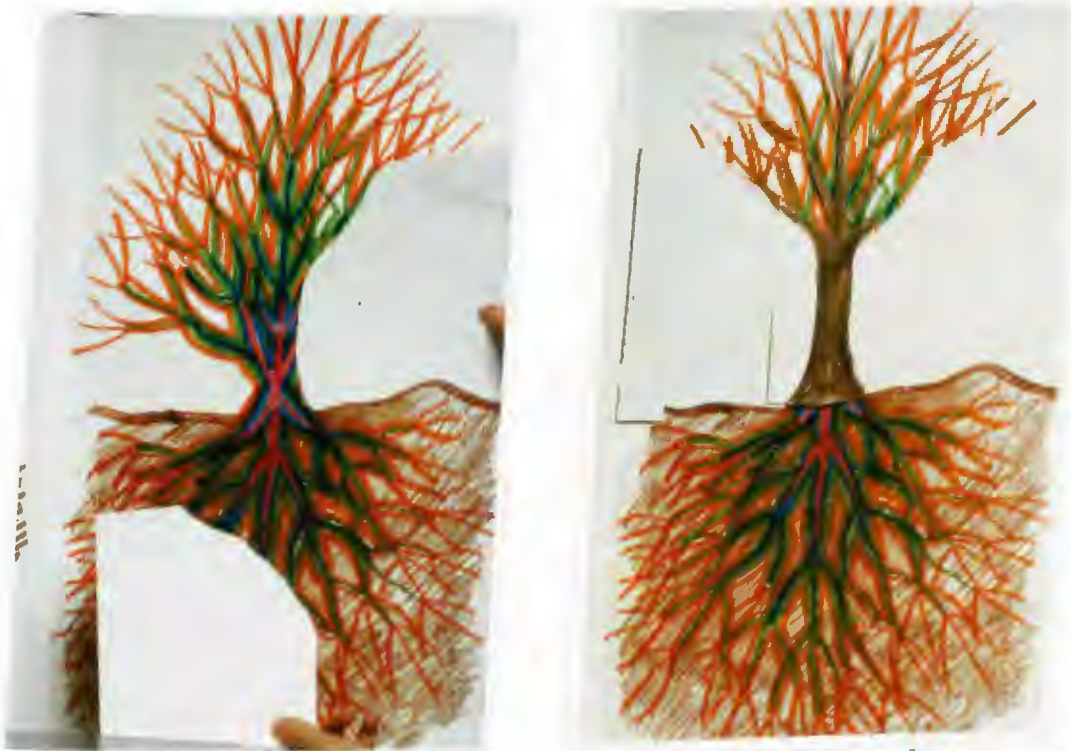


FIGURE 8. Visuals Related to Tree Growth.

Appendix B

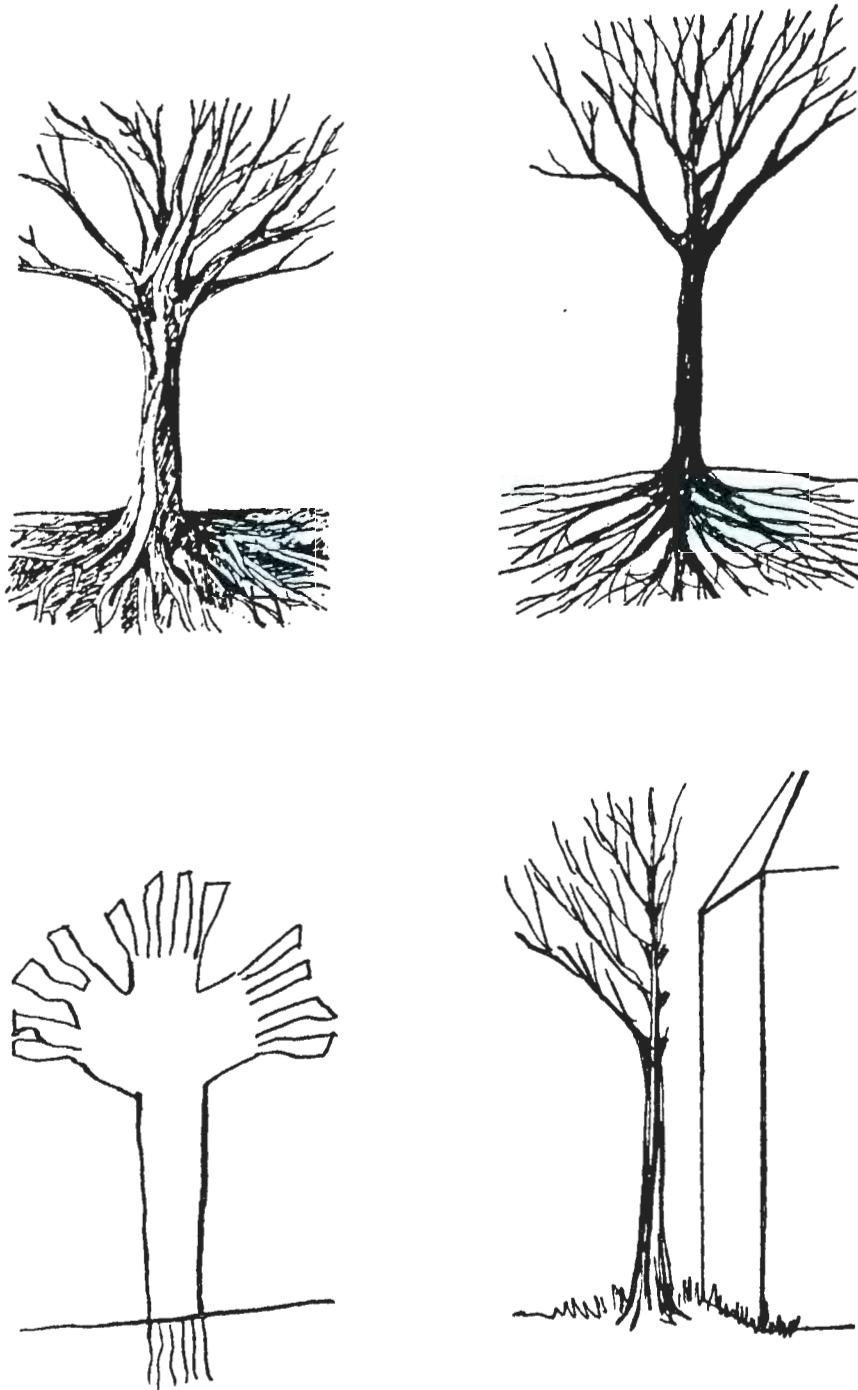


FIGURE 9. Additional Tree Visuals.

Appendix B



FIGURE 10. Poster (from Nike) Used for Tree Lesson.

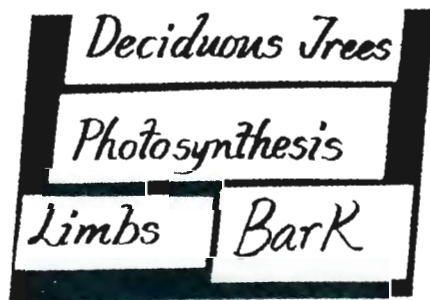


FIGURE 11. Tree Vocabulary Cards.

Appendix B

Control Group's Tree Instruction

The researcher gathered students on the floor near her to look at the diagrams she had made of how trees grow (Figure 8), drawings she had made of trees (Figure 9), a photographic poster published by Nike (Figure 10), and an illustration of a cross section of a tree trunk (partial view in Figure 8). She asked students questions designed to make them aware of tree growth characteristics listed on the preceding pages. She encouraged students to use the new vocabulary, eg, symmetrical, rings, root system, in their discussion of trees.

