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Dynamic Assessment of Preschool Children with Special Needs: Comparison of Mediation and Instruction

by

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The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies for acceptance, a thesis entitled, "Dynamic Assessment of Preschool Children with Special Needs: Comparison of Mediation and Instruction" submitted by Cheryl Missiuna in partial fulfillment of the requirements for the degree of Master of Science.

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ABSTRACT

A quasi-experimental design was used to investigate the effectiveness of two methods of intervention during a dynamic assessment procedure. The subjects were 43 special needs preschool children who were demonstrating a variety of language, behavioral and learning difficulties. A dynamic assessment procedure was administered and a comparison was made of the effects of a mediational style of intervention in contrast with an instructional approach.

The test utilized was the Children's Analogical Thinking Modifiability Instrument, an unpublished assessment designed to measure the development of analogical reasoning skills in preschool children. Four distinct phases were administered over two sessions: baseline, pretest, intervention and posttest. During the intervention phase, 27 children received mediational teaching which was provided contingently based upon each child's individual performance and behavior. The remaining 16 children received a form of task-specific, instructional teaching which was provided in a previously standardized manner.

Descriptive statistics and tests of significance were used to compare the effects of intervention (mediation/instruction), examiner, and amount of time expended. Correlational analyses were used to investigate the association between age and performance. Observations performed by an independent rater of the videotaped intervention sessions are presented. Exploratory results regarding types of errors made, pattern of cognitive functions observed, and specific examiner behaviors are also outlined.

Group composition and pretest performance were found to be nearly identical. Highly significant differences were found on posttest performance: the mediation group performed significantly better on a measure of near transfer learning while the instruction group performance remained unchanged.

The results of this study suggest that mediation is an effective method of intervention with this population for improving performance on the Children's Analogical Thinking Modifiability Instrument. Specific factors which may have influenced the effectiveness of the learning are examined. Implications for assessment procedures, education and future research are discussed.

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CHAPTER ONE

Introduction

The assessment of the preschool child is a special challenge. The young child's low verbal skills, distractibility, short attention span and transient responsiveness make him difficult to assess under the best of circumstances (Lidz, 1983; Bagnato & Neisworth, 1981; Lerner, Mardell-Czudnowski & Goldenberg, 1981). Yet, for the child with special needs, psychoeducational evaluation may be essential in order to identify, diagnose, determine placement or plan educational intervention (Ysseldyke & Shinn,1981; Resnick, 1979). Standardized assessments, traditionally used in order to perform the above functions, have been criticized by many, particularly in their usage with preschool populations. It is recognized that normative assessments may be useful for purposes of identification and for arriving at specific diagnoses (Reynolds & Clark, 1983); however, as Keogh and Becker (1973) have suggested, standardized tests, "often provide little direction to planning an educational program for the high-risk child" (1973: p.10). This viewpoint is confirmed by numerous

others (Swanson & Watson, 1982; Hamilton, 1983; Lidz, 1981; Haywood, 1977; Ysseldyke & Shinn, 1981; Stott, 1978). It is felt by many that the focus of testing in preschool children should be on the identification of a child's strengths and optimal learning style; ideally, assessment results should directly suggest approaches that may be used in remediation (Lidz, 1983; Lichtenstein & Ireton, 1984; Bagnato & Neisworth, 1981; Davidson, Silverman & Hughes, 1981; Feuerstein, Rand & Hoffman, 1979).

It has long been recognized that standardized assessments provide an underestimation of the intellectual performance and potential of many children who are demonstrating specific learning difficulties (Mercer, 1973; Bryant, Brown & Campione, 1983; Baumeister, 1984; Campione, Brown, Ferrara & Bryant, 1984). Instruments which incorporate dynamic or clinical assessment methods attempt to move beyond the static assessment results and evaluate a child's learning potential by determining the degree to which an examiner is able to produce change during the testing situation. Evidence of this change is interpreted as the degree to which a child's performance is modifiable, given appropriate intervention. The information obtained also provides an index of the amount and type of intervention which will be required in order for the child to improve.

Two theorists, Vygotsky and Feuerstein, have made major contributions in the field of assessment of learning potential. Vygotsky (1978) and followers have utilized a graduated prompt method which is based upon his theory of a zone of proximal development, the distance between a child's actual developmental level and his potential to solve problems with assistance. In this approach, the child is presented with a task in a standardized manner and is then given gradual prompts, as required, until he solves the problem.

Feuerstein's mediational approach to assessment is based upon his theory of structural cognitive modifiability (Feuerstein, Rand, Hoffman & Miller, 1980). The Learning Potential Assessment Device (Feuerstein et al, 1979) exemplifies Feuerstein's ideas regarding the use of mediated learning experiences during the dynamic assessment procedure. Intervention, termed mediated learning experience, is provided contingently upon a child's performance in order to ascertain and, hopefully, produce change in a child's cognitive deficiencies. The examiner teaches content, principles and strategies that the child needs for successful performance: these are task-related but transcend the assessment situation.

Both of the above types of assessment have been the focus of much research in older school-aged, adolescent and adult populations (reviewed in Brown & Ferrara, 1985; Feuerstein, Miller, Rand & Jensen, 1981; Feuerstein et al, 1979) yet very little research has utilized dynamic assessment procedures with young children.

Bryant, Brown & Campione (1983), using a graduated prompt assessment procedure with normal 5-year-olds, found that scores on intelligence tests plus dynamic assessment results predicted task improvement more accurately than intelligence scores alone. Burns (1983) compared the graduated prompt method and the mediation procedure with 4 to 6-year-old children who were experiencing learning problems. Children in both groups showed a pre- to posttest improvement; however, children who had received mediation scored significantly higher on posttest and transfer test performance. Tzuriel and Klein (1985) performed a validation study of a test that they have developed, the Children's Analogical Thinking Modifiability Instrument (CATM). Kindergarten children from four criterion groups (normal, disadvantaged, mentally retarded and special education) were assessed using a dynamic pretest-teach-posttest approach. During the teaching phase, intervention was provided in an instructional manner

that was not specifically contingent upon the child's performance. Children from the first three groups demonstrated improvement using this instructional method: the heterogeneous special needs group did not improve, as meaured by change in pre- to posttest performance.

It would appear that dynamic assessment procedures are useful both in predicting learning potential and in generating improvement in task performance in young children with learning problems; however, the nature of this intervention has not yet been clearly established. Tzuriel and Klein's (1985) study indicated that an instructional approach was beneficial with most children but did not produce change in children with special learning needs. The resulting implication is that an alternate form of intervention is required in order for these children to learn, as demonstrated by improved task performance. Feuerstein's theory would suggest that these children require the provision of mediated learning experiences that are directly contingent upon their behaviors and performance.

The present study investigated the effectiveness of a dynamic assessment instrument, the Children's Analogical Thinking Modifiability Instrument, (Tzuriel & Klein, in press: see Note 1) with preschool children who were experiencing learning difficulties. The major objective of

this research was to compare mediational intervention, based upon the work of Feuerstein and associates (Feuerstein et al, 1979), with a more standardized form of instructional intervention (Tzuriel & Klein, 1985). The research hypothesis postulated was that children provided with contingent mediational intervention would show greater performance gains on the pre- to posttest scores of the CATM than would children who received instructional intervention.

CHAPTER TWO

Review of the Literature

Assessment of Preschool Children with Special Needs

An Overview of the Problem

Normative assessment instruments have traditionally been used to identify, diagnose and predict future school problems in preschool children with special needs. Quite recently, there has been increasing controversy and dissatisfaction regarding the use of psychoeducational testing in special education (Galagan, 1985). An underlying assumption of this traditional approach is that children have had equal opportunities to learn and also that they are equally motivated to demonstrate this learning during a testing situation: an assumption that is clearly not valid with this population (Haywood, Filler, Shifman & Chatelanat, 1975; Haywood, 1983: see Note 2). In addition, the variable behavior and performance of the preschool child can make normative assessment results extremely difficult to interpret (Lidz, 1983b; Bagnato & Neisworth, 1981).

Current literature indicates that researchers have begun to question the reliability and validity of many standardized instruments used with

this population (Boehm & Sandberg, 1982; Palfrey, 1979; Bagnato & Neisworth, 1981) and empirical evidence has suggested that standardized assessments: 1) fail to accurately predict later school problems (Satz, Taylor, Friel & Fletcher, 1978; Horn & O'Donnell, 1984; Baumeister, 1984; Feshbach, Adelman & Fuller, 1974; Rubin, Barlow, Dorle & Rosen, 1978) ; and, 2) fail to provide useful information for educational intervention (Eaves, Kendall & Crichton, 1974; Keogh & Smith, 1970).

An advantage of standardized assessments is that they are practical and relatively easy to administer and, thus, will probably continue to be used in screening and identification. Scores received on these static tests, however, do not indicate the degree to which performance has been influenced by previous learning experiences nor do they identify individual learning processes (Meyers, Pfeffer & Erlbaum, 1985). It is clear that an alternative framework of assessment is required in order to determine the educational and therapeutic needs of the preschool child who is exhibiting learning difficulties.

MacIntyre, Keeton and Agard (1980) have proposed that the focus of the assessment procedure be upon the provision of relevant information which will facilitate learning in the classroom. This linkage between assessment and curriculum has received considerable support in the

literature (Meyers, Pfeffer & Erlbaum, 1985; Lidz, 1981; Bagnato & Neisworth, 1981; Jansky, 1978; Keogh & Becker, 1973). Elaborating more specifically on this point, Davidson, Silverman and Hughes (1981) suggest the need:

> to look at the processes which a child uses to acquire knowledge as well as at the specific knowledge he has already acquired. For this we need measures of such knowledge and of the learning process itself, especially a child's characteristic strategies of learning and problem-solving. (p.5)

This process-oriented approach signals the movement toward a model of clinical assessment which emphasizes how a child learns rather than the more traditional, product-oriented measures of performance and achievement. The results of these child-referenced types of assessments should lead more directly to the development of individualized intervention plans.

Alternatives to Standardized Assessment

Alternatives to normative assessment of preschool children with special needs may be considered under three major categories:

1) Criterion-referenced tests. Based upon an analysis of the developmental skills required in the performance of particular tasks, these tests are designed to assess a child's mastery of a specific content area. An obvious advantage of criterion-referenced measures is the direct application of test results to the classroom setting. A major disadvantage with special needs children is that these measures generally do not provide an indication of a child's problem-solving skills nor the reasons for successes and failures in learning (Lidz, 1979; 1983b).

2) Informal Assessment Techniques. A variety of techniques such as direct behavioral assessment, ongoing assessment, and systematic observation may be included in this category. Gerken (1983) defines informal assessments as, "those techniques that are not standardized and normed on a sample population, have no documented reliability and validity data, and tell what a child does, not how he or she compares with other children." (p.397). These informal techniques can be extremely useful for obtaining qualitative data in a child's natural learning environment; however, one of their major weaknesses is a lack of specificity as to a child's specific learning problems (Gerken, 1983).

3) Learning Potential Assessments. A test-teach-test format is generally used in these approaches in order to examine and measure the

processes of learning (Meyers, Pfeffer & Erlbaum, 1985). Intervention and/or instruction is an integral part of the assessment procedure and the child's response to that intervention is measured as an index of his potential for learning (Hamilton, 1983). Specifically, the assessment focuses on the types of strategies which will facilitate the acquisition of new information or skills in another learning situation (Kratchowill, 1977). Emphasis is placed upon what the child is able to learn with adult assistance, not what he has previously learned.

Dynamic assessment measures appear to elicit more accurate and relevant educational and diagnostic information. This information is of particular importance in the identification and intervention process with preschool children who are demonstrating learning difficulties. Although standardized assessments may still be used to identify these children, dynamic assessments are essential to provide an understanding of a child's potential for learning and of the manner in which that success might be facilitated.

The development of the learning potential framework which is used in dynamic assessment, as well as some of the advantages and disadvantages inherent in its use, will now be considered in more detail.

