THE EFFECTS OF A THINKING SKILLS CURRICULUM ON LEARNING ABILITY AND ACHIEVEMENT OF SECOND GRADE STUDENTS

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CHAPTER I

THE RESEARCH PROBLEM

Introduction

Many conventional theories of intelligence view man's abilities as irrevocably fixed and rendered unchangeable by biological endowment (Jensen, 1969, Eysenck, 1981). Such theories support the hereditarian point of view which defines intelligence as an inherited trait and a static entity. The opposite position is that taken by environmentalists who support the theory that intellectual functioning is determined by one's environment (Eysenck (Kamin), 1981, Watson, 1928). A blend of these two extreme points of view is that of the interactionist who theorizes that contributions from both heredity and environment create intelligence (Feuerstein, 1979, Haywood, 1982). This approach views cognitive functioning as receptive to change within the wide range afforded by physiological factors.

Influence of the hereditarian theory of intelligence is evident throughout current educational practices. The majority of educational programs provide content or subject-matter based curricula with little or no emphasis placed

on development of the thinking skills needed to collect, use and store information. These thinking skills are assumed by many to be inherited. One is either endowed with effective thought processes at birth or not, and there is little that can be done to rectify the handicap. This position seems insensitive to the very changes that education is trying to produce.

The Journal of Educational Psychology in 1921 offered fourteen psychologists' and educators' views on the nature of intelligence. Among them was S. S. Colvin who said that a person "possesses intelligence insofar as he has learned or can learn to adjust himself to his environment" (cited from Sternberg, 1982). Colvin's 1921 definition of intelligence is similar to one that is presently emerging. Research psychologists in the field of cognitive processing, or information processing, seem to be reaching at least a partial consensus on a definition that views intelligence as a set of thinking and learning skills that facilitate an individual's successful adaptation to his/her environment (Arbitman-Smith, 1982; Clarke & Clarke, 1976; Feuerstein, 1979; Haywood, 1981; Hobbs and Robinson, 1982; Luria, 1971; Sternberg, 1981; Vygotsky, 1978). This view holds significant implications for educational procedures due to the contingency that thinking skills are teachable and intelligence is modifiable.

Reuven Feuerstein (1980), an Israeli psychologist, has had successful experiences in promoting effective

changes in thinking and problem solving with retarded and low performing adolescents and young adults. He devised a process oriented curriculum (Instrumental Enrichment) and teaching techniques with the intended purpose of developing key cognitive processes. The basis for Feuerstein's curriculum is his theory of cognitive modifiability in which he identifies cognitive deficiencies that impede learning. Instrumental Enrichment provides for the remediation of these deficiencies.

The purpose of this paper is to review Feuerstein's theory of cognitive modifiability and compare it to conventional theories of intelligence and currently accepted educational practices. The experimental portion of the study will investigate the effects of a Thinking Skills Curriculum, an adaptation of Feuerstein's Instrumental Enrichment Curriculum, on the academic achievement and educational ability of second grade students.

Significance of the Problem

Theoretical Importance

Currently accepted theories of intelligence assume that one is unable to make a substantial change in the thinking processes. The predominant assumed restrictions to change in cognitive structure are age, etiology, and severity of retardation. Challenges to these assumed restrictions will be presented in the following discussion.

Age. For the past twenty years, educators have spent majority of educational funds on early childhood and elementary education programs. Seventy-five percent of the two and one-third billion dollars appropriated for 1978-1979 Title I programs went to children in grades one through six, seven percent to preschool programs and eighteen percent to grades seven through twelve (Hobbs & Robinson, 1982). These expenditures were prompted by the vast amount of research supporting the critical-period-of-development theory, the theory that a person's behavioral characteristics and thinking processes are formed during the early years and that experiences during this critical time form a personality structure that is essentially unchangeable past a certain age. Studies that led to this position include those done by Hunt (1961) and Bloom (1964). The consensus of this point of view is well stated by Bettye Caldwell (1973).

> Considerable research evidence has converged to suggest that the first three years of a child's life represent the most important period for primary cognitive, social, and emotional development and it is during this period that the environment will exert maximum effect for either facilitation or inhibition of the child's genetic potential for development (p. 24).

Feuerstein's theory of cognitive modifiability challenges this age restriction. In studies involving adolescents and young adults, he reports significant increases in intelligence and academic test scores follow-

ing two years of exposure to his Instrumental Enrichment Curriculum. Feuerstein postulates that human intellect can be modified across the entire age span. "Except in the most severe instances of genetic and organic impairment, the human organism is open to modifiability at all ages and stages of development" (Feuerstein, 1979, p. 9). The Clarkes (Clarke & Clarke, 1976, p. 72) support this conclusion: "The worse the early social history, the better the prognosis for change," and

> what one does for a child at any age, provided it is maintained, plays a part in shaping his development within the limits imposed by genetic and constitutional factors (p. 273).

Etiology. Many genetic or organic disorders produced by chromosomal or metabolic deviations are believed to unavoidably and irreversibly affect cognitive functioning. The Down's syndrome child is an example of one who is generally accepted as having a low IQ ceiling. The general slowness in behavior and development produces a restricted environmental input. The situation is further complicated by public opinion and "well meaning" pediatricians and other professionals who warn the parents that there is no chance for proper development and that the condition is irreversible (Feuerstein, 1980).

Feuerstein's work with Down's syndrome children is providing evidence to the contrary. In a research project now in progress at the Hassa-WIZO-Canada Research Institute in Jerusalem, meaningful changes are taking place in the course of development of Down's syndrome children (Feuerstein, 1982). The intent of the above project is to provide answers to such questions as: (1) to what extent genetic and organic conditions produce barriers that affect the threshold of stimulation and (2) by what means can these barriers be bypassed, or penetrated, and thereby overcome. Early indications support the theory that cognitive modifiability is available, within limits, to individuals despite the etiology of retardation.

Feuerstein (1980, pp. 55-56) reports two earlier successful case studies with Down's syndrome children and documents successes with other genetic or organic disorders that have been considered to relate directly to cognitive dysfunction.

Severity of Retardation. The label which educators and related professionals ascribe to those individuals scoring lower than fifty or sixty on a conventional measure of intelligence is descriptive of educational expectations. The prognosis for these individuals is "trainable" in menial tasks, not educable. The severity of such cognitive deficiencies may stem from poverty, cultural deprivation,

and emotional disturbances, but despite the etiology, the label which results from IQ testing is the same.

In a report on remediation of cognitive deficiencies with adolescents in Israel, Feuerstein and Rand (1975) describe the nature of observed cognitive dysfunctions as peripheral rather than central. In many cases, the low functioning individual has adequate central intellective capacities, but inadequate peripheral skills for taking in information (input) and communicating thoughts (output). The deficiency reflects inadequate work habits, insufficient learning sets, and inadequate communication skills rather than a lack of central intelligence.

The successful remediation of cognitive deficiencies in individuals labeled "trainable" is evidenced in Feuerstein's work (1979, 1980). Through training involving Instrumental Enrichment, strategies oriented toward making higher mental processes an active part of the retarded performer's repertoire, modification of cognitive processing occurred and successful adaptation to the environment was achieved. Feuerstein et al. (1980), do not report massive increases in intellectual functioning, except in isolated cases, but do indicate increases which allow these individuals to live productive, self-supporting lives.

In summary, the three major assumed restrictions to cognitive modifiability are age, etiology, and severity of retardation. The theoretical implications of Feuerstein's

theory and his research challenge currently accepted theories regarding these issues. Feuerstein postulates that cognitive modifiability is available to individuals within limits, despite age, etiology, or severity of retardation.

Practical Importance

Mandatory education laws of the past few decades have brought people into the educational systems who are ill equipped to handle school. The influx of these individuals into the public schools and the increasing amount of school failure led to the development of a number of learner classifications and curriculum strategies aimed at promoting better school performance. Assessment for classification purposes is typically based on the results of a conventional IQ test. Regarding our current trend of labeling, Feuerstein (1979) states:

> Conventional psychometric tests are concerned exclusively with cataloguing the respondent's current knowledge and measuring his manifest level of functioning. They operate on the basis of the tautological platitude, "If a then a." If the retarded performing child functions on a low level in school, the very behaviors that ensure poor school performance are then measured psychometrically and the child emerges from the testing with a low IQ, i.e., a low estimated intelligence level. The child, of course, performs poorly on the school-oriented intelligence test because he has not developed the requisite classroom skills; nevertheless, he is said to be deficient in these areas <u>because</u> of low intelligence (p. 11-12).

Feuerstein's "catch 22" assessment of conventional labeling procedures points to the lack of assessing specific

cognitive deficiencies and planning appropriate strategies for their remediation.

The lack of appropriate assessment and intervention strategies is a serious concern. An additional concern is the damaging effects of labeling on an individual's life. (See Mercer, 1975; Feuerstein, 1973; Haywood et al.; 1975; Goldstein et al., 1975). Goldstein et al. (1975, p. 24) noted that although there is little research on the relationship between labeling and self-image, "It is widely accepted that negative labels create a unique atmosphere around children, complicating their lives in significant though unmeasured ways".

The benefit of special education programs as well as labeling procedures are in question. Many studies on the effectiveness of special education classes show that remedial environments have no significant advantage, academically or socially, over regular classrooms (Johnson, 1962). The "watered down" versions of special class curriculum such as those for individuals labeled mentally retarded assume a static cognitive structure which precludes the mastery of higher learning skills (Begab, 1980). Regarding the practice of matching the instructional modality with the learner's preferred learning modality, i.e., auditory, visual, or tactile/kinesthetic, the overwhelming majority of research in the past ten years has indicated that this approach does not improve reading performance (Gross, 1981). All individuals have a favored

sensory channel or learning modality, but merely improving the non-favored channels does not improve learning (Hoffman, 1982). The following is a quote from Newcomer et al. (1975):

> We cannot help but conclude that psycholinguistic training based on the Kirk-Osgood model is not successful because it does not help children to increase their ability to speak or understand language, nor does it aid them in academic skills such as reading, writing, or spelling, ...the wrong skills are being remediated (p. 147).

Arter and Jenkins (1979) conclude:

> ...it is imperative to call for a moratorium on advocacy of Differential Diagnosis-Prescriptive Teaching (DD-PT), on classification and placement of children according to differential ability tests, on the purchase of instructional materials and programs which claim to improve these abilities, and on coursework designed to train DD-PT teachers (p. 551).

Feuerstein's Instrumental Enrichment (IE) curriculum appears an appropriate alternative to current educational practices which have failed to produce the desired results. The goal of IE is to modify the individual by assistance in the acquisition of thinking skills, modifying cognitive deficiencies, and providing experiences in learning how to learn. The aim is to modify the individual rather than modify the individual's educational environment through special class placement, lowering expectations, and matching curriculum to the individual's preferred learning modality. Instrumental Enrichment was designed for group implementation, preferably heterogeneous groups, and requires students to use several sensory or motor systems to gather and present information.

Although IE was specifically developed for use with adolescents, Feuerstein (1979, p 69) states that "the underlying principles of the program are applicable for all ages". The program, as well as the entire theory, lends itself not only to remediation but to preventive measures. Replacing current educational practices, such as those based on the labeling system and the psycholinguistic model, with assessment and instructional procedures designed to improve cognitive functioning is an alternative.

Problem Statement

The problem examined in this study is: How is the academic achievement and educational ability of second grade students affected by the inclusion of a thinking skills curriculum into the regular class program? An experimental group of second grade students who received the treatment and a control group of second graders who did not receive the treatment participated in the study. An achievement test and ability tests were administered at the conclusion of the study and analyzed for significant differences between the groups.

For the purposes of this study, a pre-test was used to determine ability levels of the subjects to facilitate a stratified random sampling of subjects from varying ability levels. Achievement was defined as subtest scores obtained on the SRA Level C Achievement Series, 1978 edition. Ability was defined as subtest scores on the

SRA Educational Ability Series Test (EAS), the Organization of Dots Test, and the Raven's Matrices Test.

Definition of Terms

Cognitive modifiability: the ability to change the processes one uses to think.

Cognitive functions: a set of processes of logical thought.

Mediated learning experience: an experience whereby a mediating agent, usually a parent, sibling or caretaker, selects and organizes environmental stimuli to facilitate successful environmental encounters and the acquisition of appropriate operational structures and learning sets.

Cognitive deficiencies: those deficiencies in the functions that underlie internalized, representational, and operational thought.

Input phase: that phase of the mental act which involves the quantity of data gathered for elaboration purposes.

Elaboration phase: that phase of the mental act which involves making efficient use of available data for problem solving purposes.

Output phase: that phase of the mental act which involves factors that lead to adequate communication of the outcome of elaborative processes.

Instrumental Enrichment: a set of instruments designed to remediate cognitive deficiencies through a series of tasks, exercises, and discussions. The instruments were designed over a period of twenty-five years by Reuven Feuerstein and his associates for use in the regular classroom.

Thinking Skills Curriculum: an adaptation of the first four Instrumental Enrichment units, revised for the purpose of implementation with second grade students. The four units; Organization of Dots, Comparing, Perceptual Analysis, and Spatial Orientation are designed to assist in the remediation of cognitive deficiencies through a series of tasks, exercises, and discussions. The instruments were created by Mary Rineer and Mary Comfort under the direction of Dr. M. Joe Keatley.

Theoretical Framework

According to Feuerstein, each person is an open system who is capable of change and modification through interaction with the environment. Cognitive Modifiability is his term for this self-regulating and responsive function of human intelligence. Except for the more severe levels of mental retardation from physiological etiology, retarded performance can be attributed to cultural deprivation. In Feuerstein's theory, this deprivation results from the failure of the child's significant others to deliberately select, focus, and interpret learning experiences. If the

child has not developed problem solving skills through these mediated learning experiences, s/he is less able to profit from and adjust to direct exposure to events in the environment. Consequently, s/he becomes passive, dependent and episodic in learning and interactions with the environment.

Unlike conventional psychological assessment which is designed to document deficit functioning, Feuerstein's Learning Potential Assessment Device (LPAD) seeks to uncover latent cognitive potential and identify cognitive deficits which interfere with successful environmental interactions. Moreover, he has developed Instrumental Enrichment (IE) which is a planned strategy for remediation of the deficit problem solving skills identified by the LPAD. Rather than teaching a specific content, IE develops basic thinking skills that enable the individual to perceive, process, and communicate information. Therefore, Feuerstein's LPAD and IE are designed to elucidate and actualize cognitive potential in retarded performers.

The Thinking Skills Curriculum, a product of Feuerstein's theory and an adaptation of Instrumental Enrichment, is a strategy for correcting deficient cognitive functions and for <u>learning how to learn</u>. The curriculum uses content-free exercises that involve a wide range of thought processes and mental operations. The exercises are not a substitution for, but a supplement to the subject-matter oriented curriculum of the regular class program.

CHAPTER II

REVIEW OF LITERATURE

Introduction

Feuerstein is often referred to as a Piagetian learning theorist. This classification seems inappropriate. Feuerstein studied with Piaget, as well as Andre Rey, in Geneva, and influences from both are evidenced in his work. There are differences between the Feuersteinian and Piagetian theories and it is advantageous to review Piaget's theory in an attempt to compare the two ideologies.

This chapter will review the theories of Feuerstein, Piaget, Vygotsky, Luria (to some extent), and Meichenbaum's Self-Instruction Method for comparative purposes and educational implications. A review of research involving Feuerstein's Instrumental Enrichment will follow, and the chapter will conclude with a rationale for the proposed research.

Feuerstein

Over a period of twenty-eight years, Reuven Feuerstein has developed a theoretical model that identifies and describes cognitive functions, an assessment device

(Learning Potential Assessment Device) for assessing cognitive functions, and a set of instructional procedures for remediating cognitive deficiencies. Feuerstein presents the concept of cognitive functions not as components of ability in the classical sense, but as process variables that are compounds of native ability, attitudes, work habits, learning history, motives, and strategies (Haywood, 1977). Feuerstein's theory of development and learning is process oriented; i.e., cognitive processes develop through interactions between individuals and their social and physical environments. Positive circumstances can promote the growth of cognitive functions, and negative circumstances (or the absence of positive ones) can inhibit the development of effective cognitive functions (Haywood and Wachs, 1981). Feuerstein (1980) conceives the development of cognitive structure as a product of two methods of interaction between the organism and the environment: "mediated learning experience" and direct exposure to sources.

The concept of mediated learning is an important difference between the developmental psychology of Piaget (1952) and that of Feuerstein. Feuerstein has extended Piaget's learning theory formula, stimulus-organism-response (S-O-R) to stimulus-human-organism-response (S-H-O-R), the H representing the human mediator. A central and critical role is assigned to the mediator who,

> by interposing himself between the child and external sources of stimulation, mediates the world to him by framing, selecting, focusing, and feeding back environmental experience in such a way as to create appropriate learning sets (Feuerstein, 1970, p. 358-359).

The most important aspect of mediated learning is its intentional nature; the individual is made aware that s/he is learning something of value in the mediator-mediatee interaction (Haywood et al., 1975).

Direct exposure learning refers to spontaneous, chance encounters between the organism and the environment and results in some modification of the existing cognitive schemes through a process such as assimilation and accomodation (Piaget, 1967). The development of information strategies is a combination of mediated learning and direct exposure learning. However, adequate cognitive development cannot take place without the active participation of mediators to interpret the environment (Feuerstein, 1980). Feuerstein describes the functions of a mediator as:

(1) Focusing the mediatee's attention thereby assisting the individual in becoming a more efficient "looker";

(2) Assisting in organizing the environment through the provision of labels for objects, events, and people;

(3) Assisting the mediatee in understanding temporal and spatial concepts in order to organize him/herself in time and space;

(4) Providing assistance in establishing relationships between objects, people, situations, etc; and

(5) Assisting in the development of comparative behavior for the purpose of categorizing environmental stimuli.

In a 1980 publication, Feuerstein described two major characteristics of mediation. He has since expanded the list to five. The following characteristics of mediation were presented by Feuerstein in a discussion of cognitive modifiability at the University of California at Riverside (Feuerstein, 1982).

(1) Intentionality: The mediator shares the intention of the learning experience with the individual. During a pure mediated learning experience a partnership forms between the parent (mediator) and child (mediatee) because they are working toward a common goal.

(2) Transcendence: The mediator transcends the immediate needs or concerns of the recipient of mediation by venturing beyond the concreteness of the here and now. For example, a mother feeds her child to fulfill the basic need of survival, but when she gives instruction on table manners or cultural eating habits, she transcends the basic reason for eating.

(3) Mediation of meaning: The mediator assists the recipient in ascribing specific meaning to specific stimuli at specific times.

(4) Mediation of a feeling of confidence: Instilling a feeling of confidence in the mediatee is not accomplished by merely telling that person that s/he is competent.

Providing tasks which are within the capabilities of the individual but pose a challenge facilitates cognitive growth and a feeling of confidence.

(5) Regulation of behavior: Regulation of behavior involves delaying an action or response until all necessary information is collected and evaluated. If a response is purely reflexive, it is considered impulsive. The mediator assists in developing an internal regulatory system by imposing a conceptual tempo on the mediatee. This is achieved by questioning such as "why don't you look at the size, color, number, orientation, etc. before responding or beginning to work?". Encourage the person to avoid acting on some kind of gestalt modality and analyze the task and all possible alternatives before acting.