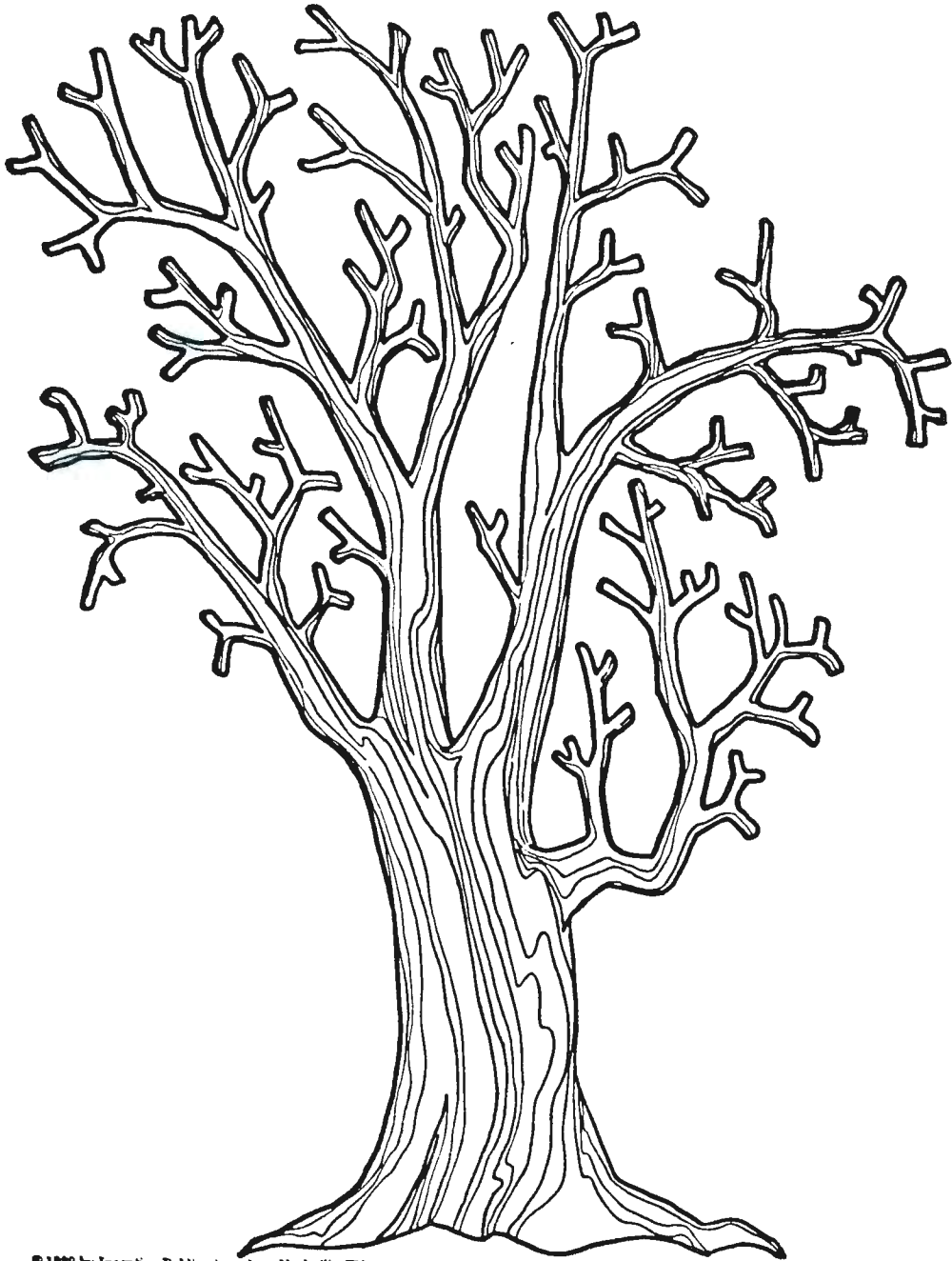
The researcher displayed a drawing of a tree that had been planted too close to a house (Figure 9) and asked students if anyone knew why it wasn't symmetrical. Students responded. She displayed an example of a poorly drawn tree (Figure 9) and asked students to identify what was wrong in the drawing. She listened to their comments and responded appropriately to them.

Students were asked to participate in a thorough review of all the information presented during the lesson.

Coloring Sheet Group's Tree Instruction

Students were given the exact same lesson given to the control group. However, instead of participating in the thorough review of the lesson, students were given the tree coloring sheet (see Figure 12) and asked to color it in. They had approximately five minutes for this portion of the lesson.

Appendix B



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FIGURE 12. Tree Coloring Sheet (Forte, 1989). (Sheet was reduced from the actual size of 8 1/2" x 11".)

Appendix B

Art-related Activity Group's Tree Instruction

The researcher gathered students on the floor near her to look at the diagrams she had made of how trees grow (Figure 8), drawings she had made of trees (Figure 9), a photographic poster published by Nike (Figure 10), and an illustration of a cross section of a tree trunk (partial view in Figure 8). She asked students questions designed to make them aware of the characteristics of tree growth listed on the preceding pages. She encouraged students to use the new vocabulary, eg, symmetrical, rings, root system, in their discussion of trees.

The researcher displayed a drawing of a tree that had been planted too close to a house (Figure 9) and asked students if anyone knew why it wasn't symmetrical. Students responded. She displayed an example of a poorly drawn tree (Figure 9) and asked students to identify what was wrong in the drawing. She listened to their comments and responded appropriately to them.

Students had approximately 10 minutes at the end of class to try drawing a tree. They were given white chalk and gray bogus paper for their drawings. The chalk did not work as well as it had in the pilot study, as these students apparently were not used to drawing with chalk. They drew heavily and were unable to correct their "mistakes" by erasing them with their hands. Many became distracted and/or frustrated by the medium.

For future research of this nature, the researcher recommends pencil instead of chalk, followed by a brown and/or black crayon for bark and branches.

APPENDIX C - TESTS AND SCORING INSTRUMENTS

Flag Multiple-Choice Test

Student's Name _____ Teacher's Name _____ Date _____

Here are some questions about the American flag. I don't expect you to be able to answer all of them. I will read each question and the four answer choices aloud. If you think you know an answer, draw a circle around the letter or around the entire answer you think is right. Do your best!

1. What shape is the American flag?
 - a. circular
 - b. square
 - c. rectangular
 - d. triangular

2. What do we call something that is used to represent our country?
 - a. a sign
 - b. a symbol
 - c. a design
 - d. a pattern

3. Which way do the stripes on the flag go?
 - a. vertically
 - b. horizontally
 - c. diagonally
 - d. randomly

4. How many stripes are on the flag?
 - a. 11
 - b. 12
 - c. 13
 - d. 14

5. How many red stripes are on the flag?
 - a. 4
 - b. 5
 - c. 6
 - d. 7

6. How many white stripes are on the flag?
 - a. 4
 - b. 5
 - c. 6
 - d. 7

7. What do the stripes represent?
 - a. the thirteen original colonies
 - b. some of our famous leaders
 - c. the religions in America
 - d. the kinds of freedom we enjoy in America
8. What stripe is at the top and bottom edge of the flag?
 - a. a white stripe
 - b. a red stripe
 - c. a wider stripe
 - d. a longer stripe
9. In what way are all the stripes alike?
 - a. length
 - b. color
 - c. width
 - d. size
10. What do we call the blue rectangle with the stars?
 - a. the field
 - b. the corner
 - c. the states
 - d. the form
11. About how much space does the blue rectangle occupy across the top of the flag?
 - a. a little more than one half
 - b. a little less than one half
 - c. about one quarter
 - d. about one fifth
12. What do the stars represent?
 - a. states
 - b. citizens
 - c. colonies
 - d. years
13. How many stars are there on the flag now?
 - a. forty
 - b. forty-five
 - c. forty-eight
 - d. fifty
14. How are the stars arranged?
 - a. in lengths and widths
 - b. in rows and columns
 - c. in plaids and stripes
 - d. in diagonals and circles

15. What pattern does this arrangement of stars create?
 - a. they form a random pattern
 - b. they form a circular pattern
 - c. they form a pattern of straight and diagonal lines
 - d. they form a triangular pattern

16. Which way do columns go?
 - a. from side to side
 - b. from top to bottom
 - c. diagonally
 - d. randomly

17. Which way do rows go?
 - a. from side to side
 - b. from top to bottom
 - c. diagonally
 - d. randomly

Appendix C
Sample Flag Drawing Test

1. Draw a horizontal line in this space.	2. Draw a vertical line in this space.	3. Draw a diagonal line in this space.
4. Draw an American flag in this space. Draw it large enough so you'll have room to put in all the stars and stripes.		

Student's Number _____

FIGURE 13. Sample Flag Drawing Test. (Test was reduced from the actual size of 8 1/2" x 11".)