Learning Potential Assessments

Historical Background

The concept of learning potential assessment has originated from the work of several twentieth century theoreticians. One of the major contributions to the dynamic assessment approach arises from the developmental concepts of the child psychologist, Jean Piaget (described in Piaget, 1952; Flavell, 1963; 1977; Ginsburg & Opper, 1979; Labinowicz, 1980). Piaget perceives intelligence as an example of biological adaptation. He describes a sequence of intellectual development that is characterized by evolving cognitive structures which adapt in response to stimuli from the environment. Adaptation is comprised of the two complementary processes of assimilation and accommodation. When a child encounters stimuli from the environment that are not too discrepant from his existing cognitive structures, he is able to assimilate the new information. If the information encountered cannot be incorporated into the existing structures, then the structures themselves accommodate to the new material. This interplay between assimilation and accommodation is always working to create cognitive structures that will enable the child

to be in a state of equilibrium with his environment. In this theory, intelligence is not perceived as a static entity that can be measured at a given point in time (Haywood et al, 1975). Instead, intelligence is seen as a process that results from the constant interaction of the child and the environment.

From a Piagetian perspective, it would seem logical that intellectual and educational assessments would attempt to measure the child's method of adaptation in a new learning situation. Yet, as Andre Rey (1934) observed, "psychometrists seem to be more interested in the already existing adaptive responses than in the process of adaptation itself and the development of the responses." (Cited in Haywood et al, 1975; p.102). Conventional intelligence tests generally measure only what the child has learned prior to the assessment (Hamilton, 1983). As previously stated, the assumption underlying this testing is that individuals have had equal opportunities to learn and that they are motivated to demonstrate that learning in the test situation (Mercer, 1973). This assumption is untenable, particularly when considering a child with special learning needs. A number of clinicians have recognized these and similar concerns and have developed various assessment procedures which incorporate some form of intervention into the assessment process.

Else Haeussermann (1958) formulated one of the first evaluations for young handicapped children in which the primary purpose was the development of a plan for educational intervention. Through careful task analysis, she developed a series of probes which permitted modification of the original test item according to the individual needs of the child. The Psychoeducational Evaluation of the Preschool Child (Jedrysek, Klapper, Pope & Wortis, 1972), based on the Haeussermann approach, "provides an opportunity to watch the child learn under standardized conditions and to explore his capacity to master new learning" (p.1). This approach was an early attempt to measure learning potential in a special education population.

The learning potential assessment procedure developed by Budoff and colleagues also stresses training, the child's ability to profit from a teaching experience. This nonverbal procedure was originally developed in order to differentiate between children who were educationally rather than mentally retarded (Budoff, Meskin & Harrison, 1971). In earlier studies, a modified Kohs Block Design Test was administered to subjects as a pretest: this was followed by training sessions which extended over a period of time. Empirical investigations have shown that mentally retarded subjects who had demonstrated improved posttest scores after

coaching (gainers) tended to perform more competently and to benefit more from academic learning situations (Budoff, Meskin & Harrison, 1971; Budoff & Gottlieb, 1976). Later studies investigating the use of Raven's Colored Progressive Matrices (Raven, 1956) and the Series Learning Potential Test, confirmed the effectiveness of training both in improving the problem-solving abilities of children (Budoff & Corman, 1976) and in tapping the intellectual potential of some low-IQ children (Babad & Budoff, 1974).

The intervention procedure used in Budoff's work focused on task-specific training which taught the child to analyze complex tasks into less complex components. This test-train-test strategy has been shown to differentiate learning potential amongst psychometrically mentally retarded children (Haywood et al, 1975) but the specific effects of the training are somewhat vague (Brown & Ferrara, 1985). In addition, the focus of Budoff's work has been upon the amount of variability among individuals not the amount of change that can be produced within a single individual.

Kratchowill (1977) has suggested that much more information is needed regarding the use of these assessment strategies with special education populations other than the mentally retarded. Sewell and

Severson (1974) attempted to evaluate the predictive effect of Budoff's learning potential strategy with young black children. Pretest to posttest gain scores were not found to exceed IQ tests in predictive potential but did serve to differentiate among children who were able to benefit from the learning experience. This finding further confirms the comment that the focus in Budoff's approach is on inter- rather than intra-individual variability.

Both Haeussermann and Budoff provide examples of clinical assessment techniques which are based upon the premise that a child's true abilities may be quite different than suggested by the results of product-oriented standardized test measures (Meyers, Pfeffer & Erlbaum, 1985). These techniques are not useful, however, in providing a systematic measure of the extent to which a given child's performance can be improved through examiner intervention. In an assessment of learning potential, the diagnostic goal of comparing a child to a normative sample is replaced by a more dynamic goal which "seeks to measure the degree of the individual's modifiability by providing him with a focused learning experience" (Feuerstein, Rand & Hoffman, 1979: p.56). This shift represents a movement away from what a child knows to a consideration of how that information has been acquired (Miller & Davis, 1981). As such,

the learning potential assessment has much more direct relevance to, and implication for, educational and therapeutic intervention.

The theoretical approaches of two individuals, Vygotsky and Feuerstein, who have made major yet distinct contributions to the assessment of learning potential, will now be examined.

Theoretical Approaches

A. Vygotsky: Zone of Proximal Development

Vygotsky's (1978) theory of cognitive development is based upon his interactive view of learning. He suggests that children first experience cognitive activities (eg. problem solving) in the presence of significant others, a situation during which the adult is doing most of the cognitive work. Gradually, the child begins to share in the cognitive activity and to internalize these functions until, eventually, he is able to perform these independently. During this process, the adult works at the level at which the child is currently functioning and leads the child to the highest level that he is capable of achieving at that time (Campione, Brown, Ferrara & Bryant, 1984). Vygotsky (1978) conceptualizes a zone of proximal development which he defines as:

> the distance between the actual developmental level as determined by individual problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers. (p.86)

The zone of proximal development, then, is considered by Vygotsky to be an index of the learning potential of the child (Meyers, Pfeffer & Erlbaum, 1985).

Clinical assessments, based upon Vygotsky's theory, attempt to distinguish between a child's actual developmental level, as one might measure through performance on a standardized test, and his level of potential development, the level which he is capable of attaining with the assistance of an adult. The difference between performance and potential is interpreted as the zone of proximal development (Haywood, 1985). In a typical testing situation, an item is presented to the child in a manner similar to that used in standardized intelligence testing. If the child is unable to derive the correct solution independently, the adult gradually adds clues or prompts and assesses how much information is required in order for the child to solve the problem. Once a solution is reached, a different version of the task is presented in order to determine whether the child is able to transfer the learning to the novel item. Both the

number of instructional prompts required and also the child's ability to transfer are measured (Brown & French, 1979; Brown & Ferrara, 1985).

Originally developed in the Soviet Union, this method of assessment has been elaborated upon in the United States by Brown and associates. In numerous investigations, this approach has shown greater evidence of potential in slow-learning children than was apparent in normative tests of intelligence (Brown & Ferrara, 1985; Brown & French, 1979; Campione & Brown, 1978; Campione, Brown & Ferrara, 1982; Bryant, Brown & Campione, 1983; Campione, Brown, Ferrara, Jones & Steinberg, 1985). In current work, Brown and colleagues have begun to focus on the speed and efficiency of learning and also on transfer flexibility as measures of ability that must be considered during the process of mapping the width of a child's zone (Brown & Ferrara, 1985; Ferrara, Brown & Campione, 1981).

Recently, Brown has emphasized the necessity of extending work in this area and developing learning potential assessment tasks that are appropriate for younger children. As previously discussed, standardized assessments have not been successful as indicators of a preschool child's future performance capabilities. Brown and Ferrara (1985) discuss the potential merits of graduated prompt methods with this type of population and state that their "particular concern is with the potential utility of ZPD

measures at an age when static IQ scores do not act as good predictors, let alone diagnostic aids." (p.25)

Studies which have utilized the graduated prompt method with preschool populations will be reviewed in a later section.

B. Feuerstein: Theory of Structural Cognitive Modifiability

Feuerstein's theory of structural cognitive modifiability is a natural extension of the developmental concepts of Piaget. Feuerstein defines intelligence as " the capacity of an organism to use previously acquired strategies for its adaptation to new situations" (Feuerstein, 1979: p.362). Adaptation takes place through two distinct methods. The first, as described by Piaget, occurs as a result of direct exposure to stimuli. The modality of change in this case is the equilibration process resulting from the assimilation and accommodation of stimuli from the environment (Feuerstein, 1979). Feuerstein postulates a second modality through which an individual's cognitive structures can be modified: he calls this mediated learning experience (Feuerstein 1979, 1981; Feuerstein & Rand, 1974). Like Vygotsky, Feuerstein focuses on the interpersonal nature of the learning situation. He feels that an essential element of learning is the presence of an individual who interposes himself between the child and the external

stimuli which he is receiving. This mediating adult organizes and transforms the stimuli so that the child is able to perceive the environment in a more meaningful way (Feuerstein, 1981). A major difference between Feuerstein's model and the Brown-Campione approach is the emphasis upon much more directive teaching by the adult of principles and strategies which can be generalized to new learning situations (Haywood, 1985).

I. Mediated Learning Experience.

Feuerstein (1979) proposes the following relationship between the two modalities of learning: "the more an organism has been subjected to adequate levels of mediation, the greater is its capacity to learn through direct exposure to stimuli." (p.366) Mediated learning experience, then, is considered by Feuerstein to be the primary, or proximal, reason for individual differences in performance. While recognizing the existence of contributory factors such as organic brain damage, environmental deprivation, emotional disturbance, etc., Feuerstein argues that these have a secondary, or distal, effect on the child's ultimate cognitive abilities (Feuerstein & Rand, 1974) The impact of these distal etiological factors on a child's outcome is felt to depend upon the nature and success of the

mediated learning which he has experienced. During a mediated learning experience, an adult intentionally mediates stimuli from the environment such that the stimuli undergo change before being processed by the child (Feuerstein, 1979;1977). The mediator transforms the stimuli:

> selecting stimuli; scheduling them; framing and locating them in time and space; grouping certain stimuli or segregating others; providing certain stimuli with specific meanings as compared with others; providing opportunities for recurrent appearances; bringing together objects and events that are separate and discrete in terms of temporal or spatial dimensions; reevoking events and reinforcing the appearance of some stimuli; rejecting or deferring the appearance of others.
> (Feuerstein, 1979: p.365-366)

The intent of a mediated learning experience is to improve the child's ability to recognize and use appropriate cognitive operations as required by a task (Feuerstein, 1970). He is also helped to perceive relationships among stimuli, objects and events. Children who are demonstrating learning difficulties may not be able to filter stimuli appropriately or perceive these relationships without the assitance of an adult. As a result of mediated learning experience, the child becomes better able to efficiently use the first modality of learning, direct exposure to stimuli (Feuerstein, 1979; 1977).

There are two major explanations for a child having received inadequate mediated learning. The first is lack of provision of mediated learning experiences for reasons such as poverty, parental disabilities, cultural disadvantage, etc. The second reason, more relevant to the special needs population, is the presence of factors within the child (eg. impulsivity, hyperactivity, behavioral and/or emotional disturbance) which make him inaccessible to mediation provided in the normal way. In these cases, mediation may need to be provided much more intensively or in a more directed fashion in order to create modifiability in the child (Feuerstein & Jensen, 1980; Feuerstein, 1981).

Feuerstein stresses that the process of mediation is not contingent upon the modality or language used nor on the content around which the mediation takes place (Feuerstein, 1979). Certain criteria, however, are essential in order for an interaction to be truly mediational.

1) Intentionality: Intentionality is evidenced by the adult's conscious desire to alter stimuli in order to meet the child's individual needs. The adult has a specific purpose or goal for that learning situation and demonstrates this through his actions or words. For example, intentionality may be observed at the beginning of an interaction when the adult engages a child and focuses his attention on a particular task or object.

2) Transcendence: A mediated learning experience must transcend the immediate needs of that situation. The adult intends to transmit to the child an understanding of principles or strategies that will be helpful to him in other situations. In a problem-solving task, the answer would not be specifically taught; instead, the focus would be placed upon the process necessary to derive the solution to this or any similar type of problem. The adult also helps the child to generalize new learning and to relate it to other situations or events.

3) Meaning: Throughout the mediated learning experience, an adult tries to create in the child an understanding of the meaning of the object or interaction. Meaning can be conveyed in verbal or nonverbal ways through use of affect, facial expressions, highlighting relationships between objects and events or explicitly discussing the meaning or purpose of the interaction with the child. The emphasis in this criterion is on the expression of that meaning to the child.