Feuerstein describes the mediated learining experience as a complex and uniquely human function which encompasses the many dimensions listed above.

Mediating the learning of children is strongly influenced by a culturally determined need to transmit cultural attributes across generations. Cultural and subcultural groups develop culture-characteristic modalities of interpreting reality, of formulating rules, of problem solving, of perceiving everyday events (Vygotsky, 1978). Through the process of "intergenerational culture transfer," the culture-specific modes of thought are conveyed from each generation to the next with the adults performing the significant role of "mediating" the experiences and

environmental encounters of children (Arbitman-Smith et al., 1982).

Inadequate mediated learning occurs when a generation fails to transmit the culture's cognitive norms to the succeeding generation. This occurrence is the result of a variety of causes such as: the transfer of a group from one cultural environment to another which results in the denial or discarding of specific cultural characteristics, poverty and struggle to fulfill basic needs affording little time for mediation, emotional disturbances within the parents, philosophies which advocate the right of the child to grow up "free" of parental influence, and barriers to mediation within the child such as autism, hyper- or hypo-activity.

Dr. A. Graham Down, Executive Director for the Council of Basic Education (Address presented during Tulsa Public Schools Administrator's Meeting, August 20, 1982) pointed to the fact that parents are currently spending less time with their children than they have in the past. Dr. Down offered the following statistics for consideration. During the 1950's a father living in the United States typically spent 2-1/2 hours a day with his children. Today, the average father-child interaction is 14 minutes each day. Dr. Down did not offer verification for the following, but reported that only 13% of American families are intact, both mother and father present in the home, while 87% are single parent families.

The significant role of the parent as a mediator is in jeopardy in this country partially due to the lack of time parents are spending with their children. Often the time that is spent in parent-child togetherness is not quality time, but devoted to watching television, movies, or some other form of entertainment. No verbal interaction, mediation, or transmission of cultural characteristics transpires. Single parents are frequently involved with work, social lives outside the family unit, or their own frustrations to the exclusion of quality parent-child interactions. The cultural void created by the lack of mediation precludes the development of adequate cognitive functioning in the child (Feuerstein, 1980).

Deficient cognitive functions are viewed as the result of inadequate mediated learning experience rather than inadequate cognitive development (Feuerstein, 1980). Feuerstein's crucial point regarding minimal or lack of mediated learning experience in the normal course of development is that this does not preclude the individual from achieving adequate cognitive development provided effective mediation takes place at some point in that person's life.

The goal of formal (school) mediated learning experiences such as that provided by Feuerstein's Instrumental Enrichment is to restore a normal pattern of cognitive development. This involves affecting change in cognitive structure. It encompasses providing individuals with cognitive prerequisites that enable them to derive maximum benefit

from exposure to numerous and varied stimuli. The aim of mediated learning experience is to assist the individual in adapting to a normal environment rather than adapting the environment to meet the specific needs of the individual (Feuerstein, 1980).

Deficient Cognitive Functions

Feuerstein (1979) has identified a set of deficient cognitive functions which relate to and help identify the prerequisites of thinking. Feuerstein (1980) does not present the set as definitive or exhaustive, recognizing that the listed functions may require additions and refinements. The deficient functions should not be considered as elements of thinking that are totally missing; rather they are conceived as weak components of thought. Humans differ as to the prerequisites used for thinking because of varying cognitive styles, but the basic cognitive functions which Feuerstein has identified are universal. They are transferable across cultures despite cultural differences (Feuerstein, 1982).

Deficient cognitive functions refer to deficiencies in those functions that underlie internalized, representational, and operational thought. Identifying deficient functions provides a means of understanding an individual's low level of performance. Frequently a child's failure to perform a given operation is attributed to a lack of knowledge of the principle involved or to a low intelligence that precludes

understanding the principles. Realistically the deficiency may exist in the underlying functions rather than the operational level or specific content of the person's thought processes. For example, systematic and precise data gathering, the ability to deal with two or more sources of information simultaneously, and spontaneously comparing cues are encompassed in the operation of classification. Therefore, failure to correctly classify objects or events may result from deficiencies in the underlying functions that are presupposed in the operation. A failure to locate the source of a child's errors will seriously affect the efficacy of any corrective action (Feuerstein, 1980).

The three phases of the mental act (input, elaboration, output) are not isolated dimensions. The interactions occurring between and among the phases affect one another to varying degrees. They are not in a linear relationship with each other but intricately overlap to produce the mental act. The following are the cognitive deficiencies identified in each phase (Feuerstein, 1979, 1980, 1982). Corresponding cognitive functions for each deficiency are provided in Appendix A.

Input

(1) Blurred and sweeping perception

(2) Impulsivity--unplanned, unsystematic exploratory behavior

(3) Lack of receptive verbal skills

(4) Lack of, or impaired, spatial orientation

(5) Lack of, or impaired, temporal orientation

(6) Lack of, or impaired, conservation consistancies

(7) Lack of, or impaired need for, precision and accurcy

(8) Lack of, or impaired use of, two or more sources of information.

Elaboration

(1) Lack of experiencing the existence of a problem

(2) Inability to mentally define a problem

(3) Inability to select relevant cues in defining a problem

(4) Lack of, or impaired spontaneous comparative behavior

(5) Narrowness of mental field

(6) Lack of, or impaired need for, summative behavior

(7) Difficulties in projecting virtual relationships

(8) Lack of, or impaired need for, pursuing logical evidence

(9) Lack of, or impaired, interiorization

(10) Lack of, or impaired, planning behavior

Output

(1) Egocentric communicational modalities (thinks the other can read his/her mind)

(2) Difficulties in projecting virtual relationships

(3) Blocking (inability to think caused by perceived failure)

(4) Trial and error responses (random non-goal oriented responses)

(5) Lack of verbal tools for communicating adequately elaborated responses

(6) Lack of a need for precision and accuracy in communicating

(7) Deficiency of visual transport

(8) Impulsive, acting out behavior

An episodic grasp of reality is a deficiency which is an umbrella concept that determines and is determined by many of the deficiencies previously listed. It refers to experiencing each object or event in a global sensorial modality without any attempt to relate or link it to previous or anticipated experiences in space or time. It reflects a passive attitude because no attempt is made to organize, order, summate, or compare. To grasp an event episodically reduces it to vague and undefined dimensions and limits experiencing to a concrete sensori-motor level. Frequently the behavior attributed to the retarded performer is an expression of an episodic grasp of reality and can be observed in the failure to actively go beyond the mere registration of incoming stimuli and information (Feuerstein, 1979).

The cognitive deficiencies listed above are conceived as the result of the absence of, or inadequacy of, mediated learning experience and these deficiencies are responsible

for retarded cognitive performance (Feuerstein, 1980). The retarded performer who is encumbered by numerous deficiencies lacks the thinking skills needed to organize, create order, and make sense of the environment. A failure to interact with the environment and go beyond the mere registration of stimuli is typical of an individual who has been deprived of mediated learning. The individual is confined to a passive and limited sensorial perception of the world.

Piaget

Jean Piaget's concepts concerning the development of child thought and intellectual ability gained popularity in the United States in the late 1960's and early 1970's. In current writings concerning child development, Piaget is one of the most quoted authorities on the evolvement of cognitive functions (Wadsworth, 1979). His influence can be seen in the educational practices of early childhood, kindergarten, and elementary programs.

Piaget's theory is based on the conception that the principles of cognitive and biological development are the same (Piaget, 1952). He views mental development as a form of biological or maturational activity and envisions intellectual and biological development as inseparable and joint contributors to a human's organization and adaptation to the environment. Piaget explains the process of mental development through the concepts of schemata, assimilation,

accommodation, and equilibrium (Skahkian, 1970). Piaget conceptualizes cognitive development as a process of these four parameters at all age levels from birth to adulthood.

According to Piaget, inherited neurological structures influence development within certain broad constraints. Development is a result of the interaction between inherited neurological capabilities and experience, and interaction with the environment (Hunt and Sullivan, 1974).

Piaget describes four developmental stages: sensory-motor, 0 - 2 years; preoperational, 2 - 7 years; concrete operational, 7 - 11 years; and formal operational, after 11 or 12 years. He postulates that humans proceed through the same stages in the same way, although at varying rates. Due to variances in neurological endowment, maturation rate, degrees of social interaction and experience, all persons do not proceed through Piaget's identified developmental stages during the same chronological stages (Wadsworth, 1979).

Feuerstein (1979) points to the fact that Piaget's stages of development are a fixed, immutable succession of stages. No stage of development can precede an earlier one. No acceleration of the development of a later stage is possible prior to an earlier one or before reaching certain biological conditions that allow the next stage to appear. A direct exposure method of learning which is

biologically based, as is Piaget's, fails to explain the varying levels of cognitive development and the fact that some people in our world do not attain the higher levels of functioning described by Piaget as formal operations. If formal operations were the result of an interaction between maturational processes and direct exposure to stimuli, a greater number of these behaviors would be evidenced in the normal population (Feuerstein, 1979).

Piaget describes intellectual behavior at any age as evolving directly from prior levels of behavior with its roots in the early sensori-motor state. Thus "early mental development determines the entire course of psychological evolution" (Wadsworth, 1979, p. 38). Feuerstein's (1979) work with the remediation of cognitive deficiencies at the adolescent stage, as well as the work of Clarke and Clarke (1976), contradicts this critical-period-of-development concept. Feuerstein and the Clarkes have reported success with the development of effective cognitive functions and the remediation of cognitive deficiencies in adolescents and young adults.

Piaget sees social interaction as one of the factors that facilitate cognitive development. Liberation from egocentrism occurs predominately through interaction with peers (Piaget, 1952). Egocentrism is described as a cognitive state in which the individual sees the world only from

his/her perspective and is unaware that other points of view exist. At the concrete operational stage, the individual is no longer egocentric, language in its egocentric state disappears and becomes social and communicative. However, egocentrism reoccurs at varying phases of development when new cognitive structures are acquired. Piaget views the reappearance of egocentrism as a negative byproduct of cognitive development which distorts the initial period of making use of newly formed schemata (Gerber, 1977).

Thus Piaget theorizes that intellectual structures are not innate but develop through direct exposure to stimuli, are constantly changing and growing and this growth is governed by maturational stages which determine the "readiness" of the individual to make cognitive adjustments.

The primary differences between the Feuersteinian and Piagetian theories appear to be: Mediated Learining (S-H-O-R) as opposed to Direct Exposure Learning (S-O-R) and numerous modifiable cognitive elements of development as opposed to four fixed, immutable stages of development. Feuerstein's mediated learning concept assigns a critical role to a mediator who provides assistance in creating appropriate learning sets. Piaget's direct exposure learning concept refers to spontaneous, chance encounters between the individual and the environment which result in modification of existing cognitive structures. The difference between these two concepts is the human element or mediator

which Feuerstein has added as a critical and central parameter in the process of learning. Through mediational experiences the individual is assisted in developing cognitive functions which underlie internalized, representational and operational thought. Development of the numerous cognitive functions does not necessarily occur in a linear progression. In contrast, Piaget postulates four stages of cognitive development which are immutable. No stages of development can precede an earlier one and all stages are rooted in the early sensori-motor stage.

Vygotsky

Lev. S. Vygotsky's work supports Feuerstein's theory of cognitive modifiability and emphasizes the relationship between thought and language which is stressed through the verbal interaction involved in mediated learning. Vygotsky viewed language as man's most powerful tool in understanding and organizing the environment.

> The most significant moment in the course of intellectual development, which gives birth to purely human forms of practical and abstract intelligence, occurs when speech and practical activity, two previously completely independent lines of development, converge (Vygotsky, 1978, p. 24).

Vygotsky observed that speech not only accompanies a child's activity but plays an important role in carrying out an action. Speech is such a vital part of a child's

activity when attempting to accomplish a task, that if not permitted to speak, the child may "freeze" and be unable to complete the task. Vygotsky noted that not only does speech facilitate the effective manipulation of objects but often controls the child's own behavior (Vygotsky, 1962). A young child who cannot solve a problem seeks help from an adult by verbally describing the situation. Later this socialized speech (appealing to the adult for help) is turned inward and the child appeals to him/herself, generating alternative possibilities for solutions.

Vygotsky views the relation between speech and action as a dynamic one which accompanies actions in early stages and gradually comes to precede action. The following analogy is offered by Vygotsky (1962). Young children name their drawings after they are completed; they need to see them before deciding what they are. At an older age, the child names the drawing when it is finished and as the child gets older s/he decides in advance what to draw. At this stage speech guides action and becomes a vital component in planning a course of action.

Young children use speech primarily for labeling which allows the identification of a particular object in the visual field. Visual perception is integral; all the elements are perceived simultaneously. Speech is a sequential process, each element is labeled separately and then

connected for sentence structure, making speech an essentially analytical function. In the context of this concept, Feuerstein (1979) has reported success with individuals labeled visual-perceptually impaired by requiring a verbal description or analysis of a design before the individual attempts to draw it. This procedure causes the person to focus attention on the parts of the drawing which are visually perceived simultaneously and analyze these parts sequentially using language. This activity sharpens the individual's focusing on each part of the design to be drawn and facilitates the execution of a more accurate reproduction of the original drawing. The use of language breaks up the fusion of elements in the visual field and assists the individual in regulating his/her behavior (in this instance motoric behavior to reproduce a design).

Language assists the child in mastering movements, increasing attention, and perceiving elements of the "whole" visual field. "In addition to reorganizing the visual-spatial field, the child, with the help of speech, creates a time field that is just as perceptible and real to him as the visual one" (Vygotsky, 1978, p. 36). Language assists the child in perceiving present changes from the point of view of past experience and act according to future perspectives. With the help of speech the time field can extend backward and forward and the spatial

field can be perceived as "parts" of the "whole". Through language the child escapes the bonds of the concrete "here and now" and can engage in symbolic representations which expedite purposeful activity.

Vygotsky, as does Feuerstein, emphasized the importance of studying the "processes" of development rather than the "products". His research did not involve the typical offering to the subject a stimulus to which he expected a response, thereby obtaining only the product of an individual's development. He used what he called the "functional method of double stimulation" (Vygotsky, 1962). He presented the subject with a task beyond his/her capabilities and provided neutral stimuli which could be used as tools for solving the problem. In observing the manner in which the neutral stimuli were drawn into the problem solving process, he was able to discover the inner processes used by the subject.

Vygotsky proposed a distinction between two types of learning: the general relationship which occurs in non-structured situations and the specific relationship that occurs in school activities. During the pre-school years, Vygotsky (1978) argues that play leads development. Through play the child stretches the conceptual capabilities through imagination and by engaging in adult-type activities.

"In play a child is always above his average age, above his daily behavior as though he were a head taller than himself" (Vygotsky, 1978, p. 129).

School learning is different in that it is concerned with the assimilation of the fundamentals of scientific knowledge. Vygotsky also views school instruction and learning as leading development. Both play and school learning involve skills and knowledge that will come to be internalized in the future. Both play and school instruction create what Vygotsky (1978, p. 85) calls the "zone of proximal development". The boundaries of the zone of proximal development include the base level, the actual developmental level characterized by the ability to solve problems independently and the ceiling level, the potential developmental level which is characterized by the ability to solve problems in collaboration with an adult or more advanced peer.

Feuerstein's Learning Potential Assessment Device (LPAD) (1979) is an assessment procedure which measures what Vygotsky called the zone of proximal development. In the test-teach-test procedure both the base and ceiling levels of development are measured. Conventional psychometric measures assess only the base level of development, those skills and abilities already mastered by the child, not what s/he is capable of mastering.

Vygotsky views learning as a social process stressing the importance of lingual-interaction in teaching and

facilitating cognitive growth. He criticizes educational practices that involve the dispensation of new concepts through oral lectures which allow for no discussion or interaction. He is also critical of educational programs which present concepts that lag behind the student's present cognitive processes instead of focusing on the emerging capabilities.

It would appear that Vygotsky's conception of intelligence is the capacity to benefit from instruction, that learning is the prelude to advancing developmentally, and that it is possible to precede to higher developmental levels through appropriate experiences.

Vygotsky disagrees with several aspects of Piaget's theory; the treatment of speech in cognitive development, modalities of experimentation, and the interaction between biological and mental development. Piaget did not attribute as important a role to speech as Vygotsky did in the organization of a child's activities and thought processes. They differed on their conception of egocentric speech; Piaget viewing this form of speech as non-communicative action and taking a secondary role in organizing the child and his/her environment. In contrast, Vygotsky perceived egocentric speech as a major tool for understanding and organizing the environment and subsequently becoming inner-speech which contributes to higher levels of planning and organizational skills. Piaget viewed social speech as following egocentric speech and the development of thought

as a gradual socialization of internalized mental processes. Vygotsky postulates that all language from childhood to adult is social, intended to communicate. He views communicative (Vygotsky's term for Piaget's socialized speech) and egocentric speech as having two different functions. When a person starts conversing with him/herself aloud (egocentric) as s/he has been with others (social), it is because the situation has forced inner speech to become outer speech, s/he thinks aloud (Vygotsky, 1962). Piaget views egocentric speech as somewhat nonproductive and disappearing with the advent of social speech, only to appear during frustration with new, unassimilated stimuli.

Vygotsky, as does Feuerstein, views humans as highly plastic and their environments as changing. Piaget stresses biologically supported, universal stages of development. All three theorists share an emphasis on the importance of interaction with the environment, but unlike Piaget, Feuerstein and Vygotsky place a greater significance on social (human) interaction as a determiner of development.

Luria

Luria and Vygotsky worked and studied together for the last ten years of Vygotsky's life. Much of Luria's subsequent research was initiated by Vygotsky's influence. The following two studies, as reported by Luria (1973), took place during their joint effort toward understanding human cognitive development.

On the basis of developmental research, Vygotsky and Luria found that children use varying types of categories for the organization of stimuli at different ages. During the early stages of development, the child perceives each object in isolation, the labels or words have no organizational effect. During the next stage of categorization the child begins to compare objects on a single parameter such as size, color, or form. In making these comparisons the child may loose sight of the parameter s/he was using for comparison and begin grouping objects such as table and spoon in one category as a result of having both present at mealtime. They found that grouping objects according to real-life situations is typical of older preschoolers and elementary children. It was at the adolescent level, that they discovered the accomplishment of categorizing objects based on concepts.

One of the four Thinking Skills Curriculum units used in this project is designed to develop comparative behaviors which are a prerequisite for categorization. Feuerstein discovered that some adolescents do not spontaneously compare objects and events in their environment. The Thinking Skills activities involve comparison of objects on concrete parameters such as size, color, shape, number, and direction. Based on the results of Vygotsky's and Luria's work these activities should be within the developmental ranges of second graders and should facilitate the development of comparative skills.