Appendix C

Sample Flag Drawing Scoring Instrument

Drawing Task 1 - Scoring Instrument

(Check if observable)	1 pt.	1/2 pt.	1/4 pt.
A. Line vocabulary -			
1. Correctly drawn horizontal line.....	<u>1</u>		
2. Correctly drawn vertical line.....	<u>1</u>		
3. Correctly drawn diagonal line.....	<u>1</u>		
B. Flag Characteristics -			
all stripes are red & white.....			<u>1</u>
colors of stripes alternate.....			<u>1</u>
red stripe at top		<u>1</u>	
red stripe at bottom		<u>1</u>	
exactly 7 red stripes.....			
only 6 red stripes.....			
exactly 6 white stripes.....			
only 5 white stripes.....			
blue field		<u>1</u>	
field in top corner	<u>1</u>		
stars are shown (dots or marks o.k.).....		<u>1</u>	
a. in rows and columns (or).....		<u>1</u>	
b. most (3/4 or more) in rows and columns.....			
50 stars (shown or written).....			
rectangular shape (fluttering or not)	<u>1</u>		
field to flag ratio 1:4 or 1:5.....	<u>1</u>		
Totals.....	<u>6</u>	<u>5</u>	<u>2</u>
	<u>x 1</u>	<u>x .5</u>	<u>x .25</u>
	<u>6</u>	<u>2.5</u>	<u>.5</u>

Student's Number 14 Code III Grand Total 9.0

Appendix C

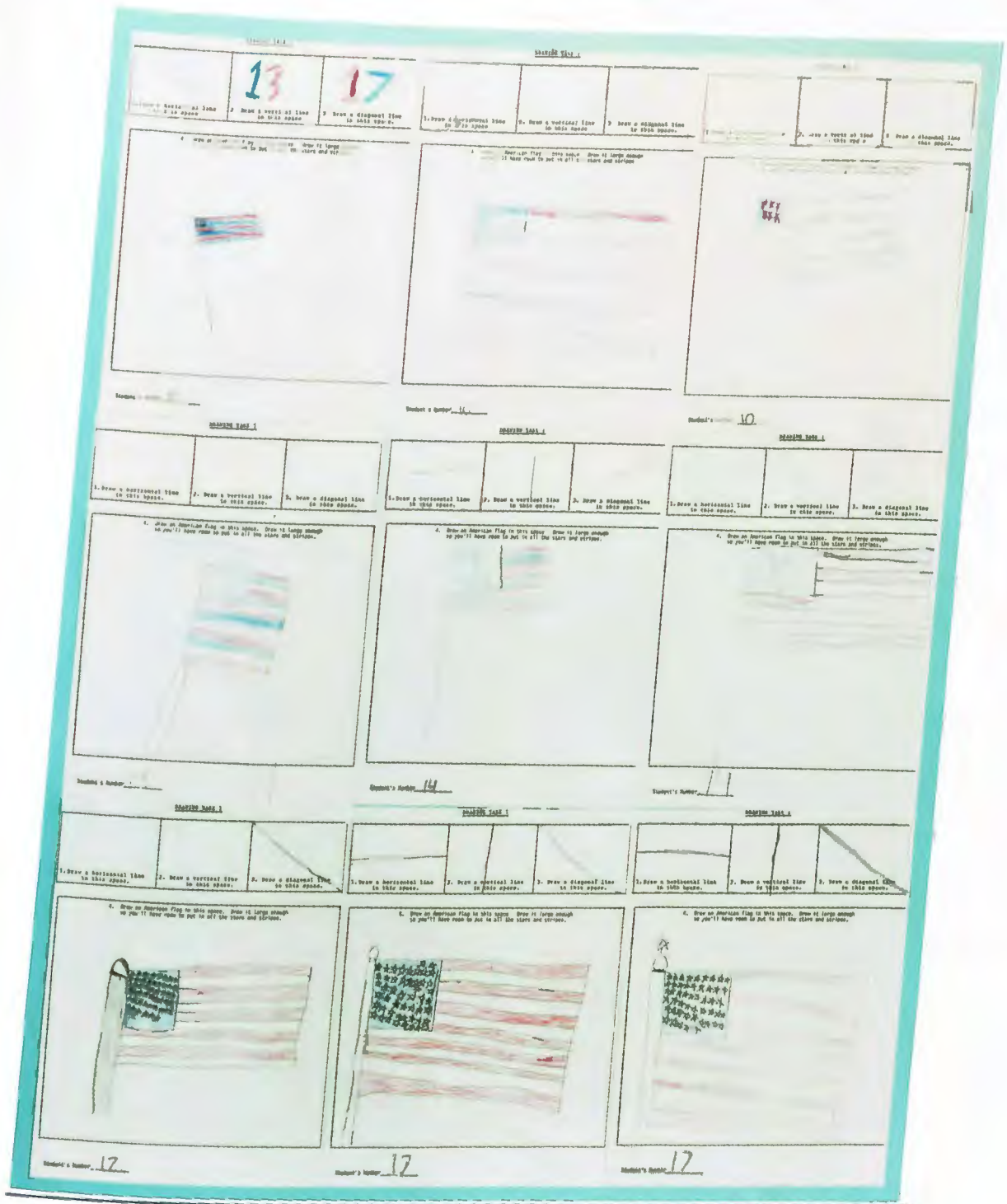


FIGURE 14. Sample of Completed Flag Drawing Tests. Top, low scores; middle, medium scores; bottom, high scores.

Drawing Task 1 - Scoring Instrument

(Check if observable)

	1 pt.	1/2 pt.	1/4 pt.
A. Line vocabulary -			
1. Correctly drawn horizontal line.....	_____	_____	_____
2. Correctly drawn vertical line.....	_____	_____	_____
3. Correctly drawn diagonal line.....	_____	_____	_____
B. Flag Characteristics -			
all stripes are red & white.....	_____	_____	1
colors of stripes alternate.....	_____	_____	1
red stripes at top.....	_____	1	_____
red stripes at bottom.....	_____	1	_____
exactly 7 red stripes.....	_____	_____	_____
only 6 red stripes.....	_____	_____	_____
exactly 6 white stripes.....	_____	_____	_____
only 5 white stripes.....	_____	_____	_____
blue field.....	_____	1	_____
field in top corner.....	_____	1	_____
stars are shown (dots or marks o.k.).....	_____	1	_____
a. in rows and columns (pk).....	_____	1	_____
b. most (3/4 or more) in rows and columns.....	_____	_____	_____
50 stars (shown or written).....	_____	1	_____
rectangular shape (fluttering or not).....	_____	1	_____
field to flag ratio 1:4 or 1:5.....	_____	1	_____
Totals.....	4	5	2
	<u>21</u>	<u>25</u>	<u>25</u>

Student's Number 17 Code III Grand Total 70

②

Drawing Task 1 - Scoring Instrument

(Check if observable)

	1 pt.	1/2 pt.	1/4 pt.
A. Line vocabulary -			
1. Correctly drawn horizontal line.....	_____	_____	_____
2. Correctly drawn vertical line.....	_____	_____	_____
3. Correctly drawn diagonal line.....	_____	_____	_____
B. Flag Characteristics -			
all stripes are red & white.....	_____	_____	1
colors of stripes alternate.....	_____	_____	1
red stripes at top.....	_____	_____	_____
red stripes at bottom.....	_____	1	_____
exactly 7 red stripes.....	_____	_____	_____
only 6 red stripes.....	_____	_____	_____
exactly 6 white stripes.....	_____	_____	_____
only 5 white stripes.....	_____	_____	_____
blue field.....	_____	1	_____
field in top corner.....	_____	1	_____
stars are shown (dots or marks o.k.).....	_____	1	_____
a. in rows and columns (pk).....	_____	1	_____
b. most (3/4 or more) in rows and columns.....	_____	_____	_____
50 stars (shown or written).....	_____	1	_____
rectangular shape (fluttering or not).....	_____	1	_____
field to flag ratio 1:4 or 1:5.....	_____	1	_____
Totals.....	7	7	2
	<u>21</u>	<u>25</u>	<u>25</u>

Student's Number 17 Code III Grand Total 11

③

Drawing Task 1 - Scoring Instrument

(Check if observable)

	1 pt.	1/2 pt.	1/4 pt.
A. Line vocabulary -			
1. Correctly drawn horizontal line.....	_____	_____	_____
2. Correctly drawn vertical line.....	_____	_____	_____
3. Correctly drawn diagonal line.....	_____	_____	_____
B. Flag Characteristics -			
all stripes are red & white.....	_____	_____	1
colors of stripes alternate.....	_____	_____	1
red stripes at top.....	_____	1	_____
red stripes at bottom.....	_____	1	_____
exactly 7 red stripes.....	_____	_____	_____
only 6 red stripes.....	_____	_____	_____
exactly 6 white stripes.....	_____	_____	_____
only 5 white stripes.....	_____	_____	_____
blue field.....	_____	_____	1
field in top corner.....	_____	1	_____
stars are shown (dots or marks o.k.).....	_____	1	_____
a. in rows and columns (pk).....	_____	1	_____
b. most (3/4 or more) in rows and columns.....	_____	_____	_____
50 stars (shown or written).....	_____	1	_____
rectangular shape (fluttering or not).....	_____	1	_____
field to flag ratio 1:4 or 1:5.....	_____	1	_____
Totals.....	7	6	2
	<u>21</u>	<u>30</u>	<u>25</u>

Student's Number 17 Code _____ Grand Total 1075

Appendix C
Tree Multiple-Choice Test

Student _____ Teacher's Name _____ Date _____

Here are some questions about trees. I don't expect you to be able to answer all of them. I will read each question and the four answer choices aloud. If you think you know an answer, draw a circle around the letter or around the entire answer you think is right. Do your best!