4) Competence: The mediator communicates to the child that he [the child] is a capable individual. This might be done explicitly through the provision of feedback to the child regarding his competence or, implicitly, through provision of experiences which are successful and motivating for the child.

5) Regulation of Behavior: During a mediated learning experience, the adult intends to help a child gain increased insight into and control of his own behavior. Behavior, in this sense, is interpreted quite broadly to include the child's characteristic approach to, elaboration of and response to a problem or event. For example, the adult may intend to improve a child's ability to explore his environment more systematically before selecting an answer.

(Criteria adapted from Feuerstein & Hoffman, 1982; Klein & Feuerstein, 1985; Klein, Note 3)

A total of ten criteria of mediated learning have now been developed by Feuerstein and colleagues and these are continually being revised. Feuerstein and Hoffman (1982) indicate, however, that only the first three criteria are absolutely essential for all mediated learning interactions. Mediation of competence and regulation of behavior should generally be included but may be more appropriate to some interactions than others. Klein and Feuerstein (1985) stress that any of these criteria can be transmitted verbally or nonverbally and that parents generally provide mediation to their children in a very natural way. As mentioned before, the child's readiness to be modified by that experience may depend upon

factors within the child as well as on the quality and appropriateness of the mediation.

The theory of mediated learning experience is the foundation of Feuerstein's belief that children's cognitive abilities can be modified (Feuerstein et al, 1980). He believes that, through the provision of mediated learning experiences tailored to meet specific needs, all children can learn and, ultimately, structural cognitive change can be generated.

Feuerstein's theories regarding this complex interaction between a child, a mediating adult and the environment, lead to a view of intelligence as the capacity for being modified through learning. It follows logically that psychoeducational assessment should be concerned with measuring the individual's capacity for modification through interaction with the examiner (Feuerstein, Rand & Hoffman, 1979).

II. Dynamic Assessment.

The Learning Potential Assessment Device (LPAD), developed for use with low-functioning adolescents and adults (Feuerstein, Rand & Hoffman, 1979), exemplifies Feuerstein's theoretical model of assessment. Feuerstein, Miller, Rand and Jensen (1981) outline the changes from traditional psychometric approaches which are required in order to assess

learning potential in a dynamic way. Any dynamic assessment which purports to be based on Feuerstein's theories would need to incorporate the following features:

1) a shift from a product to process orientation where the goal becomes the modification of cognitive functioning;
2) the ability to make alterations in the test structure along several parameters (eg. modality, complexity) intended to facilitate the diagnostic process;
3) changing the nature of the examiner-examinee relationship such that the child becomes actively engaged in the learning process;
4) interpreting the test results as an indication of areas of strength, weakness, and untapped learning potential.

Feuerstein analyzes each assessment task along several parameters: his consideration of the parameter 'phase' is of particular interest in the diagnostic assessment of children exhibiting learning difficulties. Phase refers to the type of information processing which is required during a specific mental activity. Feuerstein considers that any mental act includes three phases: input, elaboration and output. The input phase involves gathering information through the senses. Cognitive functions

involved in this phase might include gathering clear and complete information, systematic exploration of the environment, identifying and labelling objects, etc. The second phase, elaboration, involves mentally working with the information which has been acquired. For example, the individual might make a plan for action, compare and categorize objects or hypothesize about future events. The output phase includes cognitive functions which are essential for verbal or nonverbal communication of knowledge. Relevant examples might include restraint of impulsivity or the production of verbal responses that are clear and reflect an understanding of the perspective of the listener. Although all three phases are interrelated, poor performance on a task may be primarily attributable to failure in one particular phase (Feuerstein et al, 1981). During the assessment process, an attempt is made to delineate the cognitive functions which are being utilized by the child in an efficient or deficient manner in order that these may become a focus in remediation. A detailed description of these cognitive deficiencies is available in the literature (eg. see Feuerstein, Rand, Hoffman & Miller, 1980).

The Learning Potential Assessment Device (Feuerstein et al, 1979) is the culmination of Feuerstein's many years of clinical practice and the development of a very detailed theory. Haywood (1985) presents a concise

summary of the very complex requirements of this type of dynamic assessment:

> [the examiner must] identify well-developed cognitive functions, identify other obstacles (such as lack of information) to effective problem solving, determine the kind and amount of investment (ie. teaching) needed to overcome the identified deficiencies, and demonstrate successful application of appropriate cognitive strategies to the solving of new problems.
> (p.15-16)

This device, properly administered, probably reflects the ideal teaching and learning situation. Yet, as Mearig (see Note 4) points out, the LPAD is not yet widely used in school psychology, in part due to the significant amount of time, education and training required in order to learn its administration and interpretation. These disadvantages are also likely to be inherent in any assessment procedure which is developed based upon the theory of mediated learning experience. The skill of the examiner in meeting the outlined requirements will certainly be a factor in the success of the interaction.

Research on the use of Feuerstein's dynamic assessment procedures has, understandably, focused primarily on the use of the LPAD with older

school-aged children, adolescents and adults (reported in Feuerstein et al, 1979; 1981a, 1981b). Very recently, attempts have been made to develop instruments which have the same basic goals as those described above but which are more appropriate for young children. Research utilizing dynamic assessment instruments, based upon the theories of Vygotsky and Feuerstein, developed for use with preschool populations will now be reviewed.

Dynamic Assessment: Research with Preschool Populations

Dynamic assessment is probably the optimal model of assessment for preschool children with special needs yet remarkably little research has been performed with this population (Lidz, 1983a). Most of the dynamic assessment measures designed for older children evaluate different types of intellectual processes and activities than are present in preschool children. In addition, the assessment tasks are often quite inappropriate for use with young children who respond more positively to game-like approaches and three dimensional, manipulable materials (Tzuriel & Klein, in press). In a very thorough review and discussion of dynamic assessment with preschool children, Lidz (1983a) concluded that

there was not yet a standardized preschool dynamic measure in existence that was well developed. Of the assessment tools developed for use with preschool children, most (eg. Jedresyk, Klapper, Pope & Wortis, 1972; Stott, 1978; Kaufman and Kaufman, 1983) are not felt to be based upon a systematic model of learning potential such as suggested by the theories of Vygotsky and Feuerstein.

Three research studies have been performed with preschool populations in which instruments have been developed that are based upon the philosophies of Vygotsky and Feuerstein: these will now be reviewed.

Bryant and associates (1983) used a graduated prompt dynamic assessment procedure with 55 normally developing 5-year-old children. A multiple regression design was used to determine whether scores from intelligence tests plus measures of learning and transfer would predict task-specific improvement better than intelligence scores alone. Children were tested over four sessions. During session one, children received tasks from standardized intelligence tests and a task-specific pretest (15 matrices problems). In session two, training was provided through a gradual provision of hints until a pre-established criterion level was met. Session three included near transfer tasks plus graduated prompts as required. During session four, a far transfer task

was provided and , as well, the task-specific pretest was readministered. Bryant et al's (1983) results verified that the children's performance on the static pretest was generally an underestimate of their potential: the utility of training and transfer measures in predicting improvement on a specific task was confirmed.

In a 1983 doctoral dissertation, Burns adapted Arthur's Stencil Design Test (Arthur, 1947) in order to compare the graduated prompt method, the mediational method and a static testing method. One hundred and twenty seven 4 to 6-year-old children in special education classes were screened using standardized test measures. Sixty children, determined to be mentally retarded or at-academic-risk, were randomly assigned to the three assessment groups (graduated prompt/ mediation/ static). Following training, the children's performance on an independent task and on a transfer task (Animal House subtest of the Wechsler Preschool Primary Scales of Intelligence: Wechsler, 1967) was compared across groups. Burns' (1983) results again indicated that both mediational and graduated prompt dynamic assessment measures revealed abilities not shown by static assessment. In addition, the mediational group was found to be significantly higher than the graduated prompt and static groups on measures of learning and transfer. The graduated prompt group was

significantly higher than the static group on measures of learning but not on transfer. This finding would suggest that mentally retarded and special education children who receive a mediational style of intervention are better able to generalize that learning to a transfer task. Burns (1983) also examined the relationship between time spent in training and performance gains: no systematic relationship was found.

The final empirical study, performed by Tzuriel and Klein (1985), pertains most directly to this research and will be discussed in detail. The Children's Analogical Thinking Modifiability Instrument (CATM: Tzuriel and Klein, in press: see Note 1) is one of the first measures, based on Feuerstein's dynamic assessment model, which has been developed specifically for preschool children. Three dimensional blocks which the child can manipulate are used to solve a series of sequential analogical problems. The more difficult test items require a high level of abstract thinking and involve simultaneous consideration of two or three dimensions (eg. size, color, shape). Tzuriel and Klein (1985) performed a validation study in order to compare the differential modifiability of four groups of children using the CATM. One hundred and forty kindergarten children were selected who comprised the following groups: regular middle class children (N=71); culturally disadvantaged, low socio-

economic status children (N=51); children in special education classes (N=18). The special education group was heterogeneous and included children identified as having learning difficulties, social maladjustment and/or emotional problems. A fourth group of older, mentally retarded children with a mental age of 5-6 years (N=20) was obtained from institutions. All children received the CATM and a standardized test, the Raven's Colored Progressive Matrices (Raven, 1965).

The administration of the CATM included four phases: preliminary phase, preteaching, teaching, postteaching. During the preliminary phase, a baseline level of mastery of basic concepts was established and the task was introduced to the child. The preteaching and postteaching phases both included a standardized administration of 13 analogical reasoning problems: no additional intervention was provided by the examiner. These three phases are nearly identical to the method used in this research and will be described in detail in the procedure section.

The teaching phase consisted of two main intervention strategies. In the analytic strategy, each dimension (size, color, shape) was analyzed separately and then the information was integrated. During the second intervention strategy, transformational rules were taught which emphasized the dimension which changed while the other dimensions

remained constant. Although referred to in their paper as mediation (Tzuriel & Klein, 1985), these intervention procedures were standardized for all children and, thus, are felt to constitute an instructional approach.

Direct instruction has been described as a type of teaching which attempts to maximize student attention to and encourage participation in a task (Lewis, 1983). Considered to be a fairly behavioral approach, it is nonetheless reflective of techniques used in classroom settings. For example, in an ethnographic study, Dillon and Searle (1981) determined that a grade one teacher's effort was directed toward ensuring that a particular fact or skill was learned and, also, that it was learned in a pre-established way. Borkowski and Cavanaugh (1979) have suggested, specifically, that the method selected for instruction must involve an analysis of the task in order to determine the appropriate strategies to be used. This is felt to be quite similar to Budoff's approach, described earlier, in which the focus was on task-specific training which taught the child to analyze a complex task into less complex components (Kratchowill, 1977).

Support for the particular teaching strategies employed in Tzuriel and Klein's (1985) research can be found in studies of analogical reasoning. Sternberg and Rifkin's (1979) study on the development of analogical

reasoning processes indicated that young children were not always capable of integrative encoding and that they performed better when analogical terms were broken down into constituent attributes. Bisanz, Bisanz and Lefevre (1984) also found that younger children tended to construct nonanalogical strategies but found that specific instruction on analogies enabled students to construct analogical rules: it must be noted that the younger subjects in this study were nine years old.

It would seem, then, that the combination used by Tzuriel and Klein (1985) of the analytic approach (which breaks each dimension into constituent attributes) and the transformational approach (which focuses on the analogy) has been supported in related literature as a method of instructional intervention.

The instructional method used in Tzuriel and Klein's validation study (1985) was found to be successful in generating high levels of modifiability in most children as measured by improved performance on the CATM. The children's performance on the postteaching section of the assessment was analyzed using two methods of scoring: all-or-none and partial credit (described in procedure section). The results indicated that regular and disadvantaged children improved significantly according to either scoring method, indicating their high level of modifiability. Change

in the mentally retarded and special education groups was insignificant according to the all-or-none method. Using a partial credit method, however, mentally retarded children also showed significant improvement. This finding was interpreted to mean that this population was highly modifiable when partial solutions were given credit but had difficulty when a full solution, in which all dimensions had to be integrated, was required (Tzuriel & Klein, 1985). It is not known whether greater modifiability could have been produced in the mentally retarded population using another method of intervention. The special education group, on the other hand, actually decreased in performance according to the partial credit method of scoring. With regard to the lack of improvement in the heterogeneous special education group, Tzuriel and Klein (1985) suggested that further research was needed in which individual differences were classifed and compared with specific patterns of modifiability. It was also postulated that the performance of this population would be improved if more appropriate intervention strategies were used [none specified] (Tzuriel & Klein, in press).