Another study reported by Luria (1973) involved the use of preschool twins as subjects in an effort to investigate educational activities which would facilitate cognitive development. Luria and his associates developed a set of blocks which could be organized into a structure, and two stimulus model structures. One had all the elements of the constructed structure present, much like the initial stimulus cards on the WISC-R block design subtest which have lines that designate the elements of the design (build-from-the-elements activity). The other stimulus model was covered with thick white paper so that the general contours of the design were present, but the individual components were not, such as the later stimulus cards on the WISC-R block design subtest which omit the interior lines, leaving only outer lines of the design (build-from-the-model activity). Each pair of twins was divided into two separate groups, one twin in the build-from-the-model group (the stimulus that lacked exposure of the elements) and the other twin in the build-from-elements group (the stimulus that provided outlines of the parts of the whole). Both groups received training over a period of two months using the particular stimulus model assigned to the group. On post tests using different structures which concealed the parts or elements, the build-from-the-model group performed significantly better than the build-from-the-elements group. When presenting the groups with build-from-elements tasks, the children who had been trained to build from

model were still superior. They displayed more planning behavior before beginning to work and were more articulate in describing the elements of the structure. This group also displayed superior ability in reproducing structures from memory and exhibited more planning behavior during free constructive play In a follow-up study six months later there was still a significant difference between the behavior of the two groups, favoring the build-from-model group.

The Thinking Skills Curriculum unit of study on perceptual analysis used in this study is designed to influence the above behaviors through analyzing the parts of a whole using a build-from-the-model approach as well as other analytic strategies.

Self-Instruction Method

Following the theoretical work of Luria and Vygotsky concerning language and inner speech as effective regulators of human behavior, Meichenbaum (1972) has developed strategies to facilitate change in a person's behavior through self-instructional training procedures. He and his colleagues have shown that self-instructional training procedures (training a person to use positive and instructional inner speech) involving cognitive modeling and rehearsal can teach schizophrenics and impulsive children to control their thinking processes to facilitate task performance, can modify test anxiety, and can help individuals

cope with emotional and stress reactions. This procedure was shown to be more effective in group treatment than individual treatment due to group discussions of faulty thinking styles and self-statements which facilitated self-awareness.

In academic settings using a task-analysis approach, similar to Gagne's (Skahakian, 1970), the self-instruction approach translates the prerequisite behavior needed for task performance into self statements which can be modeled and rehearsed.

A concern about self-instruction training in an academic setting is the manner in which the inner-speech or self-speech is transmitted. The self-instruction method used for academic purposes appears to involve a rather rote manner of acquiring pre-requisite skills needed for the performance of a task. Opportunity for hypothetical thinking and discovery learning which lead to changing cognitive structure and developing cognitive functions does not appear to be an element of this method. Instead it appears that the context of thought is modeled through speech for the child to mimic. Such a relatively rote and mechanical means of transmitting thought processes may result in a child's verbal repetitions of the statements without internalizing their meaning.

The purpose of the self-instruction technique is similar to Feuerstein's mediated learning experience with the exception of the modality in which the cognitive thinking

processes are transmitted. The mediator is aware of the prerequisites needed to perform the Thinking Skills activity, but guides the students by questioning and examination of hypotheses through performing the task. The discussion about differing strategies used to complete a task or reach a goal assists students with investigating alternative strategies and choosing the most effective one, and facilitates internalization of prerequisite skills. If the prerequisite skills are internalized, they can be applied to similar problems encountered in the future. While working together on activities, the students are encouraged to assist each other by asking questions which will lead to discovery of the solution, as the teacher does, rather than telling their peers how to overcome difficulty. This interactive process involving questioning creates a thought provoking situation (tension) which facilitates cognitive growth (Vygotsky, 1962). It is this tension element of learning that appears lacking in the rote method of the self-instruction model.

Related Research Involving Feuerstein's Instrumental Enrichment

Feuerstein has been involved in developing Instrumental Enrichment for approximately 20 years, but only recently has the curriculum and teacher training been made available outside of Israel. As a result of the brief availability

of the program, reports of research findings involving Instrumental Enrichment are limited.

Feuerstein, Miller, Hoffman, Rand, Mintgker, and Jensen have conducted the most extensive study using Feuerstein's curriculum and mediation techniques for teaching (Feuerstein, 1974, 1982). The project was designed to investigate both short and long term effects of Instrumental Enrichment and was conducted in Israel. The research population consisted of 218 low functioning adolescents between 12 and 15 years of age who received IE for two years. The short term findings showed significant gains on various cognitive and intellectual measures in the IE treatment group in comparison to the control group, in spite of the fact that the IE groups received less instruction in formal school subjects (about 300 total hours less over a two year period).

A follow-up study was conducted for the purpose of testing the extent to which the short-term gains were sustained over time. Approximately two years after completion of the program, 184 of the subjects (IE group = 95, Control group = 89) were drafted into the Israeli Army and given an Army Intelligence test called the DAPAR. The Primary Mental Abilities test was used in the original study as a pre and post criterion measure. Using the PMA pretest and the DAPAR, the subjects were divided into four categories: low PMA, low DAPAR; low PMA, high DAPAR; high PMA, low DAPAR; and high PMA, high DAPAR. Using a chi-square

analysis within and between the IE and Control groups, a significant difference was obtained between the IE and Control groups with respect to their overall performance on the DAPAR ($p < .005$). Additional analysis results suggest that under conditions of no change there is a greater tendency of IE intervention to stabilize high performance, whereas in the absence of such intervention the tendency is for the performance to be stabilized at low levels. The reverse trend appears to characterize the change conditions. Not only does IE intervention tend to produce proportionately nearly four times as much change from initial low to subsequent high performance, but in the absence of such intervention the long term effect is a tendency for initially high performers to regress to lower levels of performance.

The major implication of these findings suggest that the effects on cognitive changes of a structural nature increase with time, while the effects of cognitive changes of a task-bound nature involve only the accumulation of specific subject matter and remain stable or diminish over time as a result of forgetting or extinction.

The John Kennedy Center of Vanderbilt University was the headquarters for a two-year Feuerstein research project in North America. The sites of research were Nashville, Louisville, New York, Toronto, and Phoenix. The subjects involved in the research project were secondary students labeled educable mentally retarded, learning disabled, behavior disordered, culturally and linguistically different, and varying exceptionalities (students who learn

poorly, two or three years below expected level, whose diagnosis had not been determined).

Both the treatment and control groups were from populations of lower socioeconomic status, and mean educational levels in all samples ranged from 2 to 7 years below expectancy for their respective chronological ages which ranged from 11 to 18 years. In Nashville and Louisville, the samples consisted of about 60% black students and in Phoenix the samples were almost all the children of Mexican-American migrant farm workers.

The treatment involved three to four hours of Instrumental Enrichment a week. One year preliminary results of the two year project indicated mean increases in the total IQ's (Lorge-Thorndike Intelligence Test) for the four categories of exceptionality: 6.93 IQ points for EMR, 7.45 for LD, 5.26 for varying exceptionalities, and 9.11 for BD. A difference significant at the .05 level was shown between the treatment and control groups. The Key Math Diagnostic Arithmetic Test, used as one criterion measure, reflected an increase for the treatment groups from grade equivalent 4.36 to 4.62 while the control groups declined slightly from 3.97 to 3.86. Although there were no significant overall differences in gains in academic achievement as measured by the Peabody Individual Achievement Test, there was a significant gain ($p < .05$) on the General Information Subtest for the experimental groups as compared to the control groups.

Other criterion measures included tests designed to investigate changes in self-concept, locus of control, self-esteem, and motivation. Although only one-half of the treatment results were reported, early analysis suggests that cognitive education creates positive changes in general intellective functioning which in turn reflects changes in the motivation to learn and positive direction in self-concept factors bringing about increased achievement in academic areas (Smith and Haywood, 1981).

At this writing there has been only one study using Feuerstein's Instrumental Enrichment curriculum with individuals younger than ten to eleven years of age (grade 5). In this study conducted by Silverman et al. (1982) in collaboration with Feuerstein, the subjects were second, third, fourth, and fifth graders in an elementary school in Askelon, Israel. There were two treatment groups and one control group for each grade level. Each treatment group received Instrumental Enrichment for one 40 minute period three times a week for a three month period. One treatment group at each grade level received training on two of the first four IE units (Organization of Dots and Comparisons) while the other treatment group received IE training on the remaining two units of the first four IE instruments (Orientation in Space and Analytic Perception).

At the second grade level (N=66) the treatment groups performed significantly better than the control groups on post tests, the LPAD Analogies (similar to Raven Matrices

tasks) (.03) and Postures test (spatial orientation test) (.05). The group which received training on the IE Organization of Dots/Comparison units performed significantly better (.03) on the LPAD Analogies than the group that received training on the IE Orientation in Space and Analytic Perception units. This group (Orientation in Space/ Analytic Perception) performed better than the Organization of Dots/Comparison group on the Primary Mental Abilities Perceptual Speed subtest (.002) (Silverman, 1982).

These results suggest that Instrumental Enrichment can have a definite effect on the development of prerequisites for higher level reasoning and effective cognitive functioning at the second grade level. The Thinking Skills Curriculum which is an adaptation of Instrumental Enrichment provides for the same development of reasoning and cognitive functioning.

Rationale

The rationale for using an adaptation of Feuerstein's Instrumental Enrichment with second grade students is as follows: (1) Although the Instrumental Enrichment units were designed for use with adolescents whose biological maturational level, according to Piaget, have reached formal operational stage, their purpose is to remediate prerequisite thinking skills normally acquired at earlier developmental stages. The Thinking Skills Curriculum

utilizes the same theoretical basis and maintains the same goal, that of facilitating development of prerequisite thinking skills.

(2) The materials are relatively content free and require no previous subject-matter skills which might be lacking at the second grade level.

(3) The materials are concrete, performance tasks which allow the individual, through discussion of problem solving strategies to mentally ascend to his/her particular level of development of abstract or representational thought.

(4) According to Vygotsky and Luria's theories of development, learning precedes development. The Thinking Skills Curriculum may prove beneficial in acquiring basic language and organizational skills that allow for growth in development of cognitive skills.

(5) According to Feuerstein, mediated learning experiences are advantageous and beneficial regardless of age.

(6) And finally, Ausubel (1968) contends, on the concrete operational stage (the Piagetian stage which describes the developmental level of the proposed subjects for this study),

> The distinguishing characteristic of the concrete operational stage is the child's ability to assimilate concepts verbally. ...it is sometimes said that it is only at the formal stage that the child is able to engage in "hypothetical - deductive or if/then" thinking. However, it seems clear that children in the concrete operational stage and even in the pre-operational stage, are quite capable of undertaking a certain kind of "if/then" thinking ... actually what distinguishes the

> various stages is not so much the kind of logical process involved as the degree of abstraction involved in the data upon which this process rests (p. 185-187).

Summary

This literature review supports the theory of cognitive modifiability and the effectiveness of a mediational approach to facilitate learning. It questions the long held belief that adverse, or a lack of profitable, early experience produces permanent and irreversible damage. The concept that learning pulls development along is supported by the work of Vygotsky and Luria. To again quote Vygotsky (1978),

> We propose that an essential feature of learning is that it creates the zone of proximal development; that learning awakens a variety of developmental processes that are able to operate only when the child is interacting with people in his environment and in cooperation with his peers. Once these processes are internalized, they become part of the child's independent development of achievement (p. 90).

CHAPTER III

METHODOLOGY

Introduction

The primary intent of this study was to test the effects of a Thinking Skills Curriculum on the academic achievement and educational ability of second grade students as measured by tests appropriate for this purpose. This chapter contains descriptions of the sample, instrumentation, research design, procedures, and data analysis.

Sample

The study was conducted using the second grade population of three Tulsa Public Schools. The three schools were selected to participate on the basis of their composite IQ scores, availability, and willingness to cooperate.

In an effort to include a wide range of ability levels in the study, three schools with differing student ability levels were sought: one with high ability, one with medium ability, and one with low ability. Three school psychologists reviewed previous results from systemwide group ability tests and selected six schools which met the criteria of variance in ability levels. Of these six schools,

three were available for participation and willing to cooperate. A review of composite (mean) IQ scores resulting from previous group testing conducted systemwide reflected the following for the three participating schools:

TABLE I

COMPOSITE (MEAN) IQ TEST RESULTS, SPRING 1982. SRA EDUCATIONAL ABILITY SERIES TEST

	Mean IQ	Corresponding Percentile
School A	108-112	66%ile-75%ile
School B	102-105	52%ile-59%ile
School C	86- 89	18%ile-22%ile

Note that the above composite scores are reported in ranges (108-112) rather than in a single score (110) indicating that the mean IQ for each school fell within the reported range.

The student population for the combined three second grades totaled 135. One-hundred twenty (120) of these subjects were involved in the study. The subjects included in the study were those who were pre-tested, selected and assigned to treatment and control groups, and who remained in the program for post-testing. In this population, 63% (75) were white, 33% (40) were black, and 4% (5) were of

other racial backgrounds. The gender breakdown was 48% (58) males and 52% (62) females. The educational classification breakdown was 85% (102) regular class, 10% (12) learning disabled, 2.5% (3) educable mentally handicapped, and 2.5% (3) gifted. The chronological ages of the subjects were 52% (62) age 7, 43% (52) age 8, and 5% (6) age 9.

Although the 3 participating schools were selected to insure a variance in ability levels, subjects were not grouped according to schools. The random selection process which was based on pretest scores resulted in representation of all three schools at all three ability levels (high, medium, and low). Within each school, the subjects involved in the treatment sessions were drawn from various second grade classes (regular, learning disabled, educable mentally handicapped, and gifted) to form the treatment group. Control group subjects remained in their regularly scheduled class programs.

The academic programs were supervised by the same team of instructional supervisors and generally used similar materials and curriculum guides. There was no reason to believe the programs in the three schools differed significantly except for variations in teachers.

A sampling bias was involved due to the participation of school populations on the basis of their willingness to cooperate rather than random selection. An additional factor which contributed to sampling bias was the selection of school populations on the basis of their composite IQ

scores. The purpose for including this selection factor was to insure the participation of a population with a wide variance in ability levels.

Instrumentation

Three criterion measures were used to assess the effect of the Thinking Skills Curriculum on second grade students. The SRA Level C Achievement Test was utilized as a post-test measure to assess academic achievement levels. The Educational Ability Series of the SRA Level C battery was used to assess ability or intelligence levels and two subtests of the Learning Potential Assessment Device (LPAD) were used to assess non-verbal reasoning and problem solving skill levels.

Two of the criterion measures, the SRA Level C Achievement test and the Educational Ability Series, were administered by classroom teachers to the total Tulsa Public Schools second grade population. The Achievement Test was computer scored and the Educational Ability Series was scored by eight certified school psychologists and psychometrists. The third criterion measure, the two subtests of the LPAD, were administered and scored by four certified school psychologists.

SRA Level C Achievement Test and Educational Ability Series (EAS)

The SRA Achievement Series was chosen as a dependent variable because it provides assessment of academic achievement as well as a general ability portion (EAS) which allows for a measure of differentiation between ability and academic achievement. The EAS portion of the SRA battery provides comparative data on the effects of treatment relating to ability. An additional factor in selecting the SRA series was to maintain consistency in testing. Because this instrument is used throughout the Tulsa Public School System annually, it will facilitate comparison with future scores for the purposes of longitudinal study.

The subtests and their internal consistency reliability coefficients are listed in Table II. No test-retest reliability coefficients are reported by the publishers.

The majority of correlations reported between test scores of the achievement series and course grades range between .43 and .79. Correlations between reading scores and reading/English course grades range between .51 and .78. For math scores and grades, the correlations range between .59 and .79 (SRA Technical Report #1, 1981).

Correlations of the SRA Achievement Series and other achievement test scores were calculated for samples of students in grades three, five, seven, and high school. The total battery score correlations are in the .70's

TABLE II

RELIABILITY DATA BASED ON FALL
1978 NATIONAL SAMPLE
(Grade 2, N=2495)

Test	Reliability Coefficients
RD Auditory Discrimination	.77
RD Letters & Sounds	.85
RD Listening Comprehension	.72
RD Vocabulary	.90
RD Comprehension	.93
Reading Total	1.00
Math Concepts	.84
Math Computation	.86
Math Total	.91
EAS	.77
Composite Score	.98

Source: SRA Technical Report #1, 1981, p. 9.

and .80's (SRA Technical Report #1, 1981). This indicates general consistency in scores across test batteries.

The entire SRA Achievement Series was standardized in the spring and fall of 1978 on students in 542 schools. Large city norms are based on scores of 19,000 students from 74 public schools in seven public school districts with student populations of 100,000 or more.

The contents of the SRA Level C as described in the SRA Achievement Series, Examiner's Manual (1978) are provided in Appendix E. The academic achievement portion provided assessment in the areas of letters and sounds, listening comprehension, vocabulary, reading comprehension, mathematics concepts, mathematics computation, language mechanics, language usage, and spelling. The EAS portion provided assessment in the areas of picture and word vocabulary, numbers, picture grouping, and spatial perception.

For the purposes of this study, the construct of academic achievement is composed of the 9 subtest scores of the SRA achievement portion of the SRA battery and the construct of ability is composed of the 5 subtest scores of the EAS portion of the SRA battery.

The Learning Potential Assessment Device (LPAD)

Two subtests of the Learning Potential Assessment Device (LPAD), the Organization of Dots and Raven's Matrices

tests, were selected as measures of nonverbal reasoning ability. These tests directly address cognitive functions which the Thinking Skills Curriculum was designed to develop.

Feuerstein (1979) developed the LPAD as a radical departure from conventional intelligence test theory and practice. He questioned the fundamental psychometric assumption that manifest level of functioning is an index of learning ability or that intelligence, as measured by conventional tests, is unchangeable. Feuerstein incorporated a learning situation into the assessment process, a train-test sequence. The purpose of the LPAD is not to make judgments about learning potential or ability based on the individual's performance relative to other examinees. Instead, it was developed to diagnose an individual's learning deficiencies and to determine the amount of investment needed to modify these deficiencies.

Rationale for using two of the four LPAD subtests as criterion measures is as follows:

(1) Feuerstein's Instrumental Enrichment Curriculum, from which the Thinking Skills Curriculum was adapted, was designed to remediate the cognitive deficiencies diagnosed by the LPAD.

(2) The LPAD is, therefore, designed to measure the cognitive processes that the Thinking Skills Curriculum was designed to teach.

(3) Although the LPAD was not designed to judge one individual's performance in relation to the performance of others, it served as a sensitive tool for measuring the effectiveness of training cognitive processes as facilitated by the Thinking Skills Curriculum.

(4) Of the four LPAD subtests, the Plateau test is at this writing unavailable for distribution and the Representation Stencil Design test requires a more lengthy examination time than the other subtests. Therefore, the Organization of Dots and the Raven's Matrices tests were selected from the LPAD battery as criterion measures.

The Organization of Dots test was administered to class groups of about 25 students and scored by three certified school psychologists. The Raven's Matrices test was administered individually and scored by two certified school psychologists. For the purpose of this study, the construct of nonverbal problem solving is composed of the subtest scores on the two subtests of the LPAD, the Organization of Dots test and the Raven's Matrices test.

The Organization of Dots Test

The Organization of Dots subtest of the LPAD was selected as a dependent variable because it provides a nonverbal assessment of perceptual analysis skills. It is based on "Organisation de points" constructed by Andre Rey and "contributes to the measurement of both general intelligence, and to a certain degree to measurement of specific

abilities in the areas of spatial perceptual activities" (Feuerstein, 1979, p. 162).