1. What does the word symmetrical mean?
 - a. tall and broad
 - b. leaning to one side
 - c. makes its own food
 - d. the same on both sides

2. Of the conditions listed below, which would help a tree grow symmetrically?
 - a. There was plenty of room for the tree to grow.
 - b. The tree was crowded in a forest.
 - c. The tree was planted too close to a house.
 - d. The wind kept blowing from one direction.

3. Which of the items listed below is called a 'system'?
 - a. trunk
 - b. root
 - c. bark
 - d. leaves

4. What do tree roots do?
 - a. help the tree resist attacks from harmful insects
 - b. anchor the tree and absorb water and minerals from the soil
 - c. bring food up from the soil to feed the tree
 - d. produce bark for the tree

5. Which of the following best describes the relation between the roots and the rest of the tree?
 - a. The roots are much smaller than the tree is.
 - b. The roots are much larger than the tree is.
 - c. The roots are about the same size as the tree is.
 - d. The roots are much thicker than the tree trunk and branches are.

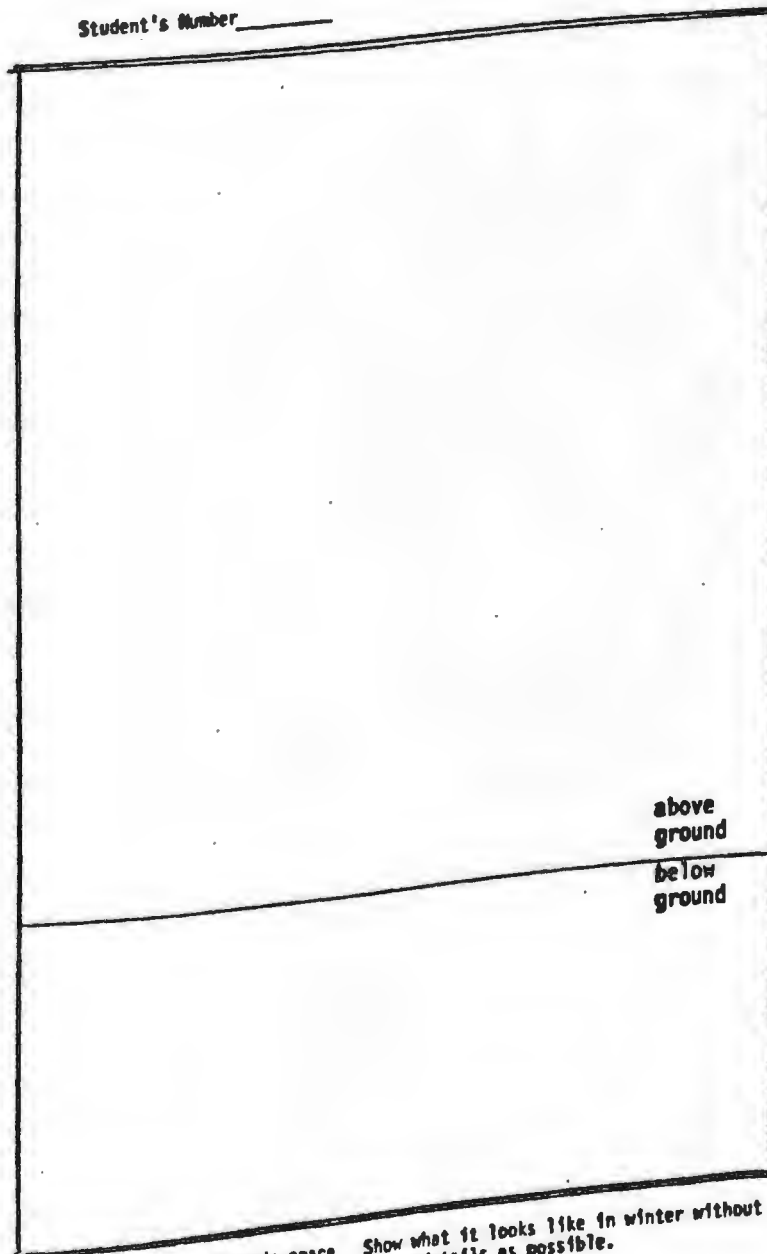
6. Which one of these statements is true?
 - a. tree trunks may grow straight up from bottom to top.
 - b. tree trunks don't grow much after the first year.
 - c. tree trunks make food for the tree.
 - d. tree trunks are always wider than they are tall
7. Which of the following statements about the way tree branches grow is true?
 - a. Branches near the top of the tree are thinner.
 - b. Branches near the top of the tree are thicker.
 - c. All branches on a tree are the same thickness.
 - d. Branches near the top of the tree are older.
8. What do we call the outer layer of the trunk?
 - a. limb
 - b. skin
 - c. bark
 - d. branch
9. How can you tell the age of a tree that has been cut down?
 - a. by studying the branches
 - b. by counting the rings
 - c. by looking at the bark
 - d. by breaking off a twig
10. How does the trunk change when the growing season is good?
 - a. it gets thicker
 - b. it gets darker
 - c. it gets lighter
 - d. it gets thinner
11. Which of the following statements is true for deciduous trees?
 - a. they keep their leaves all year long
 - b. they keep their new growth but lose their old leaves
 - c. they have needles instead of leaves
 - d. they lose their leaves in the fall
12. What is the main job performed by leaves?
 - a. make food for caterpillars and other insects
 - b. make food for the tree trunk, branches and roots
 - c. provide shade for the tree
 - d. absorb water and keep the trunk dry

13. What is photosynthesis?
- a. a process by which branches grow on trees
 - b. a process by which shade is produced by trees
 - c. a process by which tiny buds grow each year
 - d. a process by which leaves make food for the tree
14. Which of the following lives the longest?
- a. dogs
 - b. trees
 - c. giraffes
 - d. cats
15. What are branches of a tree sometimes called?
- a. the heart
 - b. the body
 - c. the limbs
 - d. the roots

Appendix C
Tree Drawing Test

DRAWING TASK 2

Student's Number _____



Draw a large tree in this space. Show what it looks like in winter without any leaves or snow on it. Show as many details as possible.

FIGURE 15. Tree Drawing Test. (Sheet has been reduced from the original 8 1/2" x 11" size.)