In summary, the Children's Analogical Thinking Modifiability Instrument (Tzuriel & Klein, in press: see Note 1) has potential as a dynamic assessment instrument that may be effectively utilized with

young children. Research utilizing learning potential assessments with preschool populations has shown that:

1) dynamic assessment measures contribute more information about a child's potential for learning than intelligence scores alone (Bryant et al, 1983; Burns, 1983);

2) regular, disadvantaged, and mentally retarded children demonstrate pre- to posttest performance gains on the CATM following standardized intervention procedures: special education children do not (Tzuriel & Klein, 1985);

3) special education children show improved learning following mediational intervention and are able to generalize this learning to a transfer task (Burns, 1983).

Summary

Normative assessment instruments are currently unable to provide the diagnostic and educationally relevant information which is needed in order to treat the preschool child with special needs. This population has clearly demonstrated their inability to profit from direct exposure to stimuli in that they have been identified by parents and professionals as children who are demonstrating learning difficulties. The exact nature of these difficulties, the extent to which each child is modifiable, and the amount and type of intervention which will be required are difficult to determine using standardized assessments. Dynamic assessment procedures provide a method of obtaining this essential information: using an interactive approach, an examiner is able to determine precisely how a child responds to and benefits from a new learning situation.

Dynamic assessments, based upon the theoretical models of Vygotsky (1978) and Feuerstein (Feuerstein et al, 1979), have shown promise with the preschool population. Research has shown that dynamic assessment measures, including the CATM, can predict learning potential and generate change in many young children. Research has yet to demonstrate the successful use of the CATM with a special education

preschool population. Burns' (1983) study and Feuerstein's theory would suggest that these children might benefit from the provision of mediation that is directly contingent upon each child's unique needs.

A review of the literature has indicated that mediational intervention has not been systematically contrasted with a standardized form of instructional intervention such as was used in the Tzuriel and Klein (1985) study. The need for this type of comparison is particularly evident with a population of children who appear to be unable to benefit from direct learning experiences and standard intervention approaches. Finally, there is a clear need for research that will contribute to the currently exiguous body of literature regarding the use of dynamic assessment procedures with preschool children who have special learning needs.

Aims of the Present Study

The purpose of the present study was to compare the effects of mediational intervention with instructional intervention utilized with special needs preschool children during a dynamic assessment procedure. The instrument selected, the Children's Analogical Thinking Modifiability Instrument (Tzuriel & Klein, in press: see Note 1), was chosen as past research indicated it to be an appropriate test for use with preschool children. The sample of special needs children obtained were considered to be representative of a preschool population who are extremely difficult to assess and for whom standardized assessments provide an under-estimation of potential performance. Dynamic assessment was used in order to demonstrate the potential of these children to be modified and to determine the specific nature of intervention which would best facilitate their success.

A detailed description of the two types of intervention which were utilized is available in the literature review. A brief definition of these terms, as they apply to this research, is given below:

Mediation: This term refers to the provision of intervention which is directly contingent upon, and modified by, the behavior and performance of

each child. An effort is made to ensure the teaching of content, strategies and principles which transcend the specific assessment task.

Instruction: A pre-established method is used to teach each child the assessment task. A combination of two instructional approaches is used which emphasize 1) task analysis (analytic approach); and, 2) an analogical, integrative solution (transformational approach).

In this study, one major research hypothesis was postulated:

Hypothesis: Children provided with contingent mediational intervention will show greater pre- to posttest performance gains on the CATM than children provided with instructional intervention.

It was anticipated that there would be no marked difference between the two groups on pretest items as indicated by their average pretest performance score.

In addition to the stated hypothesis, a number of questions were investigated which were of an exploratory nature.

It has been proposed by many that children will improve their performance through sheer repetition, or practice, of the test items (Anastasi, 1976;1981; Droege, 1966). In order to determine whether this population would benefit from additional examples of the same type, a second pretest composed of 13 parallel items, was developed by this

researcher and included in the pretest phase. The first question posed was as follows:

1) Will children in either group demonstrate any improvement in performance through provision of a second set of analogical problems during the pretest phase?

The second area of consideration was the amount of time required for the two methods of intervention. It was anticipated that mediation would take longer to administer than instruction. In Burns' (1983) study, however, no systematic relationship was found between amount of time taken and performance gains. Questions posed regarding the amount of time taken included:

2) Is there a difference in the amount of time required for mediational versus instructional intervention?

3) Is there any relationship between amount of time taken and performance gains?

Further exploratory questions were raised with regard to the performance of this group of children on this particular task:

4) Is there any relationship between age and performance outcome?

5) Is there any pattern to the type of errors made on this task of analogical reasoning?

6) Are particular dimensions of the task (size, color, shape) more or less resistant to modification?

The final area explored concerned the sample. Although this was a heterogeneous population, it was anticipated that there might be certain patterns of cognitive function which described the population. Tzuriel and Klein (1985) had recommended the need for further research to identify some delineating characteristics. The following question addressed this recommendation:

7) Is there any pattern to the type and frequency of cognitive deficiencies observed in this population while performing this task?

No specific predictions were made with regard to the above questions since they were developed in order to identify trends and to stimulate ideas regarding areas for future research.

CHAPTER THREE

Methodology

Experimental Design

A dynamic assessment instrument, the Children's Analogical Thinking Modifiability Instrument (Tzuriel & Klein, in press: see Note 1), was employed in this study in a pre- to posttest design with 43 special needs preschool children. The effects of two styles of intervention, mediation and instruction, used during the assessment process were compared. A quasi-experimental design (McMillan & Schumacher, 1984) was required since it was not possible to randomly assign subjects to the two treatment groups. This chapter provides a description of the sample, instrument and procedures used in this study.

Due to the subjective nature of the mediational form of intervention, examiner style and skill were considered to be potentially confounding variables. For this reason, a second examiner was employed to assess 14 of the children (12 mediation, 2 instruction). The examiner variable was not felt to be as critical a factor in the instructional intervention since the procedure was scripted out in a standardized fashion.

Subjects

Preschool children who are exhibiting early evidence of significant learning problems constitute a heterogeneous group. In order to obtain a sample that had identifiable characteristics, fairly stringent criteria were applied. Efforts were directed toward identification of children who were not globally developmentally delayed but who were demonstrating specific learning and/or behavioral difficulties. Agencies which provide programs for children with special needs were contacted and provided with the inclusion criteria. Parents were contacted by the respective agency and permission was obtained to determine the eligibility of their children for this project. Children were included in this study who met the inclusion criteria and for whom parental permission to participate in the assessment procedure was obtained.

Inclusion Criteria

1. Male or female child, between the ages of 4.0 to 6.0 years.
2. Currently enrolled in a preschool program which is designed for children with special learning needs.

3. Registered with one of the preschool clinics at the Alberta Children's Hospital.

4. Evidence of significant difficulties and/or at least one year delay (as determined by qualified personnel) in two or more of the following areas: behavior/socialization, receptive language, expressive language, articulation, fine motor development, gross motor development.

5. Have been recommended to receive one or more types of individual therapy intervention (eg. speech therapy, occupational therapy).

6. Normal or corrected normal vision.

7. No history of significant hearing loss.

Forty six children met the inclusion criteria and were included in the study. One child was withdrawn due to hospitalization, one child failed to pass the baseline phase (described in procedure section), and one child's data was eliminated due to a need for further examiner training.

Description of the Obtained Sample

Forty three children participated in all phases of the assessment process. Random assignment to the two intervention groups was not

possible due to a research project being performed concurrently. Thus, all of the children participating in the Learning Centre/Alberta Children's Hospital Preschool Education Project were assigned to receive mediational intervention (N=27). Half of the children in this project participated in a traditional preschool program. The other children were enrolled in a cognitive education program in which the teachers used mediational principles. In order to ensure that the teaching style used in the program had no significant effect, all children in the mediational intervention group were tested within two weeks of their entry into the program. The remaining 16 children who were obtained from four other traditional preschool programs were assigned to the instructional intervention group. The task utilized in this research was sufficiently novel that children would not have encountered either the content or the principles in their preschool program.

Descriptive data were used in order to evaluate the similarity of the two groups: the groups were determined to be nearly identical on all relevant characteristics. The final number, age, and sex distribution of each group is presented in Table 1. Determination of the Alberta Children's Hospital clinic affiliation, presented in Table 2, was made by the source of referral to the preschool program in which the child was now

TABLE 1: Summary of final groups by number, age and sex.

	Mediation Group	Instruction Group	Total Sample
Number of Subjects	27	16	43
Age			
Mean (in months)	58.56	59.50	58.91
S.D.	5.28	6.36	5.65
Sex			
Male	18	13	31
Female	9	3	12

TABLE 2

Alberta Children's Hospital Preschool Clinic Affiliation

Clinic	Mediation	Instruction	Total Sample
Preschool Developmental	24	7	31
Perinatal	1	2	3
Neurology	0	3	3
Cleft Palate	1	1	2
Speech	1	1	2
Neuromotor	0	1	1
Hemophilia	0	1	1
	N = 27	N = 16	N = 43

placed. The major disability rankings, outlined in Table 3, were indicated by the Alberta Children's Hospital assessment reports as areas of significant delay and/or recommended areas for therapeutic intervention. It can be seen that all of the children in this study had demonstrated evidence of expressive language delays as well as significant behavior and/or socialization problems. The majority of the children also had receptive language delays and many were delayed in fine motor skill development.

Instrument

The Children's Analogical Thinking Modifiability Instrument (CATM), developed by Tzuriel and Klein (in press: see Note 1), is a dynamic assessment that evaluates the development of analogical reasoning processes in young children. A test-teach-test approach is utilized to determine the extent to which a child's performance can be changed through intervention. The task initially appears to require quite basic consideration of three concepts (size, color, shape) which are familiar to preschool children. As items increase in difficulty, however, very abstract levels of thinking are required and the mental manipulation of

TABLE 3

Major Disability

	Mediation	Instruction	Total Sample
Behavior/Socialization, Exp. & Recep. Language.	8	5	13
Behavior/Socialization, Exp. & Recep. Language, Fine Motor.	12	5	17
Behavior/Socialization, Exp. & Recep. Language, Fine & Gross Motor.	1	2	3
Behavior/Socialization, Exp. & Recep. Language, Fine Motor, Articulation.	1	2	3
Behavior/Socialization, Exp. & Recep. Language, Articulation.	1	1	2
Behavior/Socialization, Exp. & Recep. Language, Gross Motor.	1	0	1
Behavior/Socialization, Exp. Language, Fine & Gross Motor.	2	0	2
Behavior/Socialization, Exp. Language, Fine Motor.	1	1	2
	N = 27	N = 16	N = 43