Technical information, for the Organization of Dots test is limited. Correlation coefficients for this test with the other LPAD subtests range from .22 to .50.

> Correlations with other tests show very little relationship with memory while higher correlations are found with tasks involving operational factors (from .23 to .67), pointing to the importance of general intelligence in the performance of this test (Rey and Dupont, 1953, p. 224).

The test contains 34 frames of amorphous clouds of dots that must be organized according to an imposed structure. The test is divided into three phases: (1) a square and a triangle, (2) two squares, and (3) two squares and one triangle.

Organization of Dots can be presented either as a group or as an individual test. A training phase using a specially designed training sheet preceeds testing. The training sheet which uses a square and triangle establishes familiarity with the two figures and with the action of linking dots to form the figures.

Rey who developed the test for use with adults imposed a 4 minute time limit for completion of the test. Feuerstein does not impose a time limit but reported a mean of 19.4 minutes (SD 7.5, N=88) for completion (Feuerstein, 1979). For the purposes of this study no time limit was imposed during the training session to insure that all examinees understood the task. But using Feuerstein's

reported mean completion time, a time limit of 20 minutes was used during the test portion of the examination.

The task of linking the dots to form designated figures involves the use of specific strategies. Four functions relevant to the performance of these tasks are described by Feuerstein (1979):

(1) The capacity to plan ahead and the inhibition of impulsive behavior. An attempt to respond immediately to the appeal of a certain dot, without delaying action until this dot is perceived as a part of the required design, will invariably end with failure.

(2) A need for precision is necessary in almost any task which requires organization. The nature of the amorphous cloud of dots in this test requires a high level of precision to organize it into the proper structures.

(3) The segregation of a given part from the whole is needed because the figures overlap and this process requires a capacity to articulate the field by a process of analysis. Discriminating the size and orientation of each figure is of direct relevance to the successful fulfillment of the task.

(4) The projection of an implied relationship, the process of identifying related dots, requires the conservation of the figure; for example, recognizing a square despite variations in its orientation. Feuerstein suggests that this generalization is not easily attained by the younger child and is even difficult for the adult whose

perceptual training has been oriented toward a base-oriented square.

Feuerstein (1979, p. 140) states:

> Organization of Dots is a task that requires an important contribution from the individual to the organization of the outer world and therefore, draws heavily on elaborative capacity. If judged on Jensen's Level I and Level II types of intelligence, the Organization of Dots test falls clearly in the realm of Level II.

Raven's Matrices

The Raven's Coloured Progressive Matrices test (CPM) was chosen as a dependent variable for the purpose of providing an additional assessment of perceptual reasoning ability. The CPM assesses somewhat the same cognitive functions as does the Organization of Dots test, but the CPM provides a medium dissimilar to any means of training perceptual analysis utilized in the treatment. The CPM is colorful, attractive, and easily understood by the examinee. It was designed for use with children under 12 years of age and is considered to be culture-free (Jensen, 1969, Feuerstein, 1979).

The CPM consists of three sets (A, AB, B) of twelve matrices arranged in a progressive sequence of tasks that start with rather simple gestalt completion and build to levels of functioning that require more complex cognitive operations, such as analogies, permutations, and logical multiplication.

In the Manual for Raven's Progressive Matrices and Vocabulary Scales (1977), Raven outlines the following "principles of cognition" involved in performing the matrices tasks:

(1) The ability to distinguish identical figures from different figures, and later similar figures from dissimilar figures;

(2) The ability to appreciate a figure's orientation with respect to himself and other objects in the perceptual field;

(3) The ability to compare analogous changes in the characters perceived, and adopt this as a logical method of reasoning;

(4) The ability to analyze the perceived whole into its constituent elements, or characters, and distinguish between what he himself contributes; and

(5) The ability to apprehend two or more discrete figures as forming a whole, or organized individual entity.

The CPM was standardized in 1949 with a representative sample of approximately 100 children of each year of age from 5 to 11-1/2 years, N=608 in Burgh of Dumfries, England. A norm table of percentile points for every 1/2 year from age 3-1/2 to 11 is provided. Percentile point scores can then be converted to an intellectual grade ranging from "intellectually superior" to "intellectually defective" (Raven, 1977).

Test-retest reliability correlations for second grade subjects (ages 7 and 8 years) range from .89 to .92. Inter-test correlations are .84 for normal second grade school children and .63 for children identified as emotionally disturbed. Internal consistency correlations range from .97 to .85 for second grade subjects (Raven, 1977).

Correlations of the CPM and other tests of general intelligence were calculated for a sample of children age 9. Correlations range from .66 to .83 (Raven, 1977).

Research Design

An experimental pretest-posttest control group design, was used to control for sources of internal and external invalidity. The following is a representation of this design.

R O X O

R O O

All second grade students in the three participating Tulsa Public Schools (N=135) were pretested on the construct of ability using the Educational Ability Series of the SRA Achievement Test, Level C, Form B. Using a random sampling technique (Gay, 1981), 126 subjects were randomly selected and randomly assigned to treatment and control groups for each of three levels of ability (high, medium, and low).

Sources of internal validity were controlled by the presence of the combination of a pretest, random assignment, and a control group. Random assignment controlled for regression and selection factors; the pretest controlled for mortality; randomization and the control group controlled for maturation; and the comparison group controlled for history, testing, and instrumentation (Gay, 1981).

Procedures

The primary purpose of this study was to investigate the effects of a thinking skills curriculum on the cognitive functioning of second grade students. A secondary investigatory purpose was to examine the effects of the treatment on different levels of ability.

The population of second grade students were pretested in January of 1983 using the Educational Ability Series of the SRA Test Battery, Level C, Form B by three certified school psychologists. The pretest yielded IQ scores which were rank ordered. A three-way split of subjects by IQ was performed to provide a high, medium, and low ability factor. Subjects were randomly selected from each group to participate in the study and then randomly assigned to treatment and control groups. The following is a representation of the results.

(1) High Ability (above 102IQ), Treatment - 21, Control - 21, Total - 42;

(2) Medium Ability (102IQ to 85IQ), Treatment - 21, Control - 21, Total - 42;

(3) Low Ability (below 85IQ), Treatment - 21, Control - 21, Total - 42; and

(4) Totals, Treatment - 63, Control - 63, Grand Total - 126.

Although the Hawthorne effect was not considered a threat to the validity of the study due to the frequency of students being pulled from their regular class programs for other instruction (speech therapy, developmental math, developmental reading), additional precautions were taken. Treatment subjects were told that their names had been "drawn from a hat" to help the facilitators work on activities and exercises for second graders. Intentional errors were included in the activities (such as the error in the Organization of Dots example in Appendix B) to further substantiate this claim.

During the treatment period as a subject was lost, a subject in the adjacent group with equivalent pretest results was randomly selected and dropped from the study. The final result was 20 subjects per group, 60 subjects per treatment and control group, and 120 total subjects.

The treatment was comprised of a thirty minute Thinking Skills class each school day for a period of 7-1/2 weeks. The Thinking Skills Curriculum is comprised of four units of study designed for implementation with primary students. The purpose of the curriculum exercises was to correct deficient cognitive functions and develop efficient and effective thinking processes. Development of the curriculum was based on the underlying principles of Feuerstein's theory of cognitive modifiability (Feuerstein, 1979, 1980). The four curriculum units are an adaptation of Feuerstein's Instrumental Enrichment Units; Organization of Dots, Orientation in Space, Comparisons, and Analytic Perception. Feuerstein's Instrumental Enrichment Curriculum was designed for implementation with adolescents and young adults while the Thinking Skills Curriculum is appropriate for primary age children.

Organization of Dots is based on a task devised by Andre Rey (Rey and Dupont, 1953) as a selective devise for the orientation of persons toward vocations and professions requiring specific spatial skills. Identification and outlining a series of overlapping geometric shapes (squares, triangles, diamonds, etc.) from amorphous clouds of dots is required. The fourteen pages of this unit were designed to develop the following cognitive strategies and skills: projection of virtual relationships, organizational behaviors, analysis of characteristics of forms, internal

representation and mental transformations of forms across variations in orientation, planning, systematic search, use of cues, and precision and accuracy.

Spatial Orientation was designed to enrich the ability to use concepts and stable systems of reference for orientation relative to one's own body, using body movements as a frame of reference for establishing directional relationships with objects in a visual field. The fourteen activities are primarily pictorial, figural, and verbal. This unit was designed to develop the following cognitive strategies and skills: division and organization of space in objective terms, dissolve egocentricity by developing the ability to see more than one point of view (more than one solution to a problem), and recognize and identify relationships between objects and events in time and space.

The unit entitled Comparing introduces the concepts of commonalities and differences. Both pictoral and verbal modalities are used in the fourteen pages of activities. The process of comparison of items uses such dimensions as size, form, number, color, and shape. Comparing was designed to develop the following: precision in identifying and describing characteristics of an object, person, event; discovery of alternative dimensions of comparing; determining relevant and irrelevant dimensions; distinguishing

between perceptual and semantic characteristics; grouping; and identifying and establishing a continuum of concrete to abstract characteristics.

The goal of the perceptual analysis unit was

> ...to teach the analysis of a whole into its component parts, to seek the relationship between the parts, to view each part as a whole unto itself, and to realize the possibility of uniting the parts into new wholes (Feuerstein, 1980, p. 190).

The fourteen activities are primarily figural and are designed to develop the following cognitive skills and strategies; analysis of a whole into parts, establishing relationships between parts, recognizing that a part is a whole unto itself and can be broken into more parts, seeking alternative ways of analyzing a whole, and recognizing equality and inequality of parts of a whole. Examples from each of the four Thinking Skills Units are provided in Appendix B.

A panel of judges comprised of one educational psychologist who teaches at the university level, one curriculum specialist who teaches at the university level, and one doctoral candidate whose major area is special education were asked to review the Thinking Skills Curriculum and Feuerstein's Instrumental Enrichment Curriculum. The judges were requested to compare both curricula and give

an opinion as to whether or not the Thinking Skills Curriculum was, in fact, an adaptation of Feuerstein's Instrumental Enrichment. The judges' critiques reflect a consensus that the Thinking Skills Curriculum is a good adaptation of Feuerstein's Instrumental Enrichment, teaching to the same philosophical goals and utilizing the same strategies while using a more basic approach appropriate for second grade students. A critique and a vita from each of the judges is provided in Appendix C.

Three school psychologists served as teachers of the treatment groups and attended bi-weekly meetings for assessment and planning purposes. Varying techniques and approaches to the didactics of the materials as they applied to the developmental stages of the subjects were considered and used as a basis for formulating implementation strategies. Further discussion regarding implementation and the role of the Thinking Skills teacher is provided in Appendix D.

At the conclusion of the treatment period in April of 1983, post-tests were administered to the subjects. The SRA Achievement Test, Level C which included the Educational Ability Series was group administered by classroom teachers to all second grade students in the three schools. The Achievement portion of the SRA battery was computer scored. The EAS portion was hand scored by a team of eight school psychometrists and school psychologists. The Organization of Dots test was administered

to class groups of 20 to 25 and scored by three school psychologists. One school psychologist acted as administrator while the other 2 assisted as aids. The Raven's Matrices test was individually administered and scored by 2 school psychologists.

The dependent variable of academic achievement was composed of the 9 subtest scores of the SRA achievement battery, the dependent variable of ability was composed of the 5 subtest scores of the EAS portion of the SRA battery, and the dependent variable of nonverbal problem solving was composed of the 2 subtest scores of Feuerstein's Learning Potential Assessment Device (LPAD).

Hypotheses

The major objective of the research project was the comparison of two educational strategies, one which involved the inclusion of a process oriented curriculum with the general educational program and the other which involved only the subject-matter oriented curriculum provided by the general educational program. The Thinking Skills Curriculum was presented as a tool for modifying cognitive structure to assist an individual in making better use of learning opportunities. Goals for the general educational program are typically limited to providing the student with basic school skills, content, and information. Therefore the following null research hypotheses were formulated.

Hypothesis One: There is no interaction between treatment levels (thinking skills training x no thinking skills training) and ability grouping (high, medium, and low) of second grade students in terms of cognitive performance in the area of educational ability.

Hypothesis Two: There is no difference between second grade students who receive thinking skills training and those who do not in terms of cognitive performance in the area of educational ability.

Hypothesis Three: There is no difference between second grade students of high, medium, and low ability in the area of educational ability.

Hypothesis Four: There is no interaction between treatment levels (thinking skills training x no thinking skills training) and ability grouping (high, medium, and low) of second grade students in terms of nonverbal problem solving.

Hypothesis Five: There is no difference between second grade students who receive thinking skills training and those who do not in terms of nonverbal problem solving.

Hypothesis Six: There is no difference between second grade students of high, medium, and low ability in the area of nonverbal problem solving.

Hypothesis Seven: There is no interaction between treatment level (thinking skills training x no thinking skills training) and ability grouping (high, medium, and

low) of second grade students in terms of academic achievement.

Hypothesis Eight: There is no difference between second grade students who receive thinking skills training and those who do not in terms of academic achievement.

Hypothesis Nine: There is no difference between second grade students of high, medium, and low ability in the area of academic achievement.

Data Analysis

Multivariate analysis of variance (MANOVA) which is a generalization of analysis of variance to a situation in which there are several dependent variables was used to investigate the hypotheses. Three separate 2x3 MANOVA's were utilized as follows: (1) investigation of hypotheses one, two, and three, the dependent variable consisting of the five subtests in the Educational Ability Series of the SRA battery; (2) investigation of hypotheses four, five, and six, the dependent variable consisting of the two subtests of the Learning Potential Assessment Device; and (3) investigation of hypotheses seven, eight, and nine, the dependent variable consisting of the nine subtests of the SRA Academic Achievement test.

Tabachnek and Fidell (1983) identify multivariate analysis of variance as appropriate for situations involving at least 2 levels of an independent variable and several dependent variables that are related. This design

facilitated the investigation of the effects of two educational programs (thinking skills training X no thinking skills training) across varying ability levels (high, average, and low) using several criterion measures.

Computations were completed by using the SPSS-X program for MANOVA. The significance level or Type I error for all statistical tests was set at the .05 level.

Summary

A total of 120 second grade students from three elementary schools participated in the study. An ability pre-test was used to classify subjects according to ability (high, medium, and low). Random assignment to treatment and control groups resulted in 60 treatment subjects and 60 control subjects. Treatment subjects were exposed to a 30 minute thinking skills lesson, five days a week for 7-1/2 weeks.

The dependent variables were educational ability (as measured by the Educational Ability Series of the SRA Level C, 1978 Edition), nonverbal problem solving (as measured by the Organization of Dots and Raven's Matrices subtests of the Learning Potential Assessment Device), and academic achievement (as measured by the SRA Achievement Test, Level C, 1978 Edition). Multivariate Analysis of Variance was used to test nine hypotheses concerning treatment effect on the dependent variables across the three identified ability levels.

CHAPTER IV

RESULTS

Introduction

Results of the statistical analysis employed in investigation of the nine hypotheses are presented in this chapter. The impetus of the study was to investigate the effects of a Thinking Skills Program on the educational ability and academic achievement of second grade students across varying levels of cognitive ability.

Information regarding the efficacy of the Thinking Skills Program in improving the cognitive performance and academic achievement of low, medium, and high ability second grade students is provided. The results are reported in three phases due to the utilization of three separate multivariate analysis of variance (MANOVA).

Underlying the multivariate procedures is a set of assumptions. The assumption of random selection and assignment was met to protect the validity of the study. Multivariate statistics are robust to violations of normality and homogeneity of variance as long as sample sizes are relatively equal.

Discussion of the Results

Phase I

A 2.3 multivariate analysis of variance was used to analyze the scores obtained on the five Educational Ability Series (EAS) subtests. Descriptive statistics by group and ability level (means and standard deviations) are provided in Table III. It is pertinent to note that dependent variables IQ1, IQ2 and IQ3 pertain to vocabulary and numbers, concepts generally associated with academic and "school learning"; while dependent variables IQ4 and IQ5 pertain to comparing, categorizing, and spatial perception, concepts generally associated with problem solving and cognitive or intellectual ability. For the purposes of this study the construct of ability was comprised of the five subtests of the EAS.

Hypothesis One: There is no interaction between treatment levels (thinking skills training x no thinking skills training) and ability grouping (high, medium, and low) of second grade students in terms of cognitive performance in the area of educational ability. This hypothesis is not rejected (Wilks Lamda $F = 220.00$, $p > .05$) indicating a lack of differing degrees of effectiveness of treatment among the three levels of ability. Treatment effect did not differentiate between variances in ability.

TABLE III

DESCRIPTIVE STATISTICS FOR EDUCATIONAL ABILITY SERIES (EAS) SUBTEST SCORES

Dependent Variable	Group	Mean	Standard Deviation
IQ 1	Control		
Picture Vocabulary	Low	2.70	1.03
	Medium	2.85	1.22
	High	3.75	1.33
	Treatment		
	Low	2.30	1.34
	Medium	2.80	1.32
	High	4.15	1.34
IQ 2	Control		
Word Vocabulary	Low	6.15	2.32
	Medium	8.35	2.48
	High	11.2	2.19
	Treatment		
	Low	5.95	2.23
	Medium	8.65	3.23
	High	11.0	2.70
IQ 3	Congrol		
Numbers	Low	1.65	.98
	Medium	1.85	1.80
	High	4.10	1.77
	Treatment		
	Low	1.35	1.27
	Medium	1.50	1.32
	High	3.65	1.69
IQ 4	Control		
Picture Grouping	Low	3.20	1.47
	Medium	3.15	1.63
	High	4.20	.89
	Treatment		
	Low	3.80	1.51
	Medium	3.75	1.29
	High	4.65	1.35

TABLE III (Continued)

IQ 5	Control		
Spatial Perception	Low	1.70	1.22
	Medium	2.45	1.20
	High	3.10	1.68
	Treatment		
	Low	2.05	1.19
	Medium	3.05	1.47
	High	3.95	1.31

The number of subjects in each cell is 20.

This hypothesis is not rejected (Wilks Lambda F = 220.00, p > .05) indicating a lack of differing degrees of effectiveness of treatment among the three levels of ability. Treatment effect did not differentiate between variances in ability (See Table IV).

Hypothesis Two: There is no difference between second grade students who receive Thinking Skills training and those who do not in terms of cognitive performance in the area of educational ability. This hypothesis is rejected (Wilks Lambda F=2.620, p < .05). Post-hoc univariate F-test results indicate IQ4 and IQ5 as primary contributors to the difference between treatment and control group performances (See Table IV). The treatment group outperformed the control group in the areas of picture grouping and spatial perception, while there was no significant difference between performance in the areas of picture vocabulary, word vocabulary, and numbers for the construct of ability.