Appendix C - Sample Completed Tree Drawing Tests

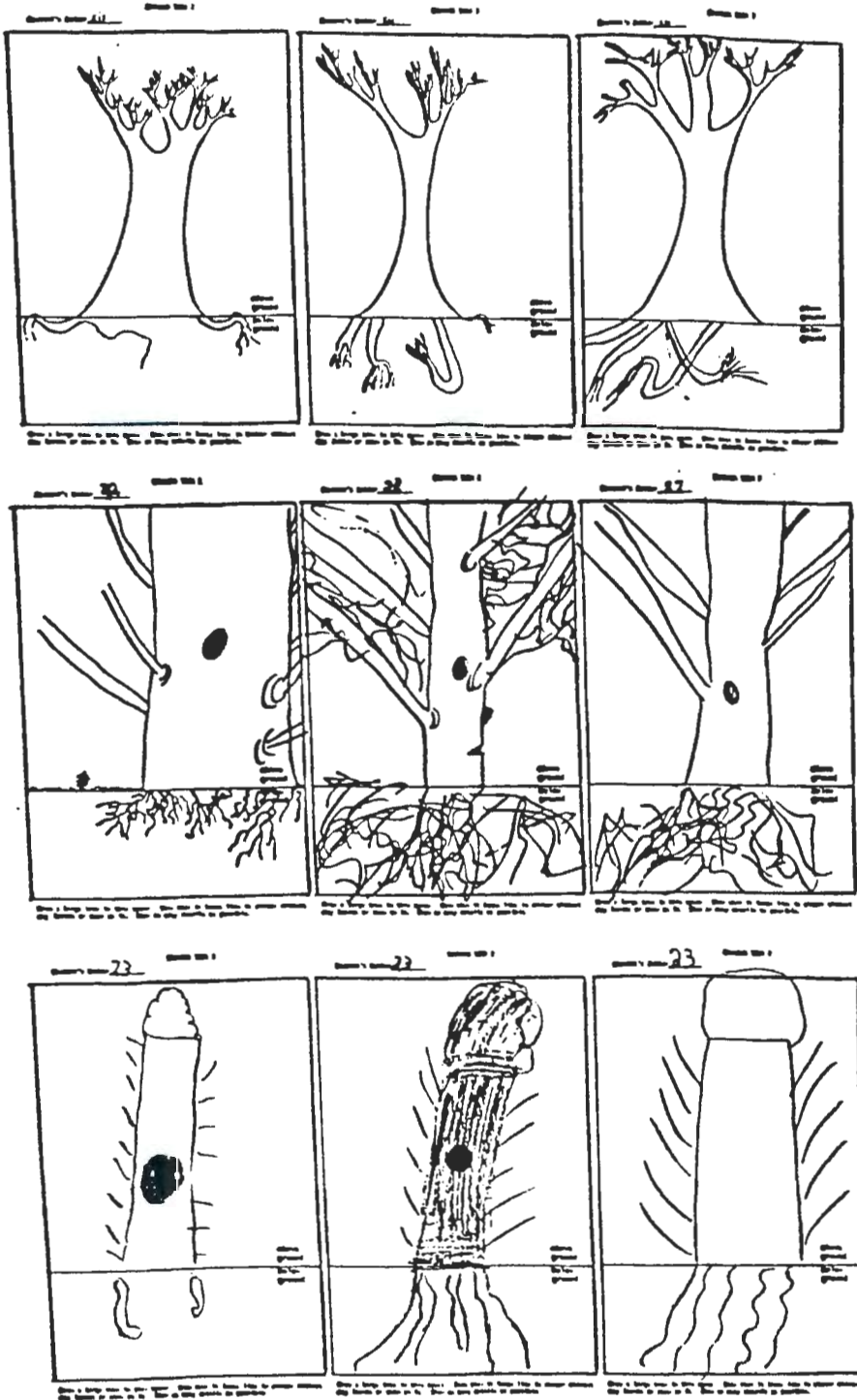


FIGURE 16. Sample Tree Drawing Tests. Top, high scores; middle, medium scores; bottom, low scores.

Appendix C

Sample Tree Drawing Scoring Instrument

Drawing Task 2 - Scoring Instrument

Award one point for each of the following:

- 1. trunk is attached to the base line..... 1
- 2. trunk is wider at the bottom of tree..... 1
- 3. bark texture is shown on the trunk..... 1
- 4. branches are drawn at a variety of angles..... 1
- 5. branches subdivide one way..... 1
- 6. branches subdivide two ways..... 1
- 7. branches subdivide many ways..... 1
- 8. branches connect to those below..... 1
- 9. most branches get thinner towards their ends.... 1
- 10. a root system is shown..... 1
- 11. at the ground line, roots connect to the tree... 1
- 12. the root system branches..... 1
- 13. roots are thicker near ground line..... 1
- 14. roots are nearly as large as the tree top..... 1

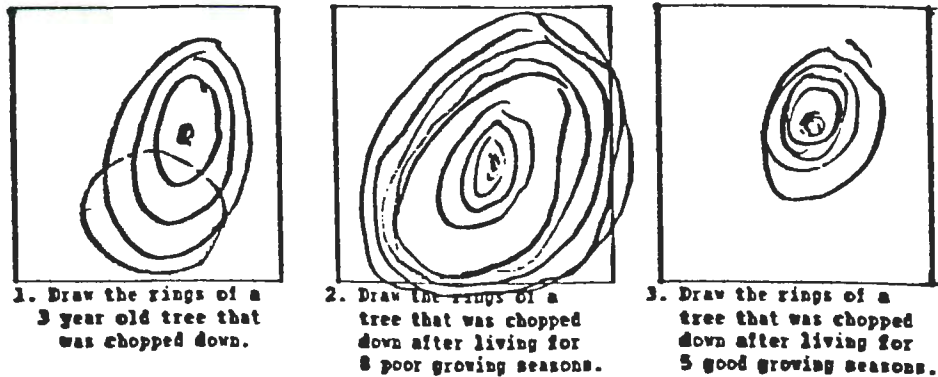
Total Score... 7

Student's Number 1 Code 11

Appendix C

Adjunct Tree Drawing Test

An adjunct drawing test was designed to measure what students had learned about the growth of trees during poor or good growing seasons. The version of this test used during the pilot study did not prevent students from copying one another's work, so it was deleted from this study. The revised version shown below was piloted late in the study and found to be effective. Although the revision came too late for this study, it should be of use to future researchers.



Drawing Task 2 - Scoring Instrument

Award one point for each of the followings:

1. trunk is attached to the base line.....	1
2. trunk is wider at the bottom of tree.....	1
3. bark texture is shown on the trunk.....	_____
4. branches are drawn at a variety of angles.....	_____
5. branches subdivide one way.....	_____
6. branches subdivide two ways.....	_____
7. branches subdivide many ways.....	_____
8. branches connect to those below.....	_____
9. most branches get thinner towards their ends.....	_____
10. a root system is shown.....	1
11. at the ground line, roots connect to the tree....	1
12. the root system branches.....	_____
13. roots are thicker near ground line.....	_____
14. roots are nearly as large as the tree top.....	1
Total Score.....	5

On follow-up tasks, give a point for each correct drawing of rings of a tree that lived:

- | | |
|---|-------|
| 1. for 3 years (box 1)..... | _____ |
| 2. for 8 growing seasons (box 2)..... | _____ |
| 3. for 5 growing seasons (box 3)..... | _____ |
| 4. through poor growing seasons (thin rings-box 2).... | _____ |
| 5. through good growing seasons (thick rings- box 3)... | _____ |

Student's Number 23 Code (23)

Adjunct Score..... 0/5

FIGURE 17. Adjunct Drawing Test and Score Sheet.

Appendix C

Item Analysis

Two envelopes of multiple-choice tests, one set each of flag and tree tests, were selected at random and the top and bottom 1/4 of each class' tests were removed from the envelope for use in this analysis. A total of 12 tests from each envelope were used to determine item difficulty and discrimination.

The formula used for item difficulty was the combined number of both high and low scoring students who got the item correct divided by the total number in each sample, which was twelve. On SPSS/PC+, the mean score of the group on each item determined the item difficulty, since items with means close to 1 were answered correctly by most subjects and those close to 0 to answered incorrectly. Means of the best items in terms of difficulty approached .5000.

The formula used for item discrimination was the number of students in the top group who got the item correct minus the number of students in the bottom group who got it correct, divided by the number of students in the top (or in the bottom) group. Items with scores close to 1.0 discriminated most effectively.

See next two pages for other item analysis information.

Appendix C

Item Analysis of the Tree Multiple-choice Test

Item	Mean and Diff.	S. D.	Disc.	Reaction
1.	.6667	.4851	.83	Strong item.
2.	.6111	.5016	1.00	Excellent item.
3.	.6667	.4851	.83	Strong item.
4.	.5000	.5145	1.00	Excellent item.
5.	.3889	.5016	.67	Quite strong item.
6.	.6667	.4851	.67	Quite strong item.
7.	.6667	.4851	.33	Quite weak item.
8.	1.000	.0000	.00	Failed to discrim.
9.	.7222	.4609	.67	Quite strong item.
10.	.7222	.4609	.67	Quite strong item.
11.	.6667	.4851	.83	Strong item.
12.	.6667	.4851	.67	Quite strong item.
13.	.3333	.4851	.17	Weak item.
14.	.8333	.3835	.50	Fairly weak item.
15.	.8333	.3835	.50	Fairly weak item.

Overall Scale Alpha = .96 with SEM = .80

Items two and four discriminated perfectly, whereas item 8 did not discriminate at all. Item 8 was too easy and should be deleted. Item 13 appears to have been too hard for students in this grade and should also be deleted.

Items 14 and 15 were fairly easy items that most students were able to answer correctly. They could be revised to increase the item's ability to discriminate. Item 7 was surprisingly weak and appears to have failed to discriminate effectively. This may be due in part to chance in that the item analysis was based upon the top and bottom 27% of a class of 24 students' tests, or 6 high scorers' and 6 low scorers' responses. It should be retained for now and examined after future use to determine if it needs revision.

The remaining 8 items were strong ones that discriminated effectively. The overall test alpha was .96 with a SEM of .80. This indicates that the instrument can be used reliably to measure degree of students' comprehension of the information presented in the lesson.

Appendix C

Item Analysis of the Flag Multiple-choice Test

Item	Mean and Diff.	S. D.	Disc.	Reaction
1.	.8696	.3444	.33	Quite weak item.
2.	.8261	.3876	.67	Quite strong item.
3.	.7826	.4217	.50	Fairly weak item.
4.	.8261	.3876	.33	Quite weak item.
5.	.3913	.4990	.00	Failed to discrim.
6.	.4348	.5069	.67	Quite strong item.
7.	.7826	.4217	.50	Fairly weak item.
8.	.9565	.2085	.17	Weak item.
9.	.8261	.3876	.33	Quite weak item.
10.	.9130	.2881	.33	Quite weak item.
11.	.6522	.4870	.50	Fairly weak item.
12.	.9565	.2085	.17	Weak item.
13.	.9565	.2085	.17	Weak item.
14.	.7391	.4490	.17	Weak item.
15.	.6957	.4705	.00	Failed to discrim.
16.	.6087	.4990	1.00	Excellent item.
17.	.7391	.4490	.67	Quite strong item.