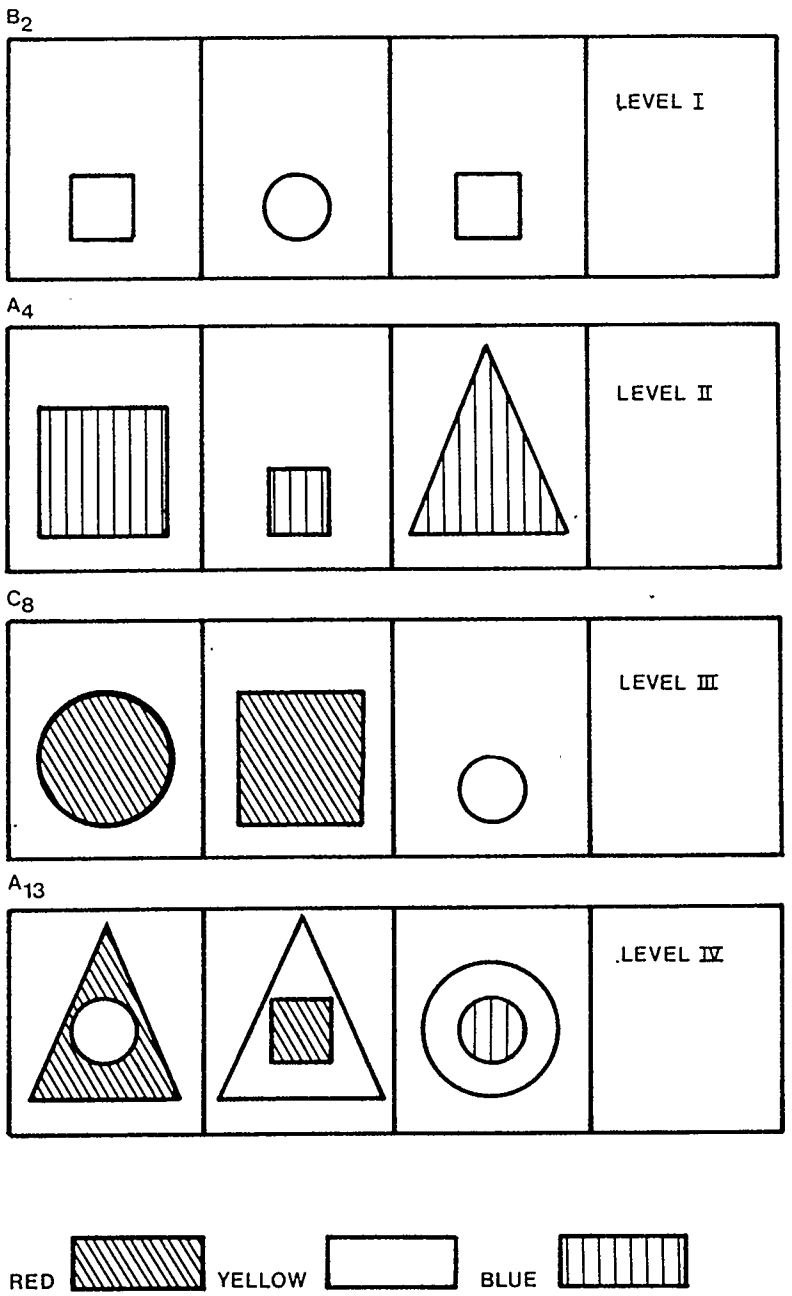
these dimensions becomes quite complex (Tzuriel & Klein, 1985).

The CATM instrument is comprised of 18 colored, flat blocks which are varied shapes and sizes. Also included are three sets of parallel items (Sets A, B, L), each set containing 13 analogical reasoning problems of ascending difficulty. Four levels of difficulty are included: Level I (items 1-2), one dimension changes while two are held constant; Level II (items 3-7), two dimensions change while one remains constant; Level III (items 8-10), all three dimensions change; Level IV (items11-13) additional blocks are introduced while three dimensions are changing. Example items are presented in Figure 1. Permission was obtained from the author to modify this instrument for research purposes (see Note 1); therefore, further descriptions pertain only to the instrument and procedures utilized in this study.

An additional set of problem items, parallel in difficulty to the other three sets, was developed by this researcher (Set C). Also, Tzuriel and Klein's (in press) teaching set (Set L) was reduced to nine items in order to decrease the length of time required during the intervention phase.

Sets A, B, and C, which were used in the Pretest 1, Pretest 2 and Posttest phases, were analyzed by the researcher to ensure that each item

Figure 1



Examplar items from the CATM

was truly of parallel difficulty (see Appendix C for examples of the level of difficulty and type of analogy required for each item). Although the sets were determined to be, theoretically, of equivalent difficulty, the order of administration was counter-balanced to eliminate any possible interference if one set was actually easier than another.

Procedure

The dynamic assessment process consisted of four phases administered over two sessions: Session1 - Baseline, Pretest; Session 2 - Intervention (mediation/instruction), Posttest. A short break was provided between each phase and a break of no less than two days and no more than one week occurred between sessions. The total assessment was approximately two hours in length. The actual scripted Baseline, Pretest, and Posttest procedures are included in Appendix A. The essential components and examplar methods for the two styles of intervention are also included in this Appendix. Two examiners were used to ensure that examiner style was not a confounding variable. Training sessions were conducted and intervention sessions were video-taped in order to ascertain a level of consistency between examiners.

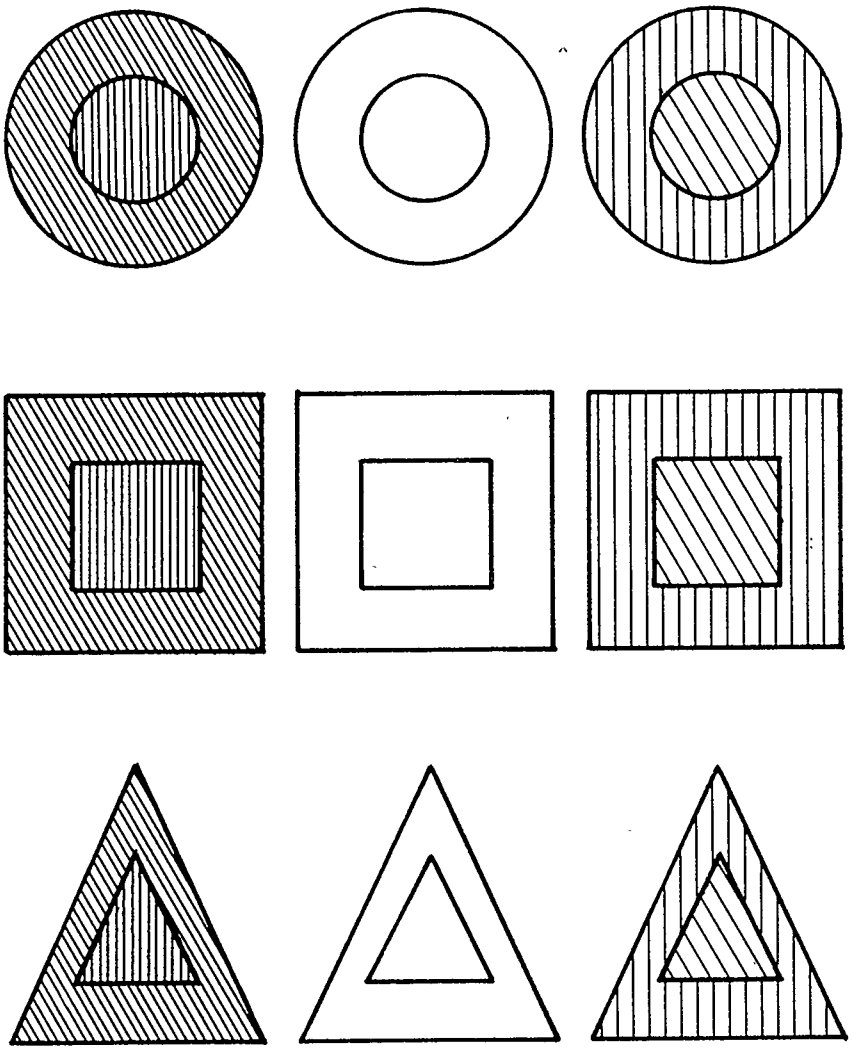
The following is a description of the general features of the procedure used in this research.

Baseline:

The assessment began with a preliminary phase during which time a baseline level of competence was established. Children were assisted by an inquiry process to form a matrix of blocks, organized on the basis of relevant attributes (see Figure 2). The presence or absence of labels (big/small; red/yellow/blue; circle/square/triangle) and concepts (size, color, shape) was determined. Children were not required to have expressive speech for the above. In addition, receptive comprehension was considered beneficial but not necessary. The minimum level of competence required to pass this phase was defined as the ability to visually match identical blocks. As previously indicated, only one child failed to meet this criterion.

In the latter part of this phase, basic rules and strategies (eg. make a pattern, search for and turn over blocks, etc.) were also taught. As suggested by Kaufman and Kaufman (1983) and also by Spiker, Cantor & Klouda (1985), two teaching items were included which allowed examiners to ensure that each child comprehended the task. Verbal instructions were

Figure 2



RED YELLOW BLUE

(Reproduced with permission)

supplemented throughout this phase by actual demonstration of the strategies and processes required to complete the analogical problems.

The baseline phase generally took 10 - 12 minutes and was followed by a 5 - 10 minute break.

Pretest:

During the second phase, the child's initial response to analogical thinking problems was assessed. Pretest 1, a set of 13 problems, was presented to the child. On each item, the child was required to compare the attributes of three blocks and to determine, by analogy, what attributes a fourth block would have. The child's verbatim response as well as his actual selection was noted. A short break was given at this point, if required. Pretest 2, a parallel set of 13 problems, was then administered in order to determine whether the child had learned from direct exposure to the first set of problems.

Intervention:

The intervention phase involved the examiner working with the child on nine analogical problems similar to those used in the pretest phase.

The specific methods employed in the two styles of intervention will be described separately.

Mediation Method:

Mediated learning experience was provided in a manner that was directly contingent upon the perceived needs of the child. At the beginning of this phase, the examiner's intentions and the purpose of the session were conveyed clearly to the child. The analytical approach and the transformational approach (see Appendix A) were used, at the discretion of the examiner, as strategies to solve the problems. An essential component of the mediation method was the emphasis on transcending the specific learning situation. Efforts were directed toward verbally or non-verbally assisting the child to focus on the problem, gather information, compare relevant features, summate and integrate the information, systematically explore the choices and then to make a single selection. It was felt that these strategies were general approaches which would be helpful to the child in any similar task or situation. The examiner encouraged the child to be an active participant in the learning process through prompting questions such as "What is the problem?". "What do we need to do first?", etc. A justification process was included at the end of each item during which time the examiner gave the child specific

feedback regarding his solution and, also, assisted the child to go over the process used in deriving that answer. An example of the mediation method can be found in Appendix A.

Instruction Method:

In this method, the examiner also began by engaging the child and ensuring that he understood the purpose of the session. The two approaches appropriate to teaching this task were then employed in a pre-established manner (see script of Instruction Method, Appendix A). The transformational strategy was introduced first. This approach emphasized the dimension (size, color, shape) in that problem which changed while the other dimension(s) remained constant. If this approach was unsuccessful, the analytical strategy was taught. In this strategy, each dimension (size, color, shape) was analyzed separately and then the information was integrated. When a solution was reached, the child's correct responses were positively reinforced by the examiner. Behavior was regulated, as required.

Posttest:

The final phase of assessment included the administration of a third set of 13 analogical problems. This phase was again performed in a

standardized fashion with no additional intervention given by the examiner. Positive feedback and encouragement were provided.

Data Collection

Scoring

Two methods of scoring were used to calculate the results of Pretest 1, Pretest 2 and the Posttest. The child's verbatim answer and actual selection were noted for each item on a scoresheet. For Method 1, the all-or-none credit method, a score of 1 was given for each correct selection. A total of 16 points was possible since items 11-13 each included the selection of two blocks. Using Method 2, the partial credit method, one point was given for each correct attribute (size, color, shape). A total of 48 points could be achieved. Additional data which was gathered included the total number of errors of size, color and shape made on each test. The amount of time taken during each phase of the assessment was also recorded.

At the end of each assessment, examiners completed a checklist (see Appendix B) regarding the type and frequency of cognitive functions observed in that child. Examiners observed videotapes and completed checklists together until an inter-rater reliability of .95 was achieved.

Distinction Between Types of Intervention

Intervention phases were videotaped in order to ensure that a clear distinction was present in the two types of intervention, regardless of examiner style. An independent rater, blind to the nature of the study, was asked to rate one-third (14) of the videotapes. These were selected according to stratified random sampling such that both examiners and both types of intervention were represented: a total of 8 mediation and 6 instruction tapes were viewed. On the basis of written definitions concerning the essential components of each type of intervention (see Appendix D), the rater was asked to determine whether each tape was an example of mediation or instruction.

All of the tapes were correctly allocated indicating a clear distinction between the two types of intervention, regardless of examiner.

Examiner Behaviors

In order to determine whether specific examiner behaviors were characteristic of a particular style of intervention, the videotapes were rated for the presence or absence of certain observable behaviors. Specific behaviors had been predetermined by the researcher to be essential components of either the mediational or instructional methods

of intervention. The criteria utilized by the independent rater were very stringent in that each examiner was evaluated for the presence of the required skill or behavior on each of the nine teaching items. The necessary components were required to be present on each separate item at least 85% of the time: all tapes met this criterion and, therefore, none were rejected.

One hundred percent compliance was required and obtained for both types of intervention on the following subjective characteristics:

Examiner engages child, develops rapport.

Examiner is friendly and enthusiastic.

Examiner is able to involve child in task.

Examiner regulates child behavior (verbally or nonverbally), as required.