Hypothesis Three: There is no difference between second grade students of high, medium, and low ability in the area of educational ability. This hypothesis is rejected (Wilks Lambda multivariate F=12.297, p < .05). Post-hoc univariate results indicate a difference between ability groups on all subtests of the Educational Ability Series which formed the construct of ability (See Table IV). There was a difference between the performances of high

TABLE IV

MULTIVARIATE AND UNIVARIATE F-TEST RESULTS
PHASE 1: EDUCATIONAL ABILITY

Multivariate	Univariate	F
Group by Ability		.38822
	IQ1 Picture Vocabulary	.99404
	IQ2 Word Vocabulary	.12807
	IQ3 Numbers	.02904
	IQ4 Picture Grouping	.03950
	IQ5 Spatial Perception	.33961
Main Effect - Group		2.62017 *
	IQ1 Picture Vocabulary	.00515
	IQ2 Word Vocabulary	.00512
	IQ3 Numbers	2.00786
	IQ4 Picture Grouping	4.77963 *
	IQ5 Spatial Perception	5.86845 *
Main Effect - Ability		12.29757 **
	IQ1 Picture Vocabulary	14.81309 **
	IQ2 Word Vocabulary	39.20383 **
	IQ3 Numbers	34.88450 **
	IQ4 Picture Grouping	6.35089 **
	IQ5 Spatial Perception	14.81149 **

* $p < .05$
** $p < .01$

ability, medium ability, and low ability groups on the construct of ability.

Phase II

The scores obtained on the two subtests of the Learning Potential Assessment Device (LPAD) were analyzed by a 2x3 multivariate analysis of variance. Table V provides descriptive statistics (means and standard deviations) for this data. Dependent variable "OD" pertains to the Organization of Dots subtest and the dependent variable "RV" represents the Raven's Matrices subtest. These two subtests comprise the construct of nonverbal problem solving.

Hypothesis Four: There is no interaction between treatment levels (thinking skills training x no thinking skills training) and ability grouping (high, medium, and low) of second grade students in terms of nonverbal problem solving. This hypothesis is not rejected (Wilks Lambda $F = 226.00$, $p > .05$) indicating a lack of differing degrees of effectiveness of treatment among the three levels of ability. Treatment effect did not differentiate between a variance in ability levels (See Table VI).

Hypothesis Five: There is no difference between second grade students who receive Thinking Skills training and those who do not in terms of nonverbal problem solving. This hypothesis is rejected (Wilks Lambda $F = 113.00$, $p < .05$). Post-hoc univariate F-test results indicate that the "OD" subtest is the primary contributor to the

TABLE V

DESCRIPTIVE STATISTICS FOR LEARNING POTENTIAL ASSESSMENT DEVICE. SUBTEST SCORES
Raven's Matrices and
Organization
of Dots

Variable	Group	Mean	Standard Deviation
OD	Control		
Organization	Low	3.7	3.57
of Dots	Medium	7.4	6.44
	High	12.6	9.70
	Treatment		
	Low	19.7	9.11
	Medium	23.7	8.61
	High	28.5	7.24
RV	Control		
Raven's Matrices	Low	18.4	3.41
	Medium	20.1	4.53
	High	23.7	5.18
	Treatment		
	Low	20.1	4.91
	Medium	23.8	6.42
	High	26.0	4.13

There are 20 subjects in each cell.

TABLE VI

MULTIVARIATE AND UNIVARIATE F-TEST RESULTS
PHASE II: NONVERBAL PROBLEM SOLVING

Multivariate	Univariate	F
Group by Ability		.24518
	Organization of Dots	.00545
	Raven's Matrices	.44173
Main Effect - Group		69.91404 **
	Organization of Dots	129.65748 **
	Raven's Matrices	8.49683 **
Main Effect - Ability		8.66917 **
	Organization of Dots	13.21188 **
	Raven's Matrices	13.19493 **

* $p < .05$
** $p < .01$

significance of this analysis. Although a significant difference between group performance was indicated for the "RV" subtest with the univariate F-test (.004 level), additional post-hoc analysis using the Roy Bargman Stepdown-F test did not yield a significant difference (.210 level). The analysis indicated mixed results for the "RV" subtest and significant results for the "OD" subtest. The treatment group outperformed the control group on the construct of nonverbal problem solving.

Hypothesis Six: There is no difference between second grade students of high, medium, and low ability in the area of nonverbal problem solving. This hypothesis is rejected (Wilks Lambda $F = 226.00$, $p < .05$). Post-hoc univariate F-test results (Table VI) indicate a difference between performance of the three ability groups on both subtests which comprised the construct of nonverbal problem solving skills. There was a difference between performances by the high ability, medium ability, and low ability groups on the construct of nonverbal problem solving skills.

Phase III

A 2x3 multivariate analysis of variance was used to analyze the scores obtained on the nine SRA Achievement subtests which formed the construct of achievement. Table VII provides descriptive statistics by group and ability level for this data.

TABLE VII

DESCRIPTIVE STATISTICS FOR SUBTESTS OF THE SRA LEVEL C ACADEMIC ACHIEVEMENT TEST

Dependent variable	Group	Mean	Standard Deviation
ACH 1	Control		
Letters and Sounds	Low	11.25	5.16
	Medium	14.20	3.82
	High	16.15	2.96
	Treatment		
	Low	12.65	3.63
	Medium	14.85	2.74
	High	17.65	2.68
ACH 2	Control		
Listening	Low	11.70	2.70
Comprehension	Medium	13.80	2.88
	High	16.30	1.72
	Treatment		
	Low	12.80	2.46
	Medium	14.70	3.13
	High	15.50	2.56
ACH 3	Control		
Vocabulary	Low	11.70	4.38
	Medium	16.35	5.93
	High	22.50	2.91
	Treatment		
	Low	14.45	5.64
	Medium	18.36	4.89
	High	22.10	3.06
ACH 4	Control		
Reading	Low	12.40	4.58
Comprehension	Medium	16.70	4.34
	High	19.65	4.26
	Treatment		
	Low	14.85	5.07
	Medium	18.20	4.87
	High	20.65	3.25
ACH 5	Control		
Math Computation	Low	18.35	5.00
	Medium	24.30	3.77
	High	28.20	4.57
	Treatment		
	Low	19.30	6.00
	Medium	22.60	5.14
	High	28.90	4.87

TABLE VII (Continued)

ACH 6	Control		
Math Calculation	Low	16.40	6.62
	Medium	20.50	4.53
	High	22.65	4.21
	Treatment		
	Low	17.70	5.49
	Medium	20.10	3.97
	High	24.15	3.48
ACH 7	Control		
Language	Low	11.50	4.49
	Medium	13.75	3.48
	High	15.45	3.15
	Treatment		
	Low	13.40	4.67
	Medium	13.90	4.06
	High	16.50	3.40
ACH 8	Control		
Language Usage	Low	10.20	4.53
	Medium	13.90	3.86
	High	16.65	4.09
	Treatment		
	Low	12.85	5.38
	Medium	15.90	7.41
	High	16.90	2.77
ACH 9	Control		
Spelling	Low	15.70	7.40
	Medium	19.35	5.41
	High	20.65	5.93
	Treatment		
	Low	16.95	6.98
	Medium	19.70	6.11
	High	23.80	5.90

The number of subjects in each cell is 20.

Hypothesis Seven: There is no interaction between treatment level (thinking skills training x no thinking skills training) and ability grouping (high, medium, and low) of second grade students in terms of academic achievement. This hypothesis is not rejected (Wilks Lambda $F = .66906$, $p > .05$) indicating that the treatment effect did not differ for the three ability groups in terms of the construct of achievement (See Table VIII).

Hypothesis Eight: There is no difference between second grade students who receive Thinking Skills Training and those who do not in terms of academic achievement. This hypothesis is not rejected (Wilks Lambda $F = .89422$, $p > .05$) indicating a lack of treatment effect on the construct of academic achievement (See Table VIII).

Hypothesis Nine: There is no difference between second grade students of high, medium, and low ability in the area of academic achievement. This hypothesis is rejected (Wilks Lambda $F = 5.05663$, $p < .05$). Post-hoc univariate F-test results indicate a difference in performance on the 9 subtests of the SRA Achievement test between the 3 ability groups (See Table VIII).

Summary

A review of the results indicate findings that reflect a significant difference between treatment and control group performance on the constructs of ability and nonverbal problem solving as measured by EAS and LPAD subtests. The

TABLE VIII

MULTIVARIATE AND UNIVARIATE F-TEST RESULTS
PHASE III: ACADEMIC ACHIEVEMENT

Multivariate	Univariate	F
Group by Ability		.66906
	Ach1 Letters and Sounds	.16635
	Ach2 Listening Comprehension	1.61797
	Ach3 Vocabulary	1.26964
	Ach4 Reading Comprehension	.26774
	Ach5 Math Concepts	.87703
	Ach6 Math Calculation	.46663
	Ach7 Language Mechanics	.49909
	Ach8 Language Usage	.64302
	Ach9 Spelling	.51020
Main Effect - Group		.89422
	Ach1 Letters and Sounds	3.23764
	Ach2 Listening Comprehension	.71250
	Ach3 Vocabulary	2.95780
	Ach4 Reading Comprehension	4.03098
	Ach5 Math Concepts	.00034
	Ach6 Math Calculation	.82196
	Ach7 Language Mechanics	2.08758
	Ach8 Language Usage	3.33997
	Ach9 Spelling	1.87788
Main Effect - Ability		5.05663 **
	Ach1 Letters and Sounds	18.89467 **
	Ach2 Listening Comprehension	19.83620 **
	Ach3 Vocabulary	39.97773 **
	Ach4 Reading Comprehension	21.22092 **
	Ach5 Math Concepts	38.77529 **
	Ach6 Math Calculation	17.26545 **
	Ach7 Language Mechanics	8.22812 **
	Ach8 Language Usage	11.81544 **
	Ach9 Spelling	8.71254 **

* $p < .05$
** $p < .01$

primary contributors toward the significant difference involving the construct of ability were the EAS subtests of spatial perception and picture grouping (comparing). The primary contributor toward the significant difference involving the construct of nonverbal problem solving was the LPAD subtest, Organization of Dots.

No significant difference was indicated in the verbal, mathematical, and academic performance of treatment and control groups as measured by EAS and SRA subtests. A lack of significance in the interaction factor suggests that treatment effect was similar across all ability levels (high, medium, and low).

CHAPTER V

SUMMARY AND CONCLUSIONS

Summary of the Investigation

Theoretical points of view regarding the nature of intelligence (hereditarian, environmental, and interactionist) and the nature of cognitive development were reviewed in this study. A theory of cognitive modifiability (Feuerstein, 1979, 1980) which holds that it is useful to view intelligence as a set of cognitive functions which can be learned was examined.

The theory of cognitive modifiability postulates that every individual's level of cognitive functioning is affected by work habits, learning history, attitudes, motives, and strategies (Arbitman-Smith & Haywood, 1978). Cognitive functions are viewed as learned in the normal course of development, primarily through a directed process of mediated learning, the main function of which is to assist individuals with monitoring behavior, inducing and applying rules, organizing perceptual data, and developing intrinsic motivation to learn. This process of mediation is seen as essential to adequate cognitive development, and when adequate mediated learning does not take place, cognitive

development, and consequently effectiveness of problem solving and learning, are impaired.

Feuerstein's theory of cognitive modifiability holds that it is possible to teach basic cognitive processes at other than the time of their normal acquisition by placing the emphasis on processes rather than specific content. The transference of effectively acquired basic cognitive processes to academic learning should follow.

The Thinking Skills Curriculum, an adaptation of Feuerstein's Instrumental Enrichment which is a program of cognitive education, was employed for this study. Instrumental Enrichment was designed for use with adolescents and young adults following the supposition that an individual must have reached Piaget's developmental stage of formal operational thought (around age 12) before "thinking about one's thinking" is possible for the purpose of modifying cognitive structure. The Thinking Skills Curriculum was developed with the intent of providing modification of cognitive structure for the younger age child, using Vygotsky's supposition that learning pulls development along and Ausubel's supposition that the child in the concrete operational stage of development (approximately 7 to 11) is capable of a certain type of hypothetical thinking.

In order to provide information which is currently unavailable in the research literature, hypotheses were formulated regarding modifying cognitive structure in

children ages seven and eight. The possibility of cognitive modification at the concrete operational stage of development is not established.

Criterion measures included tests of nonverbal problem solving, verbal and non-verbal educational ability, and academic achievement. One-hundred and twenty second graders who were enrolled in three Tulsa Public Schools participated in the study. A stratified proportional procedure (Gay, 1981) utilizing educational ability pre-test results was employed to randomly assign 60 students to the treatment group (20 from each of the three ability levels; high, medium, and low ability) and 60 students to a control group (again, 20 from each ability level). During a period of 7 and 1/2 weeks, five days a week, the treatment group received cognitive process training using a thinking skills curriculum for thirty minutes each day. Three school psychologists served as facilitators for the treatment classes while the control group students engaged in various academic activities led by second grade classroom teachers.

At the conclusion of the 7 and 1/2 week treatment period, post-tests were administered to test the hypotheses. Two non-verbal problem solving measures, an educational ability test measuring five aspects of both verbal and non-verbal abilities, and an academic achievement test measuring nine areas of academic performance were administered. Multivariate Analysis of Variance (MANOVA) was used to

analyze the data. The analysis was designed to detect differences between the treatment and control groups in performance on post-test measures as well as differences in the effectiveness of treatment for the three ability levels.

Conclusions

The following conclusions are indicated within the limits and findings of this study.

Hypothesis One: There was no significant interaction between treatment levels and ability groupings on educational ability.

Hypothesis Two: Educational Ability was significantly affected by the treatment. The treatment group outperformed the control group to a significant degree in the area of picture grouping which required recognition of similarities and differences between objects for categorization purposes and in the area of spatial perception which required analysis of a design and its parts despite variations in its orientation. However, no significant difference between treatment and control group performance was indicated in the areas of picture vocabulary, word vocabulary, and numbers.

Hypothesis Three: Performance in all five areas of educational ability was significantly different between the three ability groups (high, medium, and low). The ability variable was controlled by means of grouping subjects according to ability on the basis of a pre-test for

the purpose of investigating treatment effect on varying levels of ability.

Hypothesis Four: There was no significant interaction between treatment levels and ability groupings for the construct of nonverbal problem solving.

Hypothesis Five: Nonverbal problem solving ability was significantly affected by the treatment. The treatment group greatly outperformed the control group in the area of organization of dots which involved mentally superimposing designated figures onto amorphous clouds of dots for identification purposes. This task also required representational, organizational, and planning skills as well as self-inhibition of impulsivity (Feuerstein, 1979).

Hypothesis Six: Performance in the area of nonverbal problem solving was different for the three ability groups (high, medium, and low).

Hypothesis Seven: There was no significant interaction between treatment levels and ability groupings in the area of academic achievement.

Hypothesis Eight: Achievement in nine academic areas (letters and sounds, listening comprehension, vocabulary, reading comprehension, math concepts, math calculation, language mechanics, language usage, and spelling) was not significantly affected by the treatment.

Hypothesis Nine: Performance in the area of academic achievement was significantly different for the three ability groups (high, medium, and low).

Reflection upon the findings in this investigation suggest that a degree of cognitive modifiability is available to seven and eight year old students in non-verbal problem solving areas. Significantly higher scores obtained by the treatment group over the control group on criterion measures in the areas of organization of dots, picture grouping and spatial perception indicate that the skills involved in performing these tasks are teachable. These same skills are associated with non-verbal intelligence and are the skills which many non-verbal intelligence tests, currently in use, are designed to measure.

It is also of interest to consider the level of abstraction or amount of transfer required to perform these criterion measures. Just as it is one matter to establish spatial referents such as north, south, etc. in one's own back yard, it is another matter to transfer these referents to unfamiliar settings. In this study the least amount of transference of skills taught in the treatment sessions was required on the Organization of Dots post-test and the difference between mean treatment group and control group scores on this measure was great. The medium (clouds of dots) used in the thinking skills lesson was the same as the medium used on the Organization of Dots post-test. The primary differences between curriculum and test were that the test required changing strategies during the performance of a single activity, which had not been required during treatment, and the configuration of

designs to be located on the test were different from those used in the curriculum. Therefore a minimal amount of transfer of acquired skills was needed to perform the Organization of Dots test.

A somewhat greater degree of transference of skills was needed on the spatial perception and picture grouping subtests of the Educational Ability Series. Analytic perceptual training was provided during treatment but the curriculum used different shapes and a different approach to analyzing the parts of a whole than that utilized by the post-test. Comparing items for the purpose of categorizing was taught during treatment, but again used a medium different from that utilized by the picture grouping subtest. So a degree of transference of skills greater than that needed for performing the Organization of Dots subtest was required.

Of the criterion measures which reflected a difference between treatment group and control group performance, the Raven's Matrices test required the greatest amount of transference of skills. None of the Thinking Skills Curriculum units used matrices as a medium for instruction although the prerequisite skills needed to perform the Raven's Matrices tasks were taught through different modalities. Application of many of the skills addressed in the treatment was necessary to perform the matrices tasks and the development of these skills could not be merely at the receptive or understanding level. The skills needed to be

developed past the receptive stage to the application stage in order to achieve transference of these abilities to a medium or situation not previously experienced. Feuerstein (1980) refers to this process as transcendence, transcending the here and now. Therefore, in this project the Raven's Matrices measure was the greatest test of transfer or transcendence employed within the domain of process-oriented problem solving tasks.

The criterion measures which yielded no significant difference between treatment and control group performance were all nine areas of academic achievement tested by the SRA Achievement Test and the word vocabulary, picture vocabulary, and numbers subtests of the Educational Ability Series test. These measures share one major commonality, the presupposition of content knowledge. They are content oriented tests which require a knowledge base. The treatment was process oriented and did not intend to address content areas. However it was anticipated that, given increased effectiveness in thinking skills, there would be an accompanying measureable shift in academic achievement. The extremely short term treatment (7 and 1/2 weeks) did not allow time for improved cognitive processing to manifest itself in academic areas. Feuerstein suggests that a minimum of two years of treatment is needed to affect measurable academic improvement.

The conclusions that can be drawn from these findings, therefore, are that the incorporation of a thinking skills curriculum into the regular content oriented academic program quickly and positively affected the cognitive functioning of the second grade students involved, but improved academic achievement did not manifest itself in this same short period of time.

General Conclusions

This study was undertaken to provide information of an empirical nature regarding several theoretical questions. Is intelligence a fixed or modifiable entity? Is cognitive modifiability available to individuals in the Piagetian developmental stage of concrete operational functioning? Does improved cognitive functioning affect academic achievement? Does cognitive training have a different affect on different ability levels? General conclusions based on the findings in this study are offered in the following discussion.

Theoretical Views Concerning Intelligence

At the heart of this matter is the issue of whether the human organism is viewed as an open system that is receptive to change and modification (environmental and interactionist viewpoint) or as a closed system whose ability is a genetic product that is fixed across the entire age span (hereditarian viewpoint). Tangible expression of

the hereditarian viewpoint is evident in current educational practices such as acceptance of IQ scores as reflection of a permanent or stable level of cognitive functioning and "watered down" versions of the regular class programs for those identified by IQ scores as low functioning.

The findings in this investigation support the open and modifiable view of intelligence. Verification for this conclusion can be found in the significantly higher performance by the treatment group on criterion measures typically associated with intelligence examinations. The view of human intelligence as accessible to modification creates a need for a re-evaluation of current, passive educational approaches in the area of cognitive functioning and the development of an active approach toward teaching cognitive processing.