Overall Scale Alpha = .75 with SEM = 1.52

Item sixteen discriminated perfectly, whereas item five and fifteen did not discriminate at all. They both should

be deleted. Item eight, twelve, thirteen and fourteen were weak items and should be deleted. Items three, seven and eleven were fairly easy items that most students were able to answer correctly. They could be revised to increase the item's ability to discriminate. Item four, nine, and ten were surprisingly weak and appear to have failed to discriminate effectively. This may be due in part to chance in that the item analysis was based upon the top and bottom 27% of a class of 24 students' tests, or 6 high scorers' and 6 low scorers' responses. They should be revised.

Appendix C
Recoding Student Scores

Test Grade Level	Percentile Range	Recoded Score
		.50
First Grade	0 - 40	.75
First Grade	40 - 60	1.00
First Grade	60 - 80	1.50
First Grade	80 - 100	1.50
Second Grade	0 - 40	1.75
Second Grade	40 - 60	2.00
Second Grade	60 - 80	2.50
Second Grade	80 - 100	2.50
Third Grade	0 - 40	2.75
Third Grade	40 - 60	3.00
Third Grade	60 - 80	3.50
Third Grade	80 - 100	

Appendix C

Interrater Reliability - Flag Drawing test

To determine interrater reliability on the flag drawing test, one set of drawing tests was randomly selected to be scored by the two scorers*. The resulting score sheets were compared. The number of items scored identically by the two scorers was divided by the total number of items on the score sheet to arrive at a percentage of agreement between scorers. The overall agreement on the random set of drawings was 94.68% as shown below.

Student Number	Scorer #1	Scorer #2	Items that Differ	Items that Agree	Percent Agreement
1	8.75/13.25	8.50/13.25	.25	13.00	98%
2	4.75/13.25	6.00/13.25	1.75	11.50	87%
3	8.25/13.25	8.50/13.25	.75	12.50	94%
4	5.75/13.25	5.50/13.25	.25	13.00	98%
5	7.75/13.25	7.75/13.25	0.00	13.25	100%
6	8.50/13.25	8.75/13.25	.75	12.50	94%
7	6.25/13.25	6.50/13.25	.75	12.50	94%
8	4.75/13.25	5.00/13.25	.75	12.50	94%
10	5.50/13.25	6.00/13.25	.50	12.75	96%
11	6.25/13.25	6.50/13.25	.75	12.50	94%
12	8.50/13.25	8.50/13.25	0.00	13.25	100%
13	10.5/13.25	9.50/13.25	.50	12.75	96%
14	6.50/13.25	6.25/13.25	.25	13.00	98%
15	7.25/13.25	7.25/13.25	0.00	13.25	100%
16	7.25/13.25	7.75/13.25	.50	12.75	96%
17	5.75/13.25	6.00/13.25	.25	13.00	98%
18	9.50/13.25	8.25/13.25	0.00	13.25	100%
19	11.5/13.25	11.5/13.25	0.00	13.25	100%
20	10.5/13.25	9.75/13.25	2.25	11.00	83%
21	8.00/13.25	8.25/13.25	.75	12.50	95%
22	9.50/13.25	9.50/13.25	2.00	11.25	85%
23	9.50/13.25	11.0/13.25	1.50	11.75	89%
24	9.50/13.25	9.50/13.25	0.00	13.25	100%
26	7.75/13.25	7.50/13.25	1.25	12.00	91%
27	8.50/13.25	7.75/13.25	1.75	11.50	87%

Total Scored = 25 Total % = 2367
 Average % (2367/25) = 94.68%

* Set selected was posttests from school number 2, experimental group 2.

Appendix C

Interrater Reliability - Tree Drawing test

To determine the reliability of the tree test score sheet, one set of drawing tests was randomly selected to be scored by two scorers*. The resulting score sheets were compared. The number of items scored identically by the two scorers was divided by the total number of items on the score sheet to arrive at a percentage of agreement between scorers. The overall agreement on the random set of drawings was 92.4% as shown below:

Student Number	Scorer #1	Scorer #2	Items that Differ	Items that Agree	Percent Agreement
1	7/14	8/14	1/14	13/14	93%
2	13/14	13/14	0/14	14/14	100%
3	6/14	6/14	0/14	14/14	100%
4	8/14	6/14	2/14	12/14	86%
5	6/14	5/14	1/14	13/14	93%
7	5/14	6/14	1/14	13/14	93%
8	8/14	9/14	1/14	13/14	93%
9	9/14	10/14	1/14	13/14	93%
10	9/14	11/14	2/14	12/14	86%
11	9/14	9/14	0/14	14/14	100%
12	9/14	12/14	3/14	11/14	79%
13	8/14	11/14	3/14	11/14	79%
14	5/14	6/14	1/14	13/14	93%
15	7/14	7/14	2/14	12/14	86%
17	7/14	6/14	1/14	13/14	93%
18	7/14	7/14	0/14	14/14	100%
19	10/14	11/14	1/14	13/14	93%
20	7/14	7/14	0/14	14/14	100%
21	11/14	11/14	0/14	14/14	100%
22	8/14	9/14	1/14	13/14	93%
23	8/14	11/14	3/14	11/14	79%
24	8/14	8/14	0/14	14/14	100%
25	11/14	12/14	1/14	13/14	93%
26	10/14	11/14	1/14	13/14	93%

Total Number Scored 24 2218 2218/24 = 92.4%

*Set selected at random for this analysis was of posttests from school number 1, control group with pretests.

APPENDIX D STATISTICAL ADDENDUM

Correlations

	SEX	CRT	PRE	POST	FOLLOW	TPRE
SEX	1.0000	-.1651	.0799	-.0888	-.1015	-.1347
CRT	-.1651	1.0000	.4820**	.4984**	.5256**	.4830**
PRE	.0799	.4820**	1.0000	.5751**	.5390**	.4159**
POST	-.0888	.4984**	.5751**	1.0000	.6846**	.4842**
FOLL	-.1015	.5256**	.5390**	.6846**	1.0000	.5136**
TPRE	-.1347	.4830**	.4159**	.4842**	.5136**	1.0000
TPOST	-.1146	.4891**	.4843**	.6193**	.6077**	.6158**
TFOLL	-.1931*	.4981**	.5124**	.5990**	.5862**	.5995**
FDPRE	.0661	.3861**	.3992**	.3618**	.4202**	.3060**
FDPOS	-.2255*	.5594**	.3843**	.4557**	.5517**	.3618**
FDFOL	-.1426	.4490**	.3645**	.4509**	.5416**	.3846**
TDPRE	-.0335	.3542**	.3081**	.3493**	.4076**	.3286**
TDPOS	.0111	.2886**	.2658*	.3267**	.3796**	.2003
TDFOL	-.0822	.2713**	.2419*	.2795**	.3214**	.2011

	TPOST	TFOLL	FDPRE	FDPOST	FDFOLL	TDPRE
SEX	-.1146	-.1931*	.0661	-.2255*	-.1426	-.0335
CRT	.4891**	.4981**	.3861**	.5594**	.4490**	.3542**
PRE	.4843**	.5124**	.3992**	.3843**	.3645**	.3081**
POST	.6193**	.5990**	.3618**	.4557**	.4509**	.3493**
FOLL	.6077**	.5862**	.4202**	.5517**	.5416**	.4076**
TPRE	.6158**	.5995**	.3060**	.3618**	.3846**	.3286**
TPOST	1.0000	.7230**	.4767**	.4628**	.5131**	.4210**
TFOLL	.7230**	1.0000	.3302**	.3801**	.3747**	.3405**
FDPRE	.4767**	.3302**	1.0000	.4731**	.4408**	.4897**
FDPOS	.4628**	.3801**	.4731**	1.0000	.5597**	.4369**
FDFOL	.5131**	.3747**	.4408**	.5597**	1.0000	.3891**
TDPRE	.4210**	.3405**	.4897**	.4369**	.3891**	1.0000
TDPOS	.3574**	.3317**	.3699**	.3812**	.4205**	.6166**
TDFOL	.2889**	.2766**	.3351**	.3844**	.4026**	.5234**

1-tailed Signif: * - .01 ** - .001

Appendix D
Correlations (con't)

	TDPOS	TDFOL
SEX	.0111	-.0822
CRT	.2886**	.2713**
PRE	.2658*	.2419*
POST	.3267**	.2795**
FOLL	.3796**	.3214**
TPRE	.2003	.2011
TPOST	.3574**	.2889**
TFOL	.3317**	.2766**
FDPRE	.3699**	.3351**
FDPOS	.3812**	.3844**
FDFOL	.4205**	.4026**
TDPRE	.6166**	.5234**
TDPOS	1.0000	.4812**
TDFOL	.4812**	1.0000