The percentage of time that the examiners demonstrated particular objective behaviors is outlined in Table 4. The actual presence of the required components was very high for both methods of intervention. It was not surprising to find that compliance rates were higher for the instruction method, in which the procedure was scripted out, than for the mediation procedure, in which the examiner was free to use any teaching method.

TABLE 4: Percentage of Time Essential Components Were Present

Criterion Behavior	Mediation	Instruction
E. explains purpose of session to child.	100*	100*
Child's attention is focused on task.	100*	100*
E. attempts to elicit responses from child.	100*	100*
When answer is correct, E. proceeds directly to next item.	0[a]	100*
E. provides assistance when incorrect responses are given.	100*	100*
E. teaches principles and strategies.	97.1*	0[a]
E. uses transformational and/or analytical approach.	100[b]	100*
E. uses superordinate terms.	95.3*	100*

TABLE 4 (continued)

Criterion Behavior	Mediation	Instruction
E. sequences from child's left to right.	100*	100*
E. summates required attributes.	88.8*	97.7*
E. asks child to find block.	87.5[b]	96.8[b]
E. and child review correct answer.	98.4*	0[a]
E. reinforces child's responses.	94.0*	96.7*

E. = Examiner

* required component
a requirement that component not be present
b recommended component, not required

During mediation, the transformational and/or analytical approaches were used by the examiners 100% of the time, even though this was completely optional (ie. any teaching method could be used which was appropriate to meet the needs of the child). This would seem to suggest that these techniques were useful approaches for teaching this task.

Statistical Analyses

Statistical techniques employed in the analysis of the data are described below.

Descriptive statistics (mean, standard deviations, range) and t-tests of significance were used to investigate the pattern of performance and differences between the two intervention groups. Pretest 1, Pretest 2, Posttest, and gain (Posttest - Pretest average) scores were analyzed using the above. One tailed t-tests were employed with directional hypotheses and two-tailed t-tests with all non-directional research questions. Dependent measures t-tests were used to compare pre- to posttest performance changes within each group. Since random assignment of children was not possible, the assumption of normality which underlies all inferential statistics could not be made;

therefore, the t-test should, technically, not have been used. It has, however, been shown that the t-test is sufficiently robust that it works well even when this assumption is violated (Kerlinger, 1979). Due to the large number of comparisons and the relatively small sample size, a value of $p < .01$ was determined as the acceptable level of significance to reject the null hypothesis.

Pearson correlations were used 1) to determine whether there was any relationship between age and performance on pretest and postest; and, 2) to determine whether amount of time taken was related to performance gains.

Descriptive statistics (means, percentages) were also used to analyze the types of errors made, and the type and frequency of children's cognitive functions.

CHAPTER FOUR

Results

Effects of Intervention

Descriptive Statistics and Tests of Significance

The major hypothesis and research questions were examined using statistics which summarize the Pretest 1, Pretest 2 and Posttest scores.

Table 5 contains the descriptive results (mean, standard deviation) for the two groups utilizing both methods of scoring: Method 1 (all-or-none) and Method 2 (partial credit). Results of the independent samples t-test between the means of the mediation group and the instruction group for all assessment results are also summarized.

Figure 3 presents a graph comparing mean levels of performance for the groups on the assessments using the all-or-none scoring method. The results are again portrayed in Figure 4 using the partial credit method. The graphs clearly indicate that the mean performance of the mediation group increased greatly following intervention. The performance of the instruction group did not show change.

TABLE 5: Means, Standard Deviations and T-tests of Assessment Results by Group

Assessment Results	Mediation Group (N = 27)		Instruction Group (N = 16)		
	X	S.D.	X	S.D.	t
Pretest 1					
Method 1	1.44	1.01	2.13	1.50	1.78
Method 2	22.07	3.92	25.38	3.91	2.67
Pretest 2					
Method 1	1.33	0.92	1.88	1.31	1.59
Method 2	21.41	3.78	23.69	4.03	1.87
Posttest					
Method 1	5.30	2.60	1.94	0.85	4.99*
Method 2	31.33	6.73	23.75	2.59	4.30*

* $df = 41$, $p < .001$, one-tailed

Figure 3

Mean Performance by Group:
Method 1 Scoring

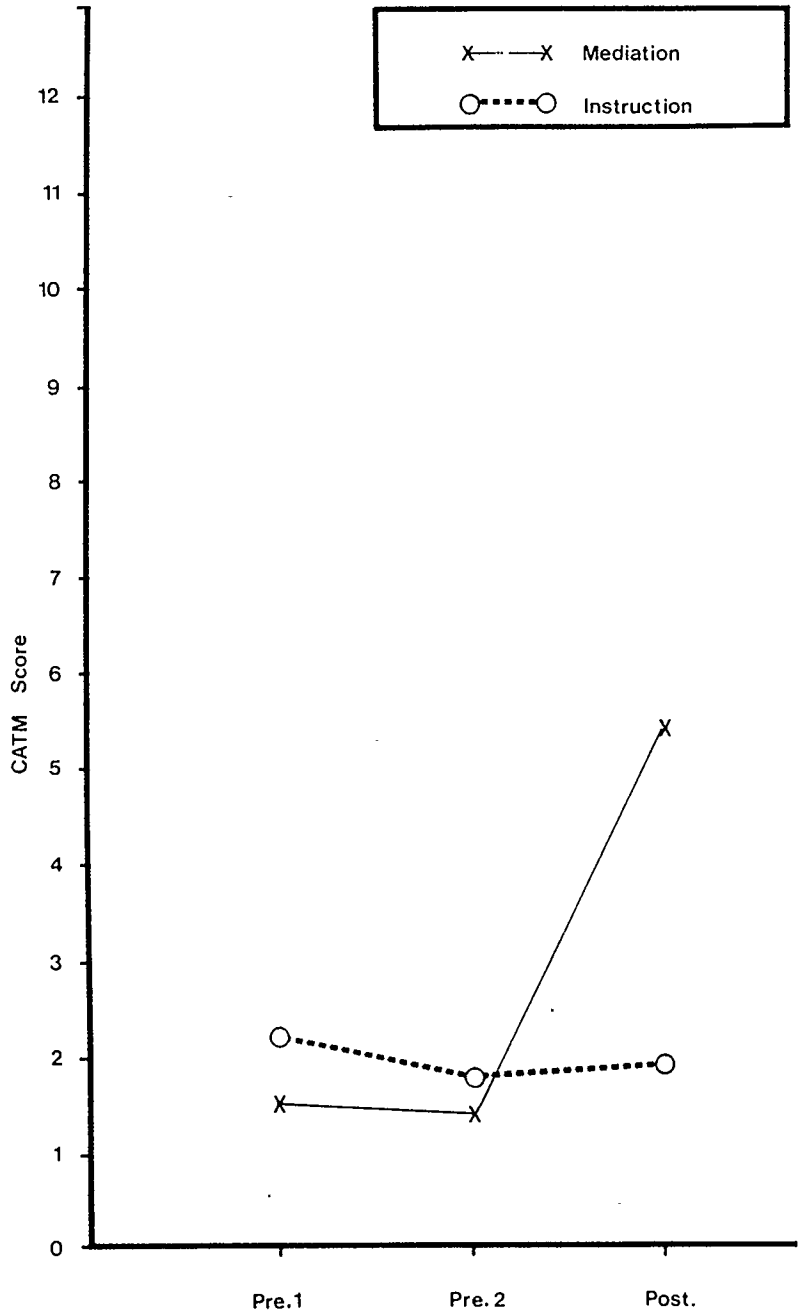
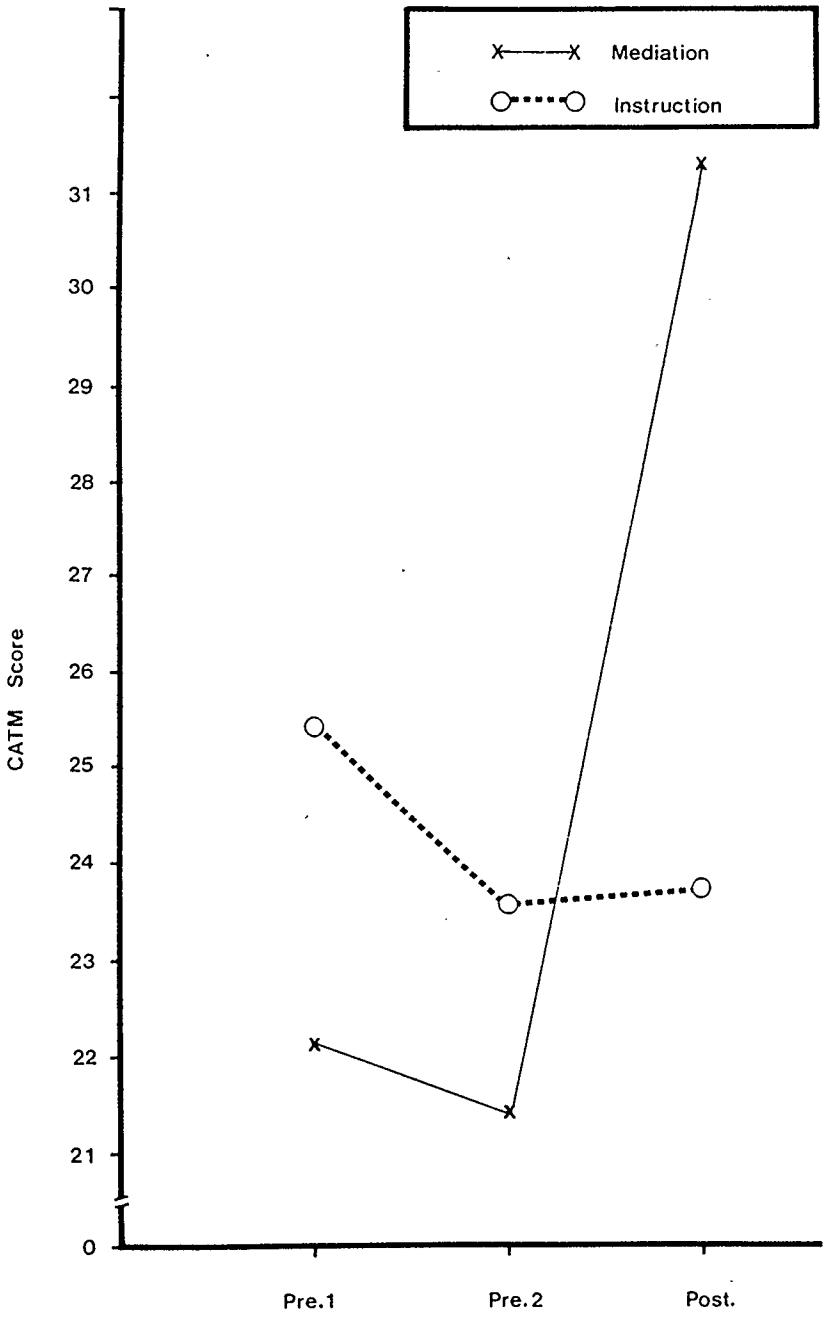


Figure 4

Mean Performance by Group:

Method 2 Scoring



It is apparent that there was no significant difference between the two groups on Pretest 1 and Pretest 2 performance. Administering a second pretest of parallel items also had no effect on mean level of performance in either group.

A highly significant difference was found between the groups for posttest performance using both methods of scoring: Method 1 ($t(41) = 4.99$; $p < .001$) and Method 2 ($t(41) = 4.30$; $p < .001$). In both instances, the mediation group performed significantly better than the instruction group on the posttest.

Dependent measures t-tests were used to compare the amount of change from pre- to posttest within each group. Pretest 1 and Pretest 2 performance scores were averaged for these calculations. The results are summarized in Table 6.

Method 1 ($t(26) = 7.59$; $p < .001$) and Method 2 scoring ($t(26) = 4.45$; $p < .001$) both showed highly significant change in performance for the mediation group. Change from pre- to posttest performance in the instruction group was found to be non-significant.

Results for each examiner were analyzed separately. Subjects assessed by both examiners were found to show highly significant change in the mediation group and non-significant change in the instruction group.