Cognitive Mofification in the Concrete Operational Stage

It was the original intent of this researcher to use portions of Feuerstein's Instrumental Enrichment Curriculum as a treatment tool for the purpose of investigating cognitive modification with younger children. However this was not possible. Despite attendance to three Feuerstein workshops and certification as an Instrumental Enrichment (IE) teacher, Curriculum Development Associates, the U.S. publishing company for IE, vetoed purchase of the materials due to the age of the subjects involved in the study. An

attempt to obtain IE materials directly from Israel led to personal correspondence with Feuerstein. Both Feuerstein and Mildred Hoffman graciously critiqued the proposal for the project and offered helpful comments for revision purposes, but expressed concern regarding the young age of the subjects. Feuerstein's concern was that the Instrumental Enrichment program would not affect cognitive structure with normal functioning children younger than 9 years and low functioning children younger than 11 years.

The unavailability of IE materials led to the creation of the Thinking Skills curriculum as a treatment tool. Feuerstein indicated that a very different technique and approach to the didactics of the materials was needed as well as a different teacher-training process. The Thinking Skills curriculum, with one exception, is a direct adaptation of Feuerstein's work. The one exception involved the creation of additional activities (primarily in the analytic perception and spatial orientation units) to facilitate acquisition of a skill. The additional exercises provided "mini-steps" rather than "mega-leaps" toward training a particular cognitive process. The teacher training process remained basically the same.

The findings in this study support the accessability of cognitive modification with children in the concrete operational stage of development. An observation on the part of the Thinking Skills teachers regarding the degree of spontaneous "if-then" thinking displayed by the subjects

during treatment also lends support to the view that a concrete operational child is capable of a certain amount of hypothetical thinking.

Effect of Improved Cognitive Functioning on Academic Achievement

It was discovered from the results of this study that improved cognitive functioning does not immediately affect academic achievement. The brevity of treatment was a significant factor for this concern. The effect of cognitive training in the academic area may be more indirect, subtle, and slower in manifesting itself, and, therefore, difficult to detect objectively until such time as improved cognitive performance becomes well established, habitual, and applied to school learning. An additional factor in this area of the investigation is the nature of norm referenced achievement tests such as the one used as a measure of academic achievement for this study. The limited number of test items presented for each content or skill area creates an insensitivity to change or improvement.

Effects of Cognitive Training on Different Ability Levels

There was not only a question of whether cognitive training would prove effective for 7 and 8 year olds and in what areas, but also for which second graders it would prove most beneficial. The treatment and control groups involved subjects who represented a wide range of abilities

including students classified as gifted, learning disabled, and educable mentally handicapped. It was anticipated that the high and medium ability students would profit more than the low ability group due to a slower learning rate at this stage of their cognitive development; however, the findings indicate that cognitive training benefits were similar across all three ability levels. The low ability students profited just as much as the medium and high ability students. However, it should be noted that the low ability students required a longer period of orientation in the areas of planning and curbing impulsivity than was necessary with the medium and high ability subjects. The higher ability students displayed a greater degree of self-control and willingness to change their customary method of approaching tasks than did the low ability subjects.

The mediational approach used during the Thinking Skills classes involved a rather lengthy period of analyzing an activity, discussing possible strategies for performing the task, and arriving at the most efficient and effective strategy through group planning before actual execution of an activity. The procedure used in regular class situations often involves instructions given by the teacher and performance of a task without group discussion. The low functioning subjects had the most difficulty with adjusting to the mediational approach and initially required a greater degree of structure and controls than the medium and high functioning students. Rushing into performance

of a task with little or no pre-thought or planning appeared to be a well established habit formation for the low ability student. This characteristic was initially observed with the majority of the subjects, but modification was more time consuming with the low ability student. As the low functioning subjects displayed the acquisition of planning skills and curbing impulsivity, the stricter controls were relaxed.

Despite the initial difficulty experienced by the low functioning students regarding adjustment to the procedures used during the Thinking Skills classes, behavioral changes appeared to be more noticeable with this group than with the medium and high ability subjects. Comments by the regular class teachers regarding positive changes in task approach skills were more frequently about low ability and learning disabled students involved in the treatment, than the other treatment subjects. Therefore, from analysis of this data, it can be concluded that cognitive modifiability is accessable to second graders across all levels of intellectual ability.

This study has attempted to provide information regarding the above four issues. Analysis of the data suggest the following: cognitive processes can be taught using a process oriented approach, cognitive modifiability is accessable to second grade students in the Piagetian stage of concrete operational functioning, and cognitive training provides similar benefits to low, medium, and high levels

of intellectual functioning. However, improved cognitive functioning did not immediately affect academic achievement.

Limitations

The primary limitation of this study is the brevity of treatment. Feuerstein (1979, 1980) stated that two years of treatment, one hour, three times each week, is needed to obtain significant improvement in learning ability and academic achievement. The subjects in this study received only 7-1/2 weeks of treatment, five times a week. Results indicate improved cognitive functioning in the area of nonverbal problem solving, but a significant effect on academic achievement was not recognized in this short time period. The brief exposure is considered a contributing factor to the lack of improvement in this area. Feuerstein's research subjects are typically adolescents and young adults. The length of time needed for improved cognitive functioning to manifest itself in academic areas in younger children is unknown.

A second limitation is the lack of randomly selecting schools for participation in the study. The three participating schools were selected on the basis of their composite IQ scores and willingness to cooperate. Willingness to participate in a project that required selection of students from different class groups to form the treatment group suggests flexibility and an openness to new and innovative educational strategies. These characteristics may

be atypical of administrators and teachers and may not be representative of the normal population of school personnel.

A third limitation is the use of school psychologists as facilitators of the thinking skills sessions rather than regular class teachers. The opportunity for "bridging" (transfering) what was learned during thinking skills sessions was limited to creating hypothetical bridging situations during the treatment time. Classroom teachers involved in both cognitive and academic training would have the benefit of being able to bridge strategies discussed during thinking skills sessions to academic situations as they spontaneously occurred during academic classes. This factor may have contributed to a lack of treatment effect on academic achievement.

Recommendations

(1) Replication of this study at the first, third, and fourth grade levels is needed to provide information regarding the accessibility of cognitive modification at these age levels.

(2) Replication of the study utilizing classroom teachers, rather than school psychologists as facilitators for the thinking skills classes, is needed. Although the three school psychologists had formerly been classroom teachers with special education experience, it is not known as to what degree the training in educational psychology

affected their role as facilitators of a cognitive training program.

(3) A longitudinal follow-up study is needed to determine the long term effects of cognitive training on the educational ability and academic achievement of the children involved in the study as they progress through elementary school.

(4) For the purposes of this study, subjects were randomly selected from the total second grade population in three schools which resulted in students being taken from different classrooms to form the treatment groups. Both Feuerstein and Mildred Hoffman expressed concern for randomly selecting treatment subjects rather than using intact class groups. The concern was based on the possibility of contamination of the study due to the anticipated effect the subjects would have on other members of their classes who were serving as controls. An additional concern was the lack of opportunity for "bridging", assisting the subjects in gaining awareness and insight into their cognitive processing and ways in which it affected their performance in academic areas. The thinking skills facilitators attempted to use bridging examples during the thirty minute class sessions, but did not remain with the students for the remainder of the school day. Therefore assisting the subjects in transfering the processes acquired during the content-free thinking skills classes to the content oriented academic classes was prohibited. The extent to

which these factors affected the results of the study is unknown. Replication of the project using intact class groups with classroom teachers as the thinking skills facilitators is recommended.

(5) Midway through the project, the facilitators began to observe spontaneous curbing of impulsivity, planning ahead, and increased self-confidence in problem solving ability on the part of many treatment subjects. Comments by school personnel suggested that the students were displaying improvements in these areas in other classes as well. Speculation regarding improved self-concept was also made. Replication of the study utilizing a criterion measure such as Piers-Harris Children's Self Concept Scale (Piers & Harris, 1969) to investigate these aspects of cognitive training is recommended.

(6) The Thinking Skills Curriculum was intentionally designed content-free so that the primary focus and emphasis could be placed on cognitive processing. It is not intended to replace the current academic program, but is intended to be used in conjunction with the regular class program. However, the problem solving approach used in the curriculum activities and the role of the teacher as a mediator blend together in harmony to provide a dynamic and effective educational tool. Incorporation of this approach into content areas of educational programs may have the potential for greatly affecting academic achievement. Extension of

the program to include content areas and training for classroom teachers in the skill of mediation is recommended.

Practical Implications

Evidence, such as the results of this study, offers support for the interactionist and environmental view of intellectual functioning, an approach that views cognitive functioning as receptive to change. This viewpoint necessitates movement away from the hereditarian theory of intelligence as an inherited trait and a static entity (the position that an individual is either endowed with effective thought processes at birth or not, and little can be done to rectify the handicap). Many current educational attitudes and practices reflect this position, taking a passive (nothing can be done about a lack of intelligence) approach.

A major practical implication offered by this study and other research in the area of cognitive functioning is the accessibility of cognitive modification and a need for a shift in attitude and practices on the part of educators from a passive-acceptance approach to an active-modification approach in the area of intellectual functioning. The only way to test the assertion that cognitive abilities are much more modifiable than had heretofore been believed is by attempting to produce cognitive change. Implementation of cognitive training programs in our educational system would

serve this purpose and would appear a valuable educational innovation which should not be ignored.

The implications in this project suggest that cognitive structure is subject to change in second grade students across a wide range of intellectual functioning. A cognitive training program produced beneficial effects for low, medium, and high ability students. Teacher observations and comments about treatment subjects identified as learning disabled, mentally retarded and slow learners indicate that these students profited from experiences afforded by process oriented training. This leads to a second practical implication, that of shifting from a primarily content skill based curriculum for low functioning special education students to the inclusion of process training to existing programs. Reflection on two aspects of current special education programs is needed: (1) homogeneous grouping and (2) strategies used in current special education practices. Homogeneous groupings for the purposes of training content based skills may be a practicality. However, within the context of information provided in the literature and observations made during this study, heterogeneous groupings facilitate cognitive training. Interaction between students of varying levels of intellectual development provides opportunities for sharing hypotheses for reaching solutions in problem solving activities. The low functioning student is exposed to discussions of strategies for seeking solutions which

would likely be unavailable in a homogeneous group of low functioning individuals. It was the experience of the facilitators in this project that the higher level functioning students tended toward providing assistance for fellow students thereby reinforcing their own cognitive skills. Mainstreaming or the least restrictive educational environment has been encouraged during the past few years for low ability students and, at least in the area of cognitive training, it is a desirable means of facilitating cognitive growth.

The discussion of current special educational practices in Chapter I suggests that the remediational procedures used at present are ineffectual and indicates that we are, perhaps, remediating the wrong skills. Programs designed to develop thinking skills, which this study supports as effective in the area of non-verbal problem solving, appears a viable alternative. Long term cognitive training programs may provide the prerequisite thinking skills needed to learn how to learn. A re-evaluation and revision of special education programs to include opportunity for heterogeneous groups in cognitive training classes should prove more effective than current practices.

A third practical implication supported by the results of this study is the recognition on the part of educators that children in the Piagetian stage of concrete operational functioning (ages 7 - 11) are capable of a certain type of hypothetical thinking. It was enlightening

on the part of the facilitators to witness the degree of "if-then" thinking which was illuminated during discussions in the thinking skills classes. One such example follows:

The thinking skills group had been involved in the spatial orientation unit for several days exploring spatial referents and their relationship to each other using a visual and concrete medium. The referents front, back, right, and left were being investigated, as well as the concept of orienting one's self differently in space resulting in a changed visual field. The aspect of changing one's orientation resulting in a different point of view had also been discussed.

An unfortunate incident occurred before the thinking skills group convened for class on this particular day and was witnessed by a large number of students. A first grader who was a new student was being verbally reprimanded by the principal for inappropriate behavior when the student's older sister saw what was happening and became hysterical, physically attacking the principal and a teacher and declaring loudly that no one was going to "hit" her little brother. No threat of "hitting" had been made and, in fact, this school used a time-out method of discipline rather than physical means. It was later learned that the mother incorporated a great deal of physical punishment in the home.

The topic of discussion which began the thinking skills class that day centered around describing what had happened. A boy in the group, who was classified as learning disabled, suggested that if we tried to "look at it from the sister's point of view we might understand why she had acted that way". Speculations on her point of view followed, including "maybe she was scared for her brother", "maybe she didn't know that we don't spank at this school". Spontaneous "if-then" comments resulted: "if" someone had told the sister that this school didn't spank, "then" she wouldn't have acted that way and "if" the principal had taken the brother into the office to talk to him "then" the sister wouldn't have seen her brother in trouble and the incident would not have occurred. During this discussion the facilitator remained a spectator; the conversation was purely spontaneous.

The above is just one example of the numerous spontaneous occurrences of a certain degree of hypothetical thinking displayed by the second graders during the thinking skills training. Encouragement on the part of the facilitators to analyze and explore possible strategies (if I do this, then this will happen) and to "bridge" what was learned during the thinking skills classes to other areas of life created an opportunity for the development of hypothetical thinking skills. Our educational programs would prove more effective if opportunities to develop analytical thinking were provided at the concrete opera-

tional level, or any level, due to increased motivation to explore aspects of the environment and the opportunity to share hypotheses and differing points of view.

Summation

At a time when our media is filled with reports concerning our nation's ineffective educational system and a need to produce citizens who are contributors in our society, it seems appropriate to emphasize investigations of concepts which hold promise for improvement in these areas. Investigations into implementation of educational strategies which will improve intellectual functioning are of timely importance. Investigations, such as this one, are needed to explore the concept of cognitive modifiability and assist in providing programs that will deter the waste of human intellectual potential.

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APPENDIXES

APPENDIX A

COGNITIVE FUNCTIONS

COGNITIVE FUNCTIONS

Input

(1) Focuses clearly and precisely on details of stimuli

(2) Uses systematic investigative strategies before starting a task

(3) Uses efficient verbal skills to label incoming stimuli

(4) Perceives spatial concepts and relationships accurately

(5) Effective use of spatial concepts to organize the environment

(5)Effective use of temporal concepts to organize the environment

(7) Conserves the constancy of objects across variations in orientation and dimensions

(8) Strives to gather precise and accurate data

(9) Uses two or more sources of information simultaneously

Elaboration

(1) Recognizes the existence of a problem through spontaneous comparing

(2) Ability to define a problem

(3) Selects relevant cues to clarify ambiguities and seek a solution

(4) Engages in spontaneous comparing behavior

(5) Applies varied units of ınformation alternately to seek a solution (hypothetical, divergent thinking)

(6) Organizes stimuli through summative processes to produce relationships

(7) Applies established relationships when investigat-ıng possible solutıons for a new problem

(8) Searches for logıcal evidence to support a hypothesis

(9) Thınks abstractly by imaginıng an object without having it present

(10) Plans and sequences steps necessary to reach a goal

Output

(1) Views lıstener (other) as distinct from oneself (elaborates a limited response, supplies evidence for a claim or argument)

(2) Pursues a problem solution in spıte of failure/ ambiguity (perseveres toward goal)

(3) Searches systematically for relevant cues/relation-shıps that are goal oriented

(4) Uses approprıate language ın communıcating mental operations

(5) Strıves to communıcate accurately and precisely

(6) Completes the desıgn/pıcture/solutıon by vısually transportıng the approprıate missıng part

(7) Responds ın a deliberate manner

The above corresponding functions are the work of Dr. Mary Joe Keatley and Mary Comfort.

APPENDIX B

THINKING SKILLS EXERCISES

ORGANIZATION OF DOTS

Description

Students must connect dots in order to project into an amorphous cloud of dots overlapping geometric figures of increasing complexity, beginning with squares and triangles, and ending with various redefined shapes.

Summary of Goals

(1) Projection of implied relationship.

(2) Definition and labeling of forms.

(3) Analysis of differences among characteristics of different but similar forms.

(4) Internal representation and mental transformation of forms from different orientations.

(5) Systematic search strategies.

(6) Planning.

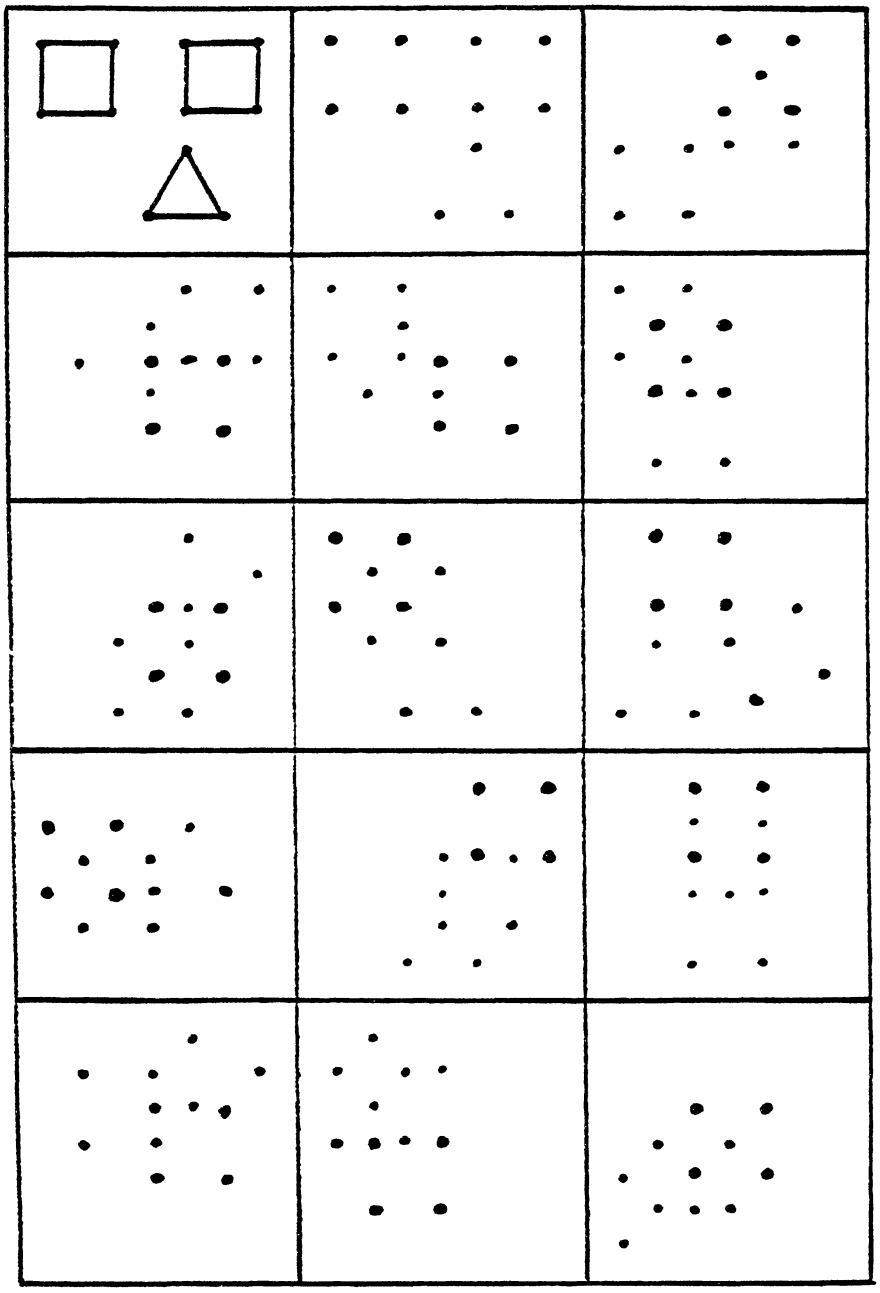
(7) Use of cues.