1-tailed Signif: * - .01 ** - .001

Appendix D
Test Statistics

Test	Items	Means	Range
Flag multiple-choice pretest	17	6.962	0 - 14
Flag multiple-choice posttest	17	11.688	0 - 17
Flag multiple-choice follow-up	17	11.006	2 - 17
Flag drawing pretest	11.5	6.115	0 - 11.5
Flag drawing posttest	11.5	8.170	4 - 11.5
Flag drawing follow-up	11.5	7.813	3 - 11.5
Tree multiple-choice pretest	15	6.127	1 - 13
Tree multiple-choice posttest	15	9.211	1 - 15
Tree multiple-choice follow-up	15	8.728	1 - 15
Tree drawing pretest	14	7.387	1 - 14
Tree drawing posttest	14	8.335	3 - 13
Tree drawing follow-up	14	7.636	3 - 13

Appendix D

Statistics - Flag Multiple-Choice Tests

Pre-tests

<u>Group</u>	<u>Mean</u>	<u>S.D.</u>	<u>Cases</u>
Control w/o Pre	--	--	--
Control w. Pre	7.34	2.66	44
Exper. w. Color Sheet	7.02	2.75	45
Exper. w. Quasi-Create	6.51	3.00	43

Post-tests

<u>Group</u>	<u>Mean</u>	<u>S.D.</u>	<u>Cases</u>
Control w/o Pre	12.83	3.35	23
Control w. Pre	12.15	3.18	47
Exper. w. Color Sheet	11.41	2.74	49
Exper. w. Quasi-Create	10.85	4.22	41

Follow-up Tests

<u>Group</u>	<u>Mean</u>	<u>S.D.</u>	<u>Cases</u>
Control w/o Pre	12.45	3.00	20
Control w. Pre	11.50	3.32	42
Exper. w. Color Sheet	10.15	3.63	47
Exper. w. Quasi-Create	10.80	3.70	45

Appendix D

Statistics - Flag Drawing Tests

Pre-tests

<u>Group</u>	<u>Mean</u>	<u>S.D.</u>	<u>Cases</u>
Control w/o Pre	--	--	--
Control w. Pre	7.02	1.85	44
Exper. w. Color Sheet	5.68	1.76	46
Exper. w. Quasi-Create	5.63	1.76	43

Post-tests

<u>Group</u>	<u>Mean</u>	<u>S.D.</u>	<u>Cases</u>
Control w/o Pre	9.20	1.71	23
Control w. Pre	8.98	2.09	46
Exper. w. Color Sheet	7.15	1.95	47
Exper. w. Quasi-Create	7.87	1.71	43

Follow-up Tests

<u>Group</u>	<u>Mean</u>	<u>S.D.</u>	<u>Cases</u>
Control w/o Pre	9.16	1.42	20
Control w. Pre	8.58	1.64	43
Exper. w. Color Sheet	6.56	2.00	47
Exper. w. Quasi-Create	7.79	2.06	44

Appendix D

Statistics - Tree Multiple-Choice Tests

Pre-tests

<u>Group</u>	<u>Mean</u>	<u>S.D.</u>	<u>Cases</u>
Control w/o Pre	--	--	--
Control w. Pre	7.67	2.38	43
Exper. w. Color Sheet	5.46	2.88	50
Exper. w. Quasi-Create	5.45	2.74	49

Post-tests

<u>Group</u>	<u>Mean</u>	<u>S.D.</u>	<u>Cases</u>
Control w/o Pre	11.09	2.54	23
Control w. Pre	10.24	3.11	42
Exper. w. Color Sheet	8.62	3.56	45
Exper. w. Quasi-Create	7.91	3.56	46

Follow-up Tests

<u>Group</u>	<u>Mean</u>	<u>S.D.</u>	<u>Cases</u>
Control w/o Pre	10.13	3.17	23
Control w. Pre	9.43	3.49	42
Exper. w. Color Sheet	8.37	3.03	48
Exper. w. Quasi-Create	7.73	3.21	45

Appendix D
 Statistics - Tree Drawing Tests

Pre-tests

<u>Group</u>	<u>Mean</u>	<u>S.D.</u>	<u>Cases</u>
Control w/o Pre	--	--	--
Control w. Pre	7.81	1.85	42
Exper. w. Color Sheet	6.96	2.53	46
Exper. w. Quasi-Create	7.43	2.18	49

Post-tests

<u>Group</u>	<u>Mean</u>	<u>S.D.</u>	<u>Cases</u>
Control w/o Pre	9.30	1.43	23
Control w. Pre	8.36	1.90	45
Exper. w. Color Sheet	7.77	2.20	44
Exper. w. Quasi-Create	8.37	2.33	46

Follow-up Tests

<u>Group</u>	<u>Mean</u>	<u>S.D.</u>	<u>Cases</u>
Control w/o Pre	8.00	1.77	24
Control w. Pre	7.98	2.07	46
Exper. w. Color Sheet	7.22	2.25	49
Exper. w. Quasi-Create	7.54	2.09	46

REFERENCES

- Aikin, W. (1942). The story of the eight year study. New York: Harper & Bros.
- Anderson, J. (1983). The architecture of cognition. Cambridge, MA: Harvard University Press.
- Arnheim, R. (1954). Art and visual perception: The psychology of the creative eye. Berkeley: University of California Press.
- Arnheim, R. (1983). Perceiving, thinking, forming. Art Education, 36(2), 9-11.
- Battle, J., & Labercane, G. (1985). Comparing achievement, ability, with visual memory and visual association. Reading Horizons, 25(2), 87-94.
- Broudy, H. (1979). Arts education: Necessary or just nice? Phi Delta Kappan, 60(5), 47-50.
- Broudy, H. (1987). The role of imagery in learning. Occasional Paper #1. Los Angeles, CA: Getty Center for Education in the Arts.
- Bruner, J. S. (1960). The process of education. New York: Random House.
- Bruner, J. S. (1966). Towards a theory of instruction. Cambridge, MA: Harvard Univ. Press.
- Carbo, M. (1980). An analysis of the relationship between the modality preferences of kindergartners and selected reading treatments as they affect the learning of a basic sight-word vocabulary (Doctoral dissertation, St. John's University, 1980). Dissertation Abstracts International, 41, 1389A.
- Claparede, E. (1907). Plan d'experiences collectives sur le dessin des enfants. (Plan for collective experiments on the drawing of children.) Architecture de Psychology, 6, 276-278.
- Clark, G. (1985). Integrated art education. Art Education, 38(6), 4.
- Clay, M. (1986). Constructive processes: Talking, reading, writing, art, and craft. The Reading Teacher. 39(8),

764-770.

- Cohen, E. P. & Gainer, R. S. (1984). Art: Another Language for Learning. New York: Schocken Books.
- Cotton, K. (1991). Educating urban minority youth: Research on effective practices. Portland, OR: Northwest Regional Educational Laboratory
- Dehn, N., & Schank, R. (1982). Artificial and human intelligence. In R. J. Sternberg (Ed.), Handbook of human intelligence (pp. 352-391). Cambridge, MA: Cambridge University Press.
- Dewey, J. (1902). The child and the curriculum. Chicago: University of Chicago Press.
- Dewey, J. (1934). Art as experience. New York: Minton, Balch.
- Dewey, J. (1938). Experience and education. New York: Macmillan.
- Dunn, K., & Dunn, R. (1987). Dispelling outmoded beliefs about student learning. Educational Leadership, 44(6), 55-61.
- Dunn, R. (1987). Research on instructional environments: Implications for student achievement and attitudes. Professional School Psychology, 2(1), 43-52.
- Dunn, R., Beaudry, J. S., & Klavas, A. (1989). Survey of research on learning styles. Educational Leadership, 46(6), 50-58.
- Efland, A. (1965). Efforts of perceptual training on second grade drawings. Unpublished manuscript, Stanford University.
- Efland, A. (1976). The school art style: A functional analysis. Studies in Art Education, 17(2), 37-44.
- Forte, I. (1989). October: Patterns, projects & plans. Nashville, TN: Incentive Publications.
- Freeman, N. H., & Cox, M. V. (1985). Visual Order: The nature and development of pictorial representation. Cambridge, MA: Cambridge University Press.
- Furth, H. (1970). Piaget for teachers. New Jersey:

Prentice-Hall, Inc.