TABLE 6: Means, Standard Deviations and T-tests for Change in Performance Within Each Group

Intervention Type	Average Pretest Performance X	S.D.	Posttest Performance X	S.D.	t
Mediation (N=27)					
Method 1	1.39	0.74	5.30	2.60	7.59*
Method 2	21.74	3.30	31.33	6.73	4.45*
Instruction (N=16)					
Method 1	2.00	1.03	1.94	0.85	- 0.24
Method 2	24.53	3.50	23.75	2.59	- 0.87

* $df = 26$, $p < .001$, one-tailed

Differences ($p < .02$) were found between examiners in the magnitude of change but not, as stated above, in the direction of change. Since both examiners achieved significant pre- to posttest change in the mediation group, only combined data have been analyzed and discussed.

Data were also grouped and analyzed separately for sex, major disability and clinic affiliation: no significant effect was found for any of these attribute variables.

Amount of Time Taken

The amount of time (minutes) utilized during each phase of the assessment was recorded in order to determine whether one type of intervention took longer to administer. Time taken to complete the pretest was measured as the average amount of time spent on Pretest 1 and Pretest 2. These results are shown in Table 7.

The difference between the mediation and instruction groups in the total amount of time taken was found to be significant at $p < .05$ ($t(41) = 2.23$). Closer examination revealed, however, that the difference in total time taken was not due to the anticipated difference in the amount of time required for intervention. A highly significant difference was

TABLE 7: Means, Standard Deviations and T-tests for Amount of Time (Minutes) Per Phase

	Mediation Group (N = 27)		Instruction Group (N = 16)		
Phase	X	S.D.	X	S.D.	t
Baseline	10.78	3.52	11.44	1.93	0.69
Pretest Avg.	10.67	2.80	9.69	0.77	- 1.36
Intervention	26.41	7.74	23.50	3.56	- 1.41
Posttest	13.96	3.89	9.94	2.14	- 3.80*
Total Time	71.74	12.60	64.25	5.98	- 2.23**

* df = 41, $p < .001$, two-tailed

** df = 41, $p < .05$, two-tailed

found in the amount of time taken by each group during the posttest phases ($t(41) = 3.80$; $p < .001$). Specifically, the mediation group took longer than the instruction group to perform the posttest. Possible reasons for this difference will be explored in the Discussion section.

Differences in time taken between the two groups on the Baseline, Pretest and Intervention phases were not found to be significant.

Pearson correlations were used to determine whether there was any relationship between time taken in intervention and performance gains for either group. No systematic relationship was found (mediation group: $r = .19$, $p = .18$; instruction group: $r = .33$, $p = .10$).

Relationship Between Age and Performance Outcome

The Pearson correlation coefficients that resulted when age was used as a predictor of performance outcome are presented in Table 8. Gain score was calculated as the change in score from Pretest Average to Posttest score. Since this examination was completely exploratory, an acceptable level of confidence was determined to be $p < .05$.

Table 8 shows that age had no effect on pretest performance but had a significant effect both on posttest performance and on the gain score, a

TABLE 8: Pearson Correlation Coeffecients for Age as Predictor of Assessment Results

Assessment	Mediation Group (N = 27) r	Instruction Group (N = 16) r
Pretest 1		
Method 1	0.04	- 0.19
Method 2	0.09	0.08
Pretest 2		
Method 1	0.30	- 0.35
Method 2	- 0.14	0.09
Posttest		
Method 1	0.40*	- 0.30
Method 2	0.40*	- 0.42*
Gain Score		
Method 1	0.33*	0.18
Method 2	0.37*	- 0.42*

* $p < .05$

measure of the degree to which an individual child's performance improved. It is interesting to note that, while older children demonstrated greater performance gains in the mediation group, increased age had a negative effect on performance gains in the instruction group.

Error Analysis

Exploratory questions were posed regarding the type and frequency of errors made and the resistance of certain dimensions to modification. In order to determine whether there was any pattern to the types of errors made, the results of the Method 2 scoring (partial credit) were further analyzed. The number of errors of size, color and shape is portrayed graphically for the mediation group in Figure 5 and for the instruction group in Figure 6.

In the mediation group, all three dimensions showed about equal change. In pre- and posttests, shape errors were the most common, followed by errors of color, then of size.

The error pattern for the instruction group was similar to the mediation group on the pretest; however, the total number of errors in each category did not change significantly following intervention.

Figure 5

Mean Number of Errors by Size, Color, Shape:
Mediation Group

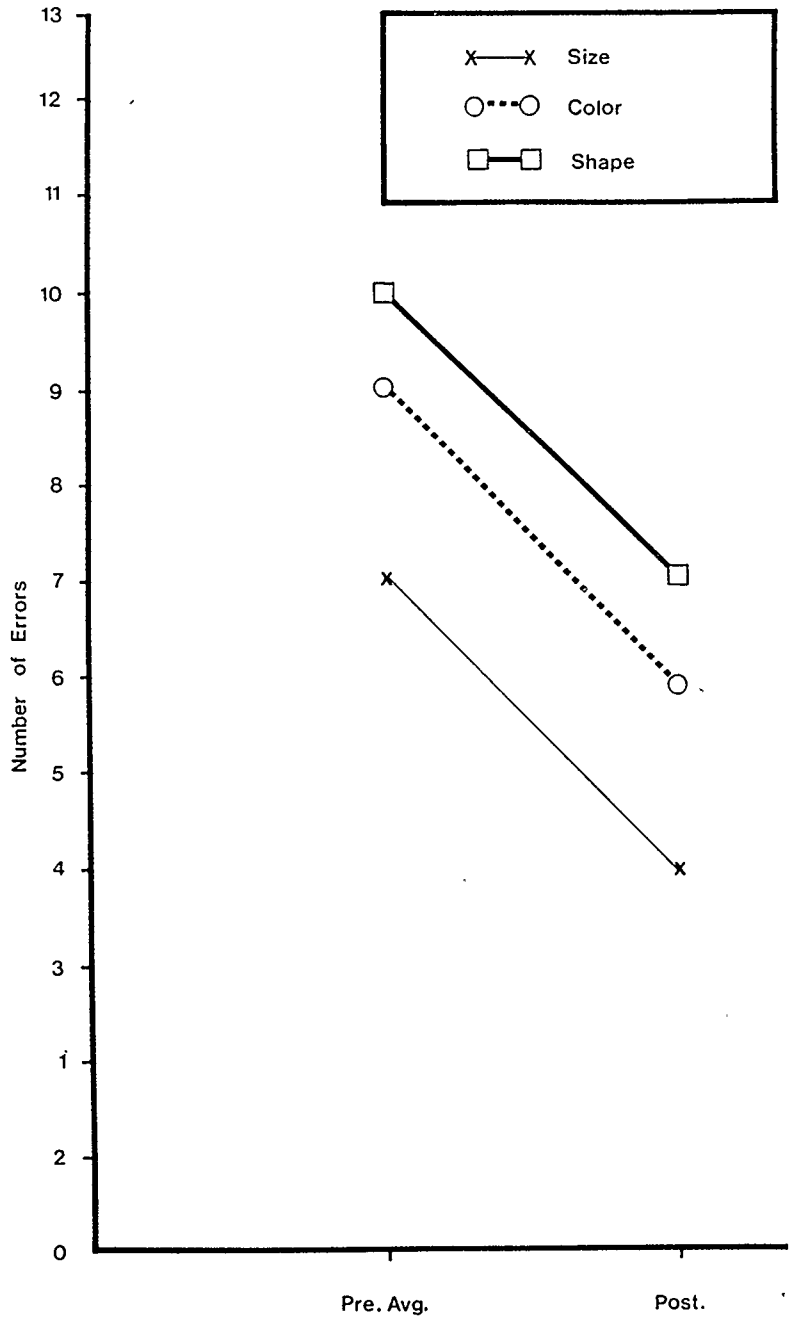
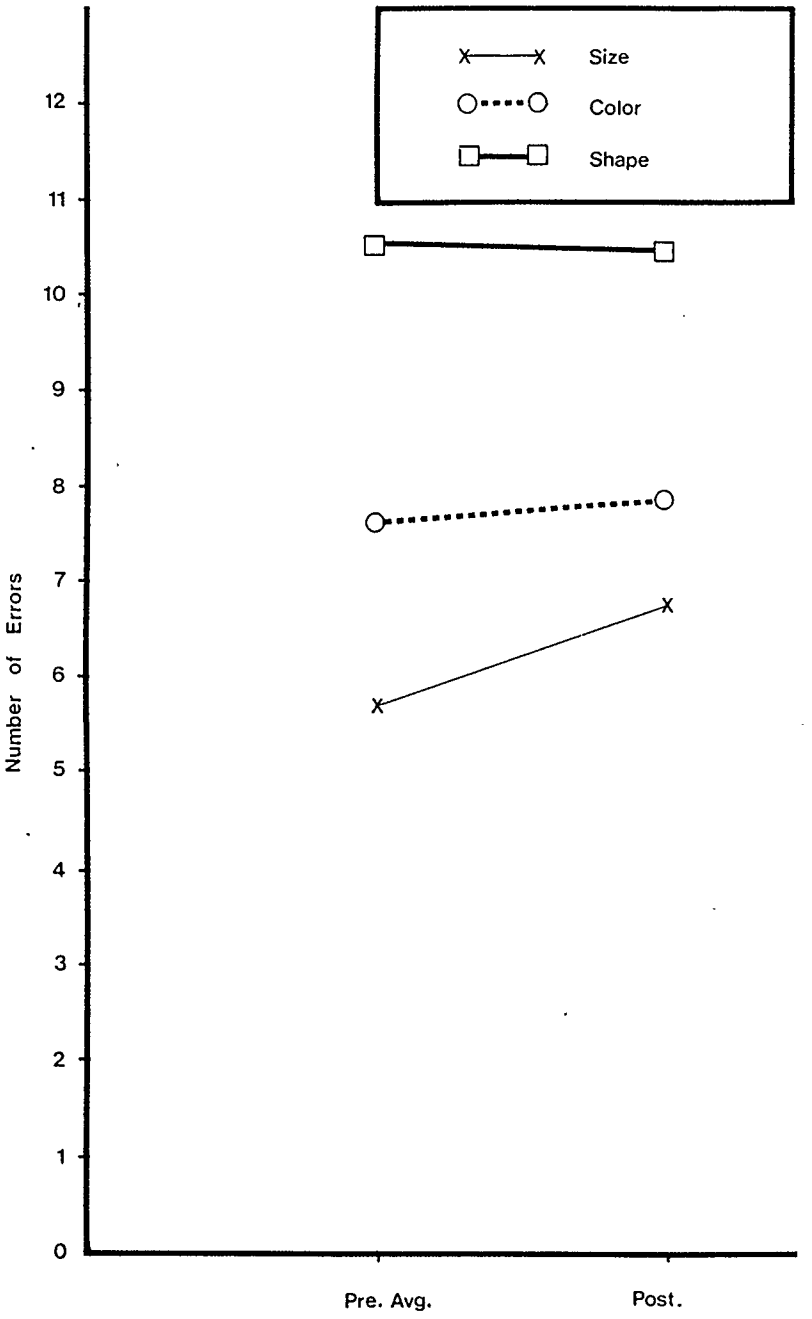


Figure 6

Mean Number of Errors by Size, Color, Shape: Instruction Group



Cognitive Functions

One of the exploratory questions posed was: Is there any pattern to the type and frequency of cognitive deficiencies observed in this population? After each assessment, the examiner completed a cognitive function sheet for each child (reliability training of the examiners is discussed in the procedure section). The cognitive function sheet developed for this research (see Appendix B) was based upon Feuerstein's list of cognitive deficiencies (Feuerstein et al, 1980) but the deficient cognitive functions were rephrased in order to be stated consistently in the positive as cognitive efficiencies. Children were rated on the presence or absence of these cognitive functions, not on their response to intervention; therefore, the results of the total test performance of all of the children are described.