(8) Comparison, use of standard model.

(9) Self-checking and spontaneous correction.

(10) Precision and accuracy.

(11) Principles of Organization.



COMPARING

Description

Students work with the relationship of sameness and difference on parameters such as size, number, shape, color, and form.

Summary

(1) Use of precise descriptive terms.

(2) Spontaneous comparison.

(3) Alternative dimensions of comparing.

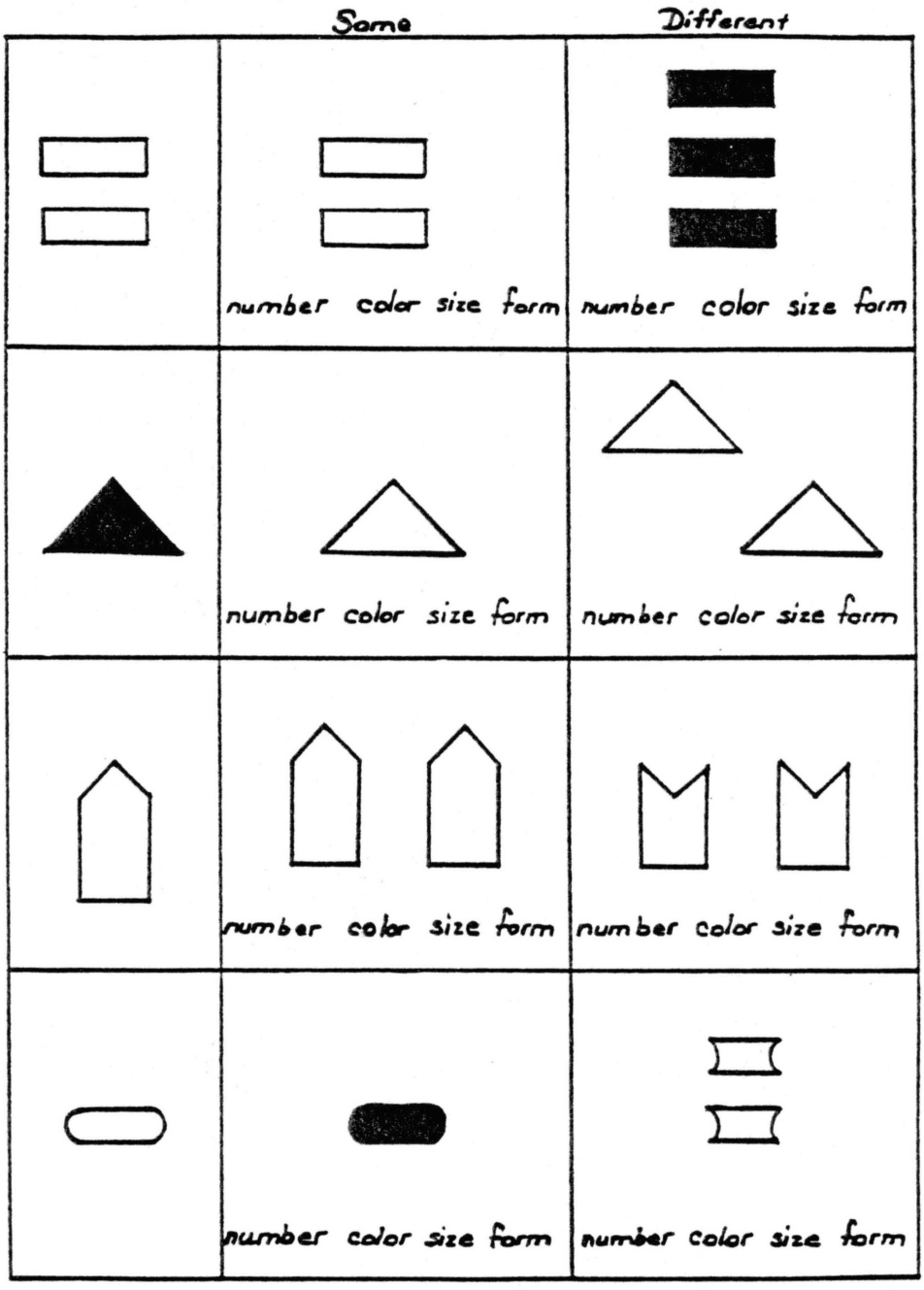
(4) Determination of relevant and irrelevant dimensions.

(5) Identifying differences and similarities.

(6) Distinction between perceptual and semantic characteristics.

(7) Continuum of concrete to abstract characteristics.

(8) Grouping by definitions.


Same
Different
number color size form
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SPATIAL ORIENTATION

Description

Students work with concepts of left, right, front, and back on two-dimensional plane using paper and pencil.

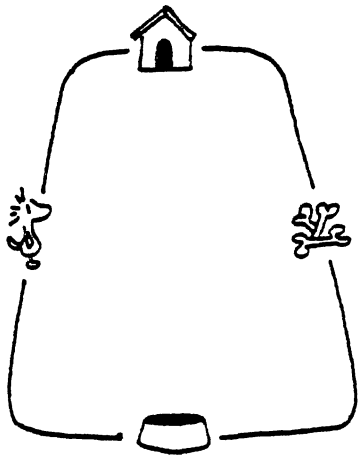
Summary of Goals

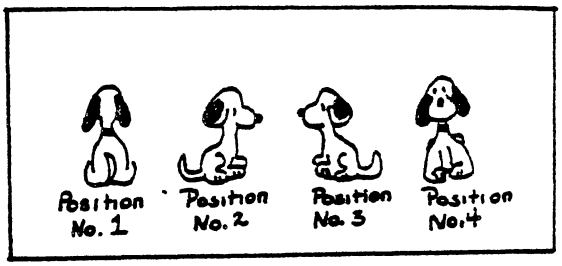
(1) Alleviate egocentric perception and communication.

(2) Divide space and organize it in objective terms.

(3) Recognize more than one alternative and think hypothetically.

(4) Perceive relationships between objects and self and between self and others.





Position	Direction in relation to Snoopy	Object
4	front	
1	right	
2	back	
3	left	
2	right	
1	left	
3	back	
4	front	
3	left	
2	right	

PERCEPTUAL ANALYSIS

Description

Students work with the whole and its parts on a two-dimensional plane in an effort to isolate the single parts of a total complex.

Summary of Goals

(1) Analyze a whole into parts.

(2) Seek relationships among parts.

(3) Recognize that a part is a whole in itself and can be broken into more parts.

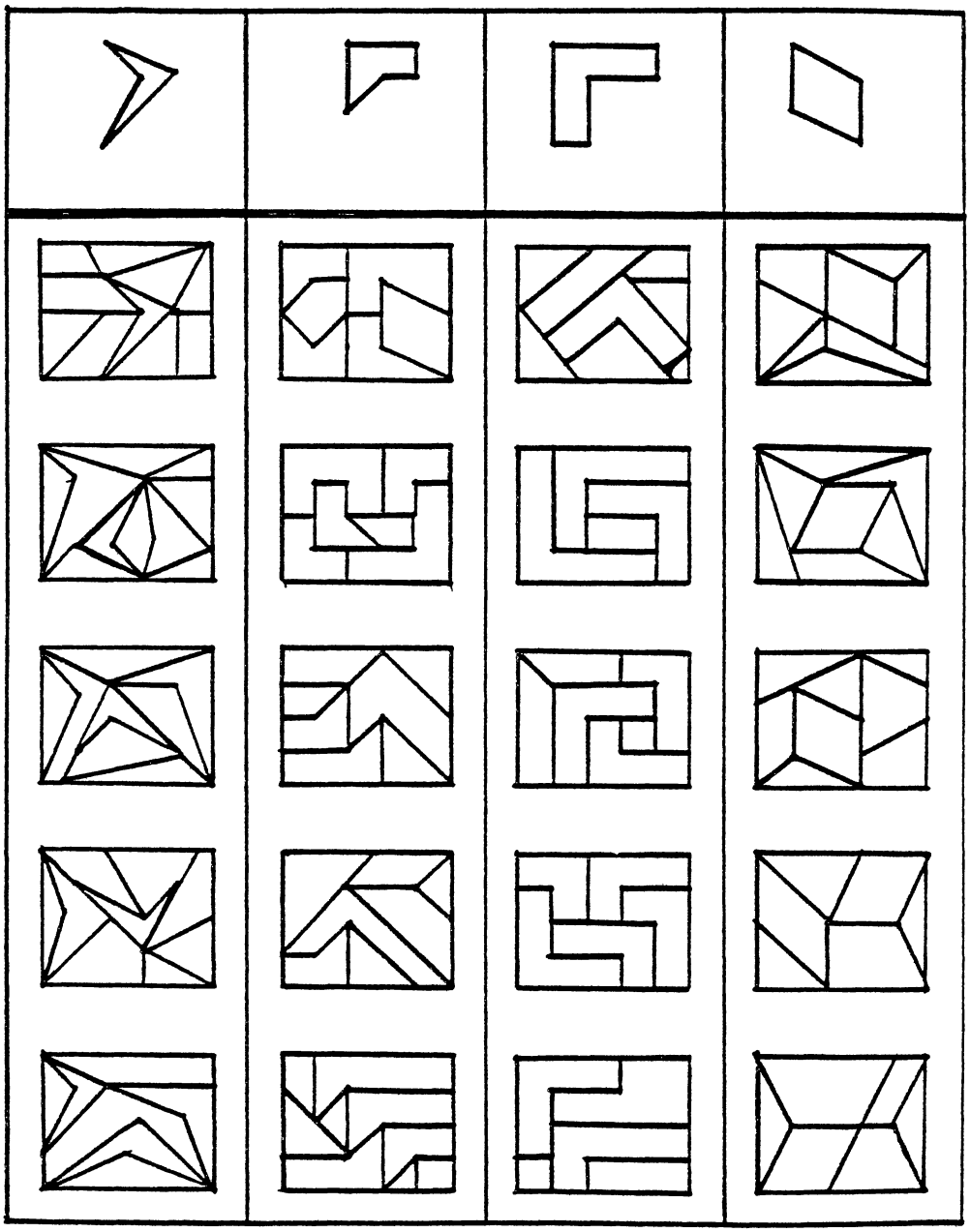
(4) Seek alternative ways of analyzing the same thing.

(5) Recognize the equality and inequality of parts.

(6) Use systematic search strategies.

(7) Recognize a part despite variations in its orientation, conservation of form and size.

The part at the left is hidden in each complete design on that row. Find the hidden part and color it.



APPENDIX C

CRITIQUES AND VITAS OF JUDGES

Northeast Louisiana University
College of Education
Department of Psychology
(318) 342-2116

August 22, 1983

Mary Comfort
10103 E. 23rd Street
Tulsa, Oklahoma 74129

Dear Mary;

I was very impressed with your adaptation of Feuerstein's Instrumental Enrichment Units: Organization of Dots, Orientation in Space, Comparisons and Analytic Perception. Like Hoffman's lesson plans, yours are very clear in stating objectives while leaving room for the teacher's creativity and/or the children's needs. The geometric shapes as well as Snoopy and his "objects" are appropriate for a second grader's developmental level and interest. The pages contained a manageable number of frames and showed a clear developmental sequence. Your Organization of Dots, Orientation in Space, Comparisons in Space and Analytic Perceptions not only are consistent with Feuerstein's theory of Cognitive Modifiability and his Instrumental Enrichment but also are appropriate for the needs and skills of second graders.

Yours truly,

Susan M. Vess, Ph.D.
Northeast Louisiana University

VITA

Vess, Susan M.
Assistant Professor of Psychology
Appointed: 1981

Earned Degrees

Ph.D. University of Illinois, 1977. Doctoral Program in School Psychology. R. Stewart Jones, Advisor. Dissertation topic: Testing Mexican American children with the Bender Gestalt and the Human Figure Drawing.

A.M. University of Illinois, 1972. School Psychology Program. T. Ernest Newland, advisor.

B.A. Loretto Heights College, Denver, Colorado, 1970. Double majors: Special Education of the Educable Mentally Handicapped and Elementary Education.

University of Northern Colorado, Greeley, Colorado, Summer, 1968.

Certification

Louisiana: Certified School Psychologist Type A; Elementary Grades, Mentally Retarded.

Illinois: Pupil Personnel Services-School Psychologist, Elementary Education; Special Education-Trainable and Educable Mentally Handicapped.

Colorado: Teacher Type B With Endorsements in School Psychology; Elementary Education, Special Education; Educable Mentally Handicapped.

Tennesee: Professional Certificate for School Psychology; Elementary Grades; Special Education-Educable Mentally Retarded.

Experience

1982-Summer: School Psychologist, Richland Parish, La. Public Schools, Kay Evans, supervisor.

1981-Summer: Workshop on Learning Potential Assessment Device. University of California at Riverside, Reuven Feuerstein, presentor.

1981-present	Assistant Professor, Psychology, Northeast Louisiana University.
Fall 1979	Taught Child Development, Evening Program, Rockford College, Rockford, Illinois.
Spring-Summer, 1977	Museum Guide-Pioneer in a Living History program, Fort Nashborough, Metro Board of Parks and Recreation, Nashville, Tennessee.
October 1980	Instructor, SOMPA Workshop for the Psychologists of Rockford Public Schools, Rockford, Illinois.
April 1980	IPART: System of Multicultural Pluralistic Assessment Workshop, Evanston, Illinois, Instructor Certification.
May 1978	IPART: System of Multicultural Pluralistic Assessment Workshop, Denver, Colorado, Examiner Certification.
April 1978	Right to Read Conference: Challenge of Change, Speaker.
March 1978	Educational Testing Service, Evaluation Improvement Program, Evanston, Illinois.
1977-1980	School Psychologist, Rockford Board of Education, Rockford, Illinois, Michael R. Wright, Ed. D.; Chief Psychologist.
Spring 1977	Assisted in the collection of data at the Tennessee Women's Penitentiary for Luton Mental Health Center, Nashville, Tennessee, Michelle Domash, Supervisor.
1974 1976	School Psychologist, Rockford Board of Education, Rockford, Illinois, Thomas E. Ciha, Chief Psychologist.
1973-1974	Intern School Psychologist, Fort Worth, ISD, Fort Worth, Texas, Reba Jones, Chief Psychologist.
Spring 1973	Teaching Assistant, Individual Intelligence Testing, University of Illinois under Dr. Camille Ference.
Summer 1970	Assisted Director, Dr. Sonya Read, Summer Special Education Program Loretto Heights College, Denver, Colorado.
Spring 1970	Student Teacher, Educable Mentally Retarded Program, Cherry Creek East Junior High School, Denver, Colorado, Ellen Steele, critic teacher.

Fall 1969 — Student Teacher, First Grade, Knight School, Denver, Colorado, Susan Reeman, critic teacher.

Spring 1969 — Represented Loretto Heights College at the state federation meetings that planned the Council for Exceptional Children Convention held in Denver.

Awards

1970-1974 — National Institute of Mental Health Fellowship in School Psychology, University of Illinois.

1968-1970 — Federal Traineeship in Special Education, Loretto Heights College.

1966-1970 — Academic Scholarship, Loretto Heights College.

1968-Summer — Colorado Association for Retarded Children Scholarship, University of Northern Colorado.

Papers Presented

"Delivery of special services and special education to private and parochial schools" October, 1981, Chicago, Illinois, Illinois Council for Exceptional Children.

Professional Associations

1983- — Louisiana School Psychological Association. Co-editor of the LSPA newsletter, article of LukeS in September 1983 issue.

1970 — National Association of School Psychologists, Louisiana representative to Delegate Assembly (term expires 6-30-1984.) Member of committees that edited the 1976,1977, and 1978 convention papers.

1975-1976 — Illinois Task Force of Bilingual School Psychologists.

1969-1981 — National Education Association with state and local affiliations in Colorado, Texas, and Illinois.

Related Experiences

Community Involvement: Ouachita Pastoral Counseling Center, Board Member
St. Paschal Church: Religious education teacher
leader of a 4-H group on Child Development.

Guest Speakerat: Speech 482 (Aural Rehabilitation) topic: Psychological Aspects on Hearing Loss
Speech 433 (Language Pathology) topic: Intelligence and Language

Reading 419 (Survey of Reading) topics. Feuerstein's Theory of Cognitive Modifiability and Feuerstein's Learning Potential Assessment Device and Instrumental Enrichment.

Reviewed treatment program of the doctoral dissertation by Mary Comfort from Oklahoma State University to determine if it was consistent with Feuerstein's theory and the developmental skills of second graders.

Placement Files

Loretto Heights College
3001 S. Federal Bl.
Denver, CO 80236

University of Illinois
College of Education
Placement Office
Urbana, IL 61820

THE UNIVERSITY OF ARIZONA
TUCSON, ARIZONA 85721

COLLEGE OF EDUCATION
Department of Special Education
(602) 621-3214
(602) 621-3248

Oct. 10, 1983

Mary Comfort
10103 E. 23rd
Tulsa OK 74129

Dear Mary;

I am pleased that you have asked me to review your Thinking Skills Curriculum. Your curriculum follows Feuerstein's Instructional Enrichment Program remarkably well. I found that the Thinking Skills Curriculum meets the same general goals and specific subgoals of Instructional Enrichment. Both expose the student to vocabulary acquisition, formation of habits, and active learning.

Having used Instructional Enrichment with older students, I was anxious to use the Thinking Skills Curriculum with young children. The students, who were second graders, enjoyed the activities very much and wanted to do more. As I am sure you found in your study, they particularly enjoyed the Orientation in Space.

In conclusion, I found the Thinking Skills Curriculum an excellent adaptation of Instructional Enrichment. The Thinking Skills Curriculum will be most useful as a process oriented program for teaching children how to learn. I commend you for your well done work. Congratulations!

Please do not hesitate to contact me if I can be of further service.