- Gardner, H. (1983). Artistic intelligences. Art Education, 36(2), 47-50.
- Gardner, H. (1983). Frames of mind: The theory of multiple intelligences. New York: Basic Books.
- Gardner, H. (1984). Assessing intelligences: A comment on testing intelligence without I.Q. tests. Phi Delta Kappan, 65(10), 699-700.
- Gardner, H. (1987). The theory of multiple intelligences. Annals of Dyslexia, 37, 19-35.
- Gardner, H. & Hatch, T. (1989). Multiple intelligences go to school. Educational Researcher, 18(8), 4-10.
- Goodenough, F. (1926). Measurement of intelligence by drawings. New York: Harcourt, Brace and World.
- Goodman, Nelson. (1983). Notes from the underground. Art Education, 36(2), 34-35.
- Gross, L. (1983). Why Johnny can't draw. Art Education, 36(2), 74-77.
- Gruber, H. & Voneche, J. (Eds.). (1977) The essential Piaget. New York: Basic Books.
- Hall, B. (1979). The arts and reading. "Coming to our senses"; Why the visual and performing arts are fundamental to reading and language development. Arlington, Va. (ERIC Document Reproduction Service No. ED 170708)
- Hamilton, D. (1985). The visual arts: an integral part of curriculum. Secondary Educational Journal, 15, 23-25.
- Harris, D. (1963). Children's drawings as measures of intellectual maturity. New York: Harcourt, Brace & World.
- Hatch, T. C. & Gardner, H. (1986). From testing intelligence to assessing competencies: A pluralistic view of intellect. Roeper Review, 8(3), 47-50.
- Hayes, D. A., & Henk, W. A. (1986). Understanding and remembering complex prose augmented by analogic and pictorial illustration. Journal of Reading Behavior,

18(1), 63-78.

- Heilman, H. (1954). An experimental study of the effect of workbooks on the creative drawing of second grade children. Unpublished doctoral dissertation, Pennsylvania State University, Pennsylvania.
- Hoeber, M. (1988). Our flag, capital and government: Grades 2-3. Palos Verdes Estates, CA: Frank Schaffer.
- Ivanoff, E. (1909). Recherches experimentales sur le dessin des ecoliers de la Suisse Romande: correlation entre l'aptitude au dessin et les autres aptitudes. (Experiments on the drawing of Swiss school children: the correlation between drawing aptitude and other capacities.) Architectural Psychology, 8, 97-156.
- Jefferson, B. (1963). The color book craze. The Association for Childhood Education International, Washington, D. C.
- Jeffers, C. (1991). Through the keyhole: Phenomenological glimpses of life in the pre-service education class, "Art for Elementary Teachers". Unpublished manuscript, The University of Maryland, College Park.
- Jefferson, B. (1969). Teaching art to children (3rd ed.). Boston: Allyn and Bacon.
- Kellogg, R. & O'Dell, S. (1967). Psychology of children's art. Del Mar, CA: CRM Books.
- Kellogg, R. (1969). Analyzing children's art. Palo Alto, CA: National Press Books.
- Khatena, J. (1983). Analogy imagery and the creative imagination. Journal of Mental Imagery, 3, 127-134.
- Kilpatrick, W. H. (1918). The project method. Teachers College Record, 19(4), 319-335.
- King, I. (1991). In search of Lowenfeld's proof that coloring books are harmful to children. Studies in Art Education, 33(1), 36-42.
- Kline, L. W. & Carey, G. L. (1922). A measuring scale for free-hand drawing. Johns Hopkins University Studies in Education, No. 5., Baltimore: Johns Hopkins Press.
- Lazerson, M. (1971). Progressive education movement. In

- L.C. Deighton (Ed.), The encyclopedia of education (pp. 249-261). New York: Macmillan.
- Lohman, D. (1989). Human intelligence: An introduction to advances in theory and research. Review of Educational Research, 59(4), 333-373.
- Lowenfeld, V. & Brittain, W. L. (1968). Creative and mental growth (4th ed.). New York: Macmillan.
- Luquet, G. (1913). Les dessins d'un enfant [The drawings of a child]. Paris: F. Alcan.
- Mayer, R. E. (1975). Different problem-solving competencies established in learning computer programming with and without meaningful models. Journal of Educational Psychology, 68, 355-359.
- Mayer, R. (1989). Models for understanding. Review of Educational Research, 59, 43-64.
- McCarty, S. (1924) Children's drawings. Baltimore: Williams & Wilkins.
- McFee, J. (1957). Perception-Delineation Theory. Unpublished manuscript, Stanford University.
- McFee, J. (1961). Preparation for art. San Francisco: Wadsworth.
- McWhinnie, H. J. (1965). Efforts of learning experiment on aesthetic preference and drawing. Unpublished manuscript, Stanford University.
- McWhinnie, H. & Lascarides-Morgan, V. (1971). A correlational study of perceptual behavior and perceptual learning in four and five year old children. Scientia Paedagogica Experimentalis. Athens, GA: J. T. Hunt.
- McWhinnie, H. J. (1992). Early childhood art education. In C. Seefeldt (Ed.). Research in early childhood education (chapter 2). Second edition in press. New York: Teachers College Press.
- Mills, J. C. (1975). Teaching of reading and arts education; An approach to reading development. Nashville, TN: Communications/Reading Conference. (ERIC Document Reproduction Service No. ED 119 148)

- Montgomery County Public Schools. (1986). Final report of the superintendent's ad hoc committee on criterion-referenced testing. Rockville, MD: Author.
- Montgomery County Public Schools. (1987). A celebration of citizenship: Activities for the elementary grades. Rockville, MD: Author.
- Montgomery County Public Schools. (1988). MCPS Program of Studies: Science grades K - 6. Rockville, MD: Author.
- Montgomery County Public Schools. (1988). MCPS Program of Studies: Science grades K - 6. Rockville, MD: Author.
- Olson, L. (1988). Children 'flourish' here: 8 teachers and a theory changed a school world. Education Week, 7(1), 18-19.
- Piaget, J. & Inhelder, B. (1969). The psychology of the child. New York: Basic Books, Inc.
- Piaget, J. (1973). The psychology of intelligence. (M. Piercy & D. E. Berlyne, Trans.). New Jersey: Littlefield, Adams & Co. (Original work published 1947).
- Piaget, J. (1977). The development of thought: Equilibration of cognitive structures. New York: Viking Press.
- Posner, M. I. (1989). Foundations of cognitive science. Cambridge: M.I.T. Press.
- Pratton, J., & Hales, L. (1986). The effects of active participation on student learning. The Journal of Educational Research, 79(4), 210-215.
- Rigney, J. W., & Lutz, K. A. (1976). Effect of graphic analogies of concepts in chemistry on learning and attitude. Journal of Educational Psychology, 68, 305-311.
- Royer, J. M., & Cable, G. W. (1976). Illustrations, analogies, and facilitative transfer in prose learning. Journal of Educational Psychology, 68, 205-209.
- Russell, I. & Waugaman, B. (1952). A study of the effect of workbook copy experiences on the creative concepts

- of children. Research Bulletin, the Eastern Arts Association, 3(1), 5-11.
- Salome, R. A. (1965). The effects of perceptual training upon the two-dimensional drawings of children. Studies in Art Education, 7(1), 18-33.
- Saunders, R. J. (1972). But what's wrong with coloring books? Education Digest, 38(1), 58-59.
- Sternberg, R. (1985). Beyond IQ: A triarchic theory of human intelligence. Cambridge, MA: Cambridge University Press.
- Sternberg, R. (1988). The triarchic mind: A new theory of human intelligence. U.S.A.: Penguin Press.
- Sternberg, R. (1989). The tyranny of testing. Learning, 17(7), 60-62.
- Thorndike, E. (1913). The measurement of achievement in drawing. Teachers College Record, 14(5).
- Vasu, E. S., & Howe, A. C. (1989). The effect of visual and verbal modes of presentation on children's retention of images and words. Journal of Research in Science Teaching, 26(5), 401-407.
- Walker, S. & Others (1982). Title I children's program: Learning to read through the arts. Final evaluation report, 1981-82. Brooklyn, NY: New York City Board of Education, Office of Educational Evaluation. (ERIC Document Reproduction Service No. ED 236 280)
- Weinberg, F. (1983). An experimental investigation of the interaction between sensory modality preference and mode of presentation in the instruction of arithmetic concepts to third grade underachievers (Doctoral dissertation, St. John's University, 1983). Dissertation Abstracts International, 44, 1740A.
- Wheeler, R. (1980). An alternative to failure: Teaching reading according to students' perceptual strengths. Kappa Delta Pi Record, 17(2), 59-63.
- Wheeler, R. (1983). An investigation of the degree of academic achievement evidenced when second grade learning disabled students' perceptual preferences are matched and mismatched with complementary sensory approaches to beginning reading instruction (Doctoral

dissertation, St. John's University, 1983).
Dissertation Abstracts International, 44, 2039A.

Winslow, L. L. (1939). The integrated school art program.
New York: McGraw-Hill.

Wolf, T. and D. (1985). The arts as reinforcers of basic
academic skills. Education Digest, 51, 44-45.