Data presented in Table 9 indicate the total percentage of children observed using the described cognitive function to the specific extent stated. These categories are relatively subjective; however, the intent was only to establish whether any commonalities were present. The N/O column indicates that the examiner did not have the opportunity on this task to observe that particular cognitive function in that child. Most of

TABLE 9: Percentage of Children Using Cognitive Functions Efficiently

Cognitive Functions	N/O	-2	-1	0	1	2
Input Phase						
Gathers clear and complete information.	0	11.6	30.2	23.3	32.6	2.3
Exhibits systematic exploration.	0	0	30.2	30.2	32.6	7.0
Uses labels to identify objects.	0	25.6	37.2	25.6	11.6	0
Uses spatial systems of reference.	100	0	0	0	0	0
Exhibits temporal concepts.	100	0	0	0	0	0
Conserves constancies of objects.	0	11.6	39.6	11.6	37.2	0
Is precise and accurate when needed.	0	14.0	44.1	37.2	4.7	0
Considers 2 or more sources of info.	0	11.6	32.6	32.6	23.2	0

N/O = not observed
-2 = never/rarely
-1 = occasionally
0 = sometimes
1 = frequently
2 = always

TABLE 9 (continued)

Cognitive Functions	N/O	-2	-1	0	1	2
Elaboration Phase						
Recognizes and defines problems.	0	11.6	23.2	23.2	41.9	0
Selects relevant vs. non-relevant cues.	0	18.6	18.6	37.2	25.6	0
Spontaneously compares objects/events.	0	11.6	23.2	23.2	41.9	0
Able to remember/retrieve required information.	0	0	16.3	39.5	44.1	0
Exhibits summative behavior.	0	25.6	44.1	25.6	4.7	0
Projects learned relationships: bridges.	0	7.0	34.9	30.2	27.9	0
Uses logic to prove things.	100	0	0	0	0	0
Forms mental picture of objects/ behavior.	0	27.9	41.9	30.3	0	0
Uses hypothetical thinking.	100	0	0	0	0	0
Uses strategies for hypothesis testing.	100	0	0	0	0	0
Makes a plan to achieve a goal.	34.8	18.6	32.6	9.3	4.7	0
Able to categorize new object/ experience.	0	16.3	16.3	65.1	2.3	0
Perceives relationships among events.	0	2.3	32.6	44.1	20.9	0

TABLE 9: (continued)

Cognitive Functions	N/O	-2	-1	0	1	2
Output Phase						
Communication reflects awareness of information/perspective of listener.	0	65.1	30.2	2.3	2.3	0
Uses strategies to overcome blocking.	9.3	37.2	30.2	16.3	7.0	0
Thinks before answering (not trial and error).	0	32.6	30.2	23.3	13.9	0
Able to elaborate on verbal responses.	0	69.8	25.6	2.3	2.3	0
Visual transport of image.	0	2.3	34.9	16.3	32.6	13.9
Perceives need for clear, precise responses.	0	37.2	46.5	13.9	2.4	0
Restrains impulsive behavior.	0	27.9	37.2	20.9	14.0	0

N/O = not observed
-2 = never/rarely
-1 = occasionally
0 = sometimes
1 = frequently
2 = always

these categories (eg. hypothetical thinking) are functions which would not normally be expected to be present at the developmental level of these children.

Some patterns of efficient/deficient cognitive functioning were noted and are summarized below:

Input Phase.

Children's abilities were fairly equally distributed on the information gathering phase. One major area of weakness noted was the failure to use labels to identify objects and events. Children also tended not to be precise or accurate, even when this ability was required.

Elaboration Phase.

Abilities were again fairly diversified. Relative areas of strength were noted in the ability to spontaneously compare objects and events and also in the abilitiy to remember and retrieve information when required. Weaknesses were particularly noted in the failure to exhibit summative behavior, to stop and plan and to categorize new objects/experiences.

Output phase.

This phase was a significant problem area for almost all of the children. Nearly 100% of the children: 1) were unable to use language that reflected an awareness of the perspective of the examiner; 2) were unable

to elaborate on or modify verbal responses; 3) failed to perceive a need to check their answers for precision or accuracy; and, 4) failed to restrain impulsive behavior. Of interest, nearly half of the children demonstrated signficant strength in their ability to visually transport images.

It would appear that this heterogeneous population did demonstrate some similarities in pattern of cognitive deficiencies. Specific comments regarding the pattern of strengths and weaknesses observed will be made in the Discussion section.

Examiner Behaviors

The steps used to identify the presence or absence of specific examiner behaviors were reviewed in the procedure section. Comments made by the independent rater indicated an unexpected difference between examiners regarding the justification process used during mediation. An essential component of the mediation method was the examiner reviewing the correct answer with the child. This component was present 98.4% of the time. Examiner 1, however, usually preceeded the examiner and child justification by asking the child why the answer was correct. This was not specified as a required component. Examiner 2 generally proceeded

directly to justifying with the child the process used to arrive at the correct answer.

The video tapes were reviewed and the specific breakdown for this behavior is summarized in Table 10 (mediation group only). Examiner 1 requested the child to justify his answer 94.4% of the time while Examiner 2 made this request 29.7% of the time.

Summary of Major Results

The mediation group demonstrated highly significant change in pre- to posttest performance on the Children's Analogical Thinking Modifiability Instrument (Tzuriel & Klein, in press: see Note 1). The performance of the instruction group did not change significantly from pre- to posttest.

According to the evaluation of an independent rater, the two methods of intervention (mediation/instruction) are clearly distinct, regardless of examiner style.

The performance of children in either group did not change through provision of additional exposure to the test items or the testing situation.

Mediational intervention did not take significantly longer to provide

TABLE 10: Specific examiner behaviors used in justification process

	Behavior Present	
	Examiner 1	Examiner 2
Criterion Behavior:		
Examiner and child review correct answer.	100%	96.3%
Specific Description of Behaviors		
A. Examiner first asks child to justify answer.	94.4%	29.7%
B. Examiner (then) justifies answer while child's attention is focused on task.	100%	96.3%

than instruction. Children who received mediation took significantly longer to complete the posttest than children who had received instruction. Amount of time taken in intervention was not correlated with improvement in performance.

Age was significantly correlated with improved performance in the mediation group and with decreased performance in the instruction group.

Errors of shape were made most commonly on this task, followed by errors of color and then of size. Improvement in the mediation group was equal along all three dimensions. The error pattern of the instruction group did not change from pre- to posttest.

There was a pattern to the type and frequency of cognitive functions observed in this population. The major areas of weakness were observed in the output phase.

CHAPTER FIVE

Discussion

Effects of Intervention

The major objective of this research was to compare the effectiveness of two methods of intervention in producing change on the Children's Analogical Thinking Modifiability Instrument. The results strongly supported the hypothesis that special needs preschool children provided with contingent mediation would show greater pre- to posttest performance gains than children provided with instructional intervention. The results also replicated the findings of Tzuriel and Klein (1985) that the performance of special education children was not changed using an instructional method of intervention. Burns' (1983) study also looked at this type of population and found mediation to be the most effective form of intervention on another similar type of task. These results would seem to suggest that children with learning difficulties have unique learning needs which must be identified and met on an individual basis. This research finding has implication for assessment and also for teaching methods utilized in the classroom: both will be discussed in a later section.

Given that instructional intervention is an effective method with other populations (Tzuriel & Klein, 1985), it becomes important to consider possible reasons for the differing results found with the special education population. One reason may be the type of task used. Some would argue that, by using parallel items on the posttest, the CATM task was actually measuring the child's ability to transfer his learning. Blackman and Lin (1984) define transfer as, "the continued application of a strategy learned in one task structure to an identical task structure where only the specific materials differ" (p.247). Using this definition one might conclude, as Burns (1983) suggested, that the mediation children were better able to transfer the strategies learned in the intervention phase to new examples of the same situation. Campione and Brown (1984) have proposed that the learner is an active organism who has to perceive and identify a relationship between the new situation and the old. It was the perception of both examiners that the children who had received instruction had actually learned strategies during the intervention phase but, on the posttest, did not know how to apply them. Although purely speculative, it is suggested that children who receive instruction may be less active as learners than children who receive mediation; thus, they do not learn how to, or do not take responsibility for recognizing relation-

ships between situations. It is not known whether the instruction children might have performed better if an identical set of tasks had been used in the posttest.

A related factor which became apparent was the difference in the type of justification process used in the mediational style of intervention. During instruction, when an answer was correct, the child was reinforced (eg. "That was the very best answer.") and then the examiner proceeded directly to the next item. In mediation, the examiner reviewed with the child why his choice was the best answer; specifically, the process used to derive the solution was reviewed and then the answer was checked for accuracy. The slight difference in examiners, noticed during the justification process, was interesting. As indicated, Examiner 1 asked the child to justify his/her answer and then worked with the child's response to complete the justification. Examiner 2, in most cases, justified the answer for the child while the child's attention was focused on the task. The distinction between the two approaches has been described in the literature as elaborated feedback (Examiner 2) and verbalization by the subject plus elaborated feedback (Examiner 1). Carlson and Wiedl's (1978) experiment, which studied differential performance gains using six types of teaching conditions, found these two approaches to be equally effective.

Spiker, Canton and Klouda's (1985) experiments with kindergarten and Grade one children suggested that, on simple tasks, children provided themselves with feedback. As task difficulty increased, specific feedback by the examiner became critical in the improvement of reasoning activities. Blank (1974) has proposed that a great effect is also seen when the child internally imposes a search for explanation. She further presents the idea that children who verbalize have an advantage on transfer tasks because, through their verbalization, they grasp the concepts shared by the training and transfer tasks. It is not known whether the preliminary question by Examiner 1 may have caused the child to take greater responsibility internally for justifying his solution. This issue remains unresolved in this research since, due to expressive language delay, the majority of the children questioned were still unable to verbalize their justification. Of interest, the children assessed by Examiner 1 generally showed greater performance gains; however, this may have been due to their higher mean age relative to the lower mean age level of Examiner 2's subjects, a chance effect, or other unmeasurable factors.

Closer examination of the assessment results indicated that there was little difference between results obtained from the two methods of

scoring. Unlike the mentally retarded children who appeared more modifiable along individual dimensions (Tzuriel & Klein, 1985), this special education population seemed to either acquire and apply a strategy or to make a "full blown" mistake.

Error analysis indicated that children in the mediation group improved about equally along all three dimensions (size, color, shape). Similarly, children in the instruction group made equal errors along each dimension in the pretest and the posttest. In both groups, the lowest number of errors was observed in the dimension of size, next in color, and the highest number was made in the dimension of shape. This pattern is not unexpected from a developmental perspective since shape concepts are usually acquired later than concepts of color and size (Vulpe, 1977). It was interesting to note, however, that each of these dimensions was equally open to modification in this population.

Amount of Time Taken

Mediation which is provided contingently might have been expected to take longer to administer than a pre-established instruction method. This was not found to be the case: the group difference in time taken

during intervention (mediation/instruction) was not significant. There was also no relationship found between total time taken and posttest performance or gain scores. This finding confirms Burns' (1983) results in which no systematic relationship was found between length of time taken and performance results.

In the present study, a significant difference was found between the groups in time taken on posttest. The mediation group took, on average, 29% longer to respond to the posttest items. The children in this study were generally very fast, impulsive responders; therefore, as suggested by Haywood and Bransford (1983: see Note 2), it was important for the examiners to increase the latency period before the child was permitted to respond. In the mediation group, a board was frequently used to cover the array of blocks so that children were not able to choose an answer until they had looked at and considered the problem. Although the board was not used in the posttest, the children in the mediation group clearly took longer before responding than did the instruction group children. Since the mediation group posttest performance was also much better, it might be assumed that controlling impulsive responding during intervention may have helped the children to take the time they needed to think about the problem. In the posttest, they were able, to a degree, to control their own

impulsivity. It is not known to what extent this control was influenced by the examiner emphasis on the mediation children taking responsibility for their own behavior.

Control of impulsivity is unlikely to be a complete explanation for the observed difference between the groups. An alternative explanation for the increased length of time taken by the mediation children is suggested by Feuerstein's discussion of level of efficiency (Feuerstein et al, 1980). He proposes that, when a new strategy is learned, children may initially perform less efficiently as they attempt to implement their newly acquired skills. Presumably, in the pretest, the children did not have a large repertoire of strategies from which to choose. During the posttest, they may have performed more slowly as they took time to identify the problem and to select a strategy appropriate to the particular task item. The instruction children who had not had the focus on the justification of strategy selection may have been unaware that they should stop and evaluate the information given by the task prior to implementing a strategy.

Relationship Between Age and Performance Outcome

An interesting and unexpected finding, given the narrow age range of the children, was the relationship of age to performance outcome. Pretest scores were not found to be related to differences in age. This would seem to suggest that previous experience and maturity did not assist the children with this relatively novel task. Older children also did not demonstrate any more benefit from repeated exposure to