Sincerely,

Beth Lasky

Beth Lasky

RESUME

Beth Anne Lasky
3201 East Seneca, #148
Tucson, Arizona 85716

602/325-3370

Educational Background

Institution	Major	Degree	Years
University of Arizona	Special Education	Ph.D.	1981-Present
Calif. State University, Northridge	Special Education	M.A.	1973-1977
Calif. State University, Northridge	Psychology	B.A.	1969-1973

Professional Experience

University of Arizona Tucson, Arizona	Graduate Assistantship, Department of Special Education	Fall 1981-present
Pima County Juvenile Courts Tucson, Arizona	Counselor - Structured Learning Therapy	Fall 1982-present
Calif. State University, Northridge	Instructor, Department of Special Education	January 1980-June 1981
Los Angeles Unified School District	Assessment Service - Teacher	September 1979-June 1981
	Learning Disability - Teacher	September 1976-June 1979
	Educable Mentally Retarded - Teacher	February 1974-June 1976
	Autistic, Emotionally Disturbed, Mentally Retarded - Teacher for summer school programs	February 1974-August 1981

Presentations

First Annual Symposium on Bilingual Research - BUENO Center	"The Bilingual Learning Disabled: An Instructional Approach" Vail, Colorado	May 4, 1983
12th Annual International Conference, National Association for Bilingual Educators	"Working with Parents of Bilingual Handicapped Children" Washington, D.C.	February 15, 1983

Beth Lasky - Resume (continued)

South Central Regional Conference - The Association of the Gifted	"Parents as Partners - Working with Parents of the Gifted" Tulsa, Oklahoma	December 3, 1982
Council for Exceptional Children - Arizona State Conference	"Understanding and Working with Mexican American Parents of Exceptional Children" Tucson, Arizona	February 27, 1981
Conference on the Bilingual as an Exceptional Child	"Working with Parents of the Bilingual Exceptional Child" Northridge, California	October 1981
The Exceptional Bilingual Child - Council for Exceptional Children	"Training Teachers at a School for the Handicapped in Quezaltenango, Guatemala" New Orleans, Louisiana (ED 210 856)	February 1981
Staff Colloquium on Mainstreaming	"Materials for Use with the Learning Disabled" Northridge, California	May 6, 1980

Special Experiences

Coordinator, "Gifted Minorities Conference" — June 13-14, 1983
The Association for Gifted
Tucson, Arizona

Trained teachers at a school for the handicapped
Quezaltenango, Guatemala — June & July, 1980

Numerous workshops for adults and students on handicap awareness

Professional Memberships

Council for Exceptional Children

National Association for Bilingual Educators

Association for Children and Adults with Learning Disabilities

Professional Certifications

Arizona Certifications for Teaching
- Learning Handicapped
- Severely Handicapped

California Life Teaching Credentials
- Learning Handicapped
- Mental Retardation
- Severely Handicapped
- Standard Elementary

Oklahoma State University

APPLIED BEHAVIORAL STUDIES IN EDUCATION

STILLWATER OKLAHOMA 74074
310 NORTH MURRAY HALL
(405) 624-6036

November 8, 1983

Ms. Mary Comfort
10103 E. 23rd Street
Tulsa, OK 74129

Dear Mary:

As requested, I have reviewed the four units of materials which you have adapted from Feuerstein's materials. In addition, I have reviewed other Feuerstein works including the philosophical base inherent in his materials.

In general, I feel your four units: Analytic Perception, Comparisons, Orientation in Space, and Organization of Dots are excellent adaptations of Feuerstein's materials. I was particularly impressed with the way your materials maintained the philosophical and psychological slant so evident in Feuerstein's packets. For example, you have followed his system of including key vocabulary and general instructions for the leader much as the original materials do. Your materials have enough of the instructional design components to provide the leader with a good foundation from which to facilitate the goals of Feuerstein.

I was particularly impressed with the manner in which your materials were geared down for the younger age group with which you worked. This is necessary given some of the developmental constraints of the children. I think the adaptation of "Orientation in Space" using the familiar "Snoopy" character is noteworthy. The simplification of figures in the "Comparisons" unit is also well designed. Despite these necessary developmental changes, it appears that you have maintained the integrity of the original units.

I feel your materials have accomplished your goal--adapting Feuerstein's materials to a younger age group. You have paid attention to both the design aspects of the original materials and the developmental concerns of your population. I commend you on your task.

Sincerely,

David S. Lane

David S. Lane, Jr.
Assistant Professor

DAVID S. LANE, JR.

OFFICE: Oklahoma State University
Department of Applied Behavioral Studies
303 North Murray Hall
Stillwater, Oklahoma 74078
(405) 624-6036

HOME: 2623 N. Park Circle
Stillwater, OK 74075
(405) 372-1205

EDUCATIONAL BACKGROUND:

Ph.D. (1980) The Florida State University
Tallahassee, Florida
Educational Psychology
A joint program between the Department of Psychology and the Department of Educational Research, Development, and Foundations

B.A. (1977) St. Olaf College
Northfield, Minnesota
Department of Psychology

DISSERTATION TOPIC: "Designing Instruction to Facilitate Conditional Reasoning Performance in Preadolescent Children."

AREAS OF PRIMARY FOCUS:

Educational psychology, developmental psychology, instructional design, quantitative methods, research design and methology.

PROFESSIONAL EXPERIENCE:

1983-present Assistant Professor
Oklahoma State University
Department of Applied Behavioral Studies

Primary Responsibilities:

Design and instruction of educational psychology, motivation, learning, and instructional psychology courses. Supervision of graduate students and work on masters and doctoral graduate comittees.

Courses Taught:

Undergraduate level
ABSED 4223 Human Learning in Educational Psychology

Graduate level
ABSED 5213 Advanced Educational Psychology
ABSED 5463 Theories of Learning
ABSED 5613 Instructional Programming
ABSED 6533 Human Motivation

1981-1983 Assistant Professor
Southwest Missouri State University
Psychology Department

Primary Responsbilities:

Design and instruction of educational psychology and developmental psychology courses for the psychology department.

Courses Taught:

Undergraduate level
PSY 231 Psychology of Childhood
PSY 290 Educational Psychology

Graduate level
PSY 610 Psychology of Education

1978-1980 Research Associate
Office of Personnel & Faculty Relations
Board of Regents--State University System of Florida

Primary Responsibilities:

Identifying pertinent needs and issues affecting the 6000+ instructional and research faculty in the State University System. Assisting in the development and review of policies for the specific areas of tenure, conflict of interest, and salary policy. Representing the office at legislative hearings on personnel rules and issues. Preparing written analyses and reports on issues for Regents, Presidents, and Legislators.

1977-1980 Instructor
The Florida State University
Department of Educational Research, Development, and Foundations and
Department of Developmental Studies in Education

Primary Responsibilities:

Development and teaching of comprehensive upper-level undergraduate developmental psychology and educational psychology courses required for teacher certification.

1976-1977 Academic Personnel Counselor
St. Olaf College
Student Services

Primary Responsibilities:

Direct supervision over students selected by Federal and State Government guidelines for potential academic difficulties. Providing said students with academic counseling, tutoring, and assistance.

1976-1977 Research Assistant
St. Olaf College
Department of Psychology

Primary Responsibilities:

Conducting laboratory sessions for upper-level undergraduate experimental psychology course, in addition to providing resource material and preparation for instructor.

PROFESSIONAL ACTIVITIES:

Publications:

1983 Lane, Jr., D. S. Using observational and action instruction to facilitate conditional reasoning performance in early adolescents. Journal of Early Adolescence. (In press).

1983 Lane, Jr., D. S., Fletcher, H. J., Fletcher, D. N. "Conditional reasoning with pre-adolescent intellectually gifted and normal children: An effective instructional method." Journal of Educational Psychology, 75, 441-449.

1980 SUS FACT BOOK: Personnel Section. Update of the 1979 version.

1979 SUS FACT BOOK: Personnel Section. Published by the State of University System of Florida as a summary of various personnel facts and policies.

1979 "Guidelines and Procedures for the Comprehensive Five Year Evaluation of SUS University Presidents." A procedural policy statement detailing rationale and implementation of the presidential evaluation process.

Publications submitted and under review:

1983 Lane, Jr., D. S., Investigating the necessity of the Venn diagram format in a conditional reasoning instructional system. Contemporary Educational Psychology.

1983 Lane, Jr., D. S. and Neuman, D., Adaptations of a proven instructional system on college-aged subjects' conditional reasoning ability. Journal of Experimental Education.

Publications in progress:

Lane, Jr., D. S. "Conditional reasoning performance in preadolescent children: Long term retention following instruction."

Lane, Jr., D. S. and Kundert, D. K. The developmental relationship of children's cognitive styles to sequential and simultaneous processing measures assessed by the Kaufman Assessment Battery for Children.

Kundert, D. K., Lane, Jr., D. S., Neuman, D., and Bull, K. S. The effect on test performance of knowledge of test-item category and difficulty given Bloom's taxonomy and implicit motivation.

Presentations:

1984 "Children's Learning Styles." Workshop to be presented March 30 and 31, 1984 for graduate students, Oklahoma State University.

1984 "Designing Classroom Instruction." Workshop to be presented on February 10 and 11, 1984 for local and regional educators, Oklahoma State University.

1983 "Learning Theories for the College Instructor." Workshop presented for university faculty through the University Center for Effective Instruction, Oklahoma State University, October 26 and November 2, 1983.

1983 "Research on the Development of Conditional Reasoning in Children and Its Relationship to Instruction." Colloquium presented to faculty in the College of Education, Oklahoma State University, May 5, 1983.

1982 "Designing Instruction to Facilitate Conditional Reasoning Performance in Preadolescent Children." Paper presented at Southwestern Psychological Association, Annual Convention, Dallas, Texas, April 17, 1982.

1977 "Differential Aspects of Male/Female Readiness for Counseling." Paper presented at Minnesota Undergraduate Psychology Association Meeting, Hamline University, St. Paul, Minnesota, February, 1977.

1976 "Peer Counseling: A Viable Alternative in Residence Halls?" Paper presented at Midwest Association of University Housing Directors Meeting, Des Moines, Iowa, November, 1976.

Other:

1983 Recipient of University Research Grant - Southwest Missouri State University. Project entitled: "The effect of field independence and dependence on children's conditional reasoning performance."

1982 Coordinator of Divorce Support Group for Children ages 8-18. Group operated under auspices of Catholic Social Services, Springfield, Missouri.

1980 Regents Staff Liaison - State University System of Florida Chancellor Search Procedure. September, 1979 - December, 1980.

1979 Assistant Conference Coordinator - State University System of Florida. "Faculty Evaluation Conference" for all Academic Vice Presidents, Deans, Faculty Senate and Faculty Union presidents in the State of Florida. Orlando, Florida, May, 1979.

HONORS:

Cum Laude graduate - St. Olaf College, May 1977.
Departmental Distinction - Psychology Department, St. Olaf College, May, 1977.
Psi Chi Membership - National Honor Society in Psychology

PERSONAL.

Birthdate: June 2, 1955
Married, two children

REFERENCES:

Dr. Kay S. Bull
Associate Professor
Department of Applied Behavioral Studies
Oklahoma State University
Stillwater, Oklahoma 74078

Dr. Allen J. Edwards
Chairman and Professor
Department of Psychology
Southwest Missouri State University
901 S. National
Springfield, Missouri 65804

Dr. Bill K. Elsom
Head and Professor
Department of Applied Behavioral Studies
Oklahoma State University
116 North Murray Hall
Stillwater, Oklahoma 74078

Dr. Harold J. Fletcher
Professor
Department of Educational Research, Development, and Foundations
305 Stone Building
The Florida State University
Tallahassee, Florida 32306

Dr. Robert M. Gagne
Professor
Department of Educational Research, Development, and Foundations
305 Stone Building
The Florida State University
Tallahassee, Florida 32306

Dr. Harry L. Horn, Jr.
Professor
Department of Psychology
Southwest Missouri State University
901 S. National
Springfield, Missouri 65804

APPENDIX D

ROLE OF THE THINKING SKILLS TEACHER

ROLE OF THE THINKING SKILLS TEACHER

The Teacher's Guides to the Instrumental Enrichment Program were used as a core guide for developing strategies for implementing the Thinking Skills Curriculum. The levels of cognitive development of the students involved in the project were considered to discover the most effective methods for implementing the activities. Varying techniques and approaches to the didactics of the materials as they applied to the developmental stages of the subjects were considered and used as a basis for formulating implementation strategies.

The following goals were a major consideration in planning daily activities:

(1) To correct the cognitive functions that are deficient as a result of the lack of mediated learning experience, which is the basis for inadequate cognitive behavior.

(2) To teach the vocabulary, concepts, operations, and relationships necessary for the mastery of the tasks, and for problem-solving generally.

(3) To produce intrinsic motivation through the formation of habits, or internal need systems.

(4) To increase task-intrinsic motivation.

(5) To encourage reflective thinking and to develop insight into the reasons for success or failure, and into the applicability of the principles and strategies acquired in the Thinking Skills Curriculum to academic, and experiential areas.

(6) To arouse students from cognitive passivity by making them aware that they are capable of generating and extrapolating information, and giving them the opportunity to do so.

The attempt to attain the objectives was fostered by a combination of the materials and the teacher, in the role of the mediator, providing continual feedback to the students in regard to their achievement and the meaning of what they had accomplished. Rather than emphasizing number of correct answers and the speed in which they were obtained, the focus for achievement was on the micro-changes in the process of the student's performance. Through the individual's awareness of the meaning and importance of the micro-changes in cognitive behavior, an active partnership between teacher and student in the process of remediation of cognitive deficiencies was formed.

As each lesson was planned the underlying goals of the program were considered. However, the teacher tried to remain flexible and willing to depart from the prepared plan when the needs of the students and the group situation dictated a change. Each lesson involved task definition and goal setting which began as a joint effort between

teacher and student and evolved to student effort. To make sure the vocabulary, concepts, and instructions were understood, the students were asked to translate them into their own words.

The teacher provided individual assistance and encouragement during independent work time to investigate each student's progress, reinforce successful mastery, and avoid repetition of errors and frustration by assisting with seeking sources of difficulty. Activities such as being student helpers, planning "bridging" examples for discussion, or developing role playing activities or additional related exercises were provided for those who successfully completed the work early. Individuals who needed additional help were assisted by the teacher or a student helper.

Because the emphasis was on the process of problem solving rather than the product, during group discussion the teacher would not ask for correct responses or answers but would explore with the students various responses. It was important to determine that the responses (even if considered correct) were a product of reflection through which other possible answers had been considered and eliminated. It could be that a wrong answer was correct when viewed in the context of the information that was elaborated and the hypothesis that was formulated. When several alternatives seemed correct, group discussion was used to guide the

students through the process of reaching a decision when faced with several options.

In an attempt to develop insight, class discussions involved talking about the various functions required to complete a task, types of errors and their sources, efficient and economical strategies for mastering the task, and an appreciation of what had been learned in the process of completing the exercises. It was through insight that the student became aware of the application of functions, operations, and strategies used in completing the task to learning and life situations. By the process of induction the student moved from the page to the discovery of the rule or principle. By the process of deduction the student found examples of the application of the rule in many different areas.

The process of application is what Feuerstein refers to as "bridging". Through the student's bridging examples they indicate their grasp of the concepts or principles and their ability to use them in various situations. The teacher played an important role in the development of insight by giving feedback and assistance. Successes were applauded and failures minimized. All responses were welcomed for the purpose of analyzing the hypothesis which led to the response. An incorrect answer can be deemed inappropriate without rejecting it or the student. The student was complimented for thinking hypothetically and then assisted with investigation of the faulty hypothesis.

An effort was made to minimize negative feelings that accompany mistakes by centering the discussion around the hypothesis rather than the student. Through occasional teacher mistakes the students were provided a model for modalities of thinking through the processes which lead to the error and making needed adjustments.

Insight into what was learned in the thinking skills exercises can be generalized into academic and experiential areas. A thorough understanding of the second grade academic curriculum was needed to facilitate the process of attaining insight into the academic area. Informal meetings of the thinking skills teachers and the regular teachers aided in familiarizing the thinking skills teachers with the second grade curriculum.

The logo for Instrumental Enrichment is "Just a minute...Let me think". During the thinking skills classes, the students were encouraged to use this response when an answer was not readily apparent rather than saying "I don't know". Encouragement to participate in the activities and discussions was fostered by a supportive atmosphere, the absence of grades, and a positive attitude on the part of the teacher that the student was capable of making meaningful changes to correct cognitive deficiencies. Perhaps this is the most important aspect of the teacher's role: to view each child as having the capability of incorporating effective and efficient thinking processes into his/her cognitive style.

APPENDIX E

CONTENTS OF THE SRA ACHIEVEMENT TEST AND EDUCATIONAL ABILITY SERIES

SRA LEVEL C ACHIEVEMENT TEST AND EDUCATIONAL ABILITY SERIES

Contents of the SRA Level C Achievement Test are described in the SRA Achievement Series Examiner's Manual, Level C, Form 1 (1978) as follows:

Academic Achievement

Letters and Sounds consists of two parts. In the first part the students select letters that stand for beginning, middle vowel, and ending sounds in words given orally. In the second part they select words that have the same beginning, middle vowel, and ending sounds as words given orally.

Listening Comprehension consists of selecting pictures showing answers to questions about passages read by the examiner. The twenty passages range in length from single sentences to stories of several paragraphs. There is one sample. In Listening Comprehension the following skill clusters are tested: understanding directions, identifying details, summarizing, perceiving relationships, and drawing conclusions.

Vocabulary contains twenty-five items that test word meanings. The student selects from four words the one that has almost the same meaning as a definition of a word given orally in context.

Reading Comprehension is a twenty-four item timed test with two samples. In the first part of the test the students read pairs of sentences. They use context clues to select from four given words the one that is missing from the second sentence. In the second part of the test the students read passages, which are followed by questions. The questions cover the student's ability to grasp details, summarize, perceive relationships, and draw conclusions.

Mathematics Concepts is a five item test. Skill areas tested include sets and numeration, operations and problem solving, measurement, and geometry.

Mathematics Computation is a twenty-seven problem timed test. Included are problems in addition and subtraction of two- and three-digit numbers with regrouping and problems involving multiplication of one-digit numbers.

Mechanics, which is timed, consists of twenty items. Items 1-6 test the student's ability to alphabetize lists of four words according to the first two letters. Items 7-12 test the student's ability to select a sentence part that completes a sentence with correct punctuation. In items 13-20, the students select a sentence part that is not capitalized correctly.

Usage consists of twenty items and a sample. The students work independently within a time limit, selecting the correct word or group of words from four alternatives. The items test students' skills in correct usage of verb

tenses and forms, pronouns, comparatives of adjectives and comparatives of adjectives and adverbs, and sentence structure.

Spelling is a twenty-nine item test. Students select from four alternatives the correct spelling of words given orally in the context of a sentence. Words tested include many of the most commonly misspelled words.

Educational Ability Series (EAS)

Picture and Word Vocabulary is a twenty-item test which examines a student's knowledge of word meanings. Each item consists of a word stimulus and four picture or word choices, one of which illustrates or means the same as the word stimulus. To answer correctly, the student must identify the picture named or find the word with the same meaning. The items in this cluster constitute the verbal component.

Number contains seven items designed to measure whether the student has acquired some general quantitative concepts. The student must be able to understand certain concepts and perform some elementary operations using the concepts. The items in this cluster contribute to the nonverbal component.

Picture Grouping consists of seven items and each item is composed of four pictures. Three of the pictures are alike in some way; one picture is different. The student is required to find the picture that is different and does

not belong with the other pictures. These items are included in the nonverbal component.

Spatial examines the student's ability to visualize the relation of one shape to another. Given a stimulus in the form of a partially completed square, the student is required to select the piece that correctly completes the square. These items are part of the nonverbal component.

VITA 2

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Doctor of Philosophy

Thesis: THE EFFECTS OF A THINKING SKILLS CURRICULUM ON LEARNING ABILITY AND ACHIEVEMENT OF SECOND GRADE STUDENTS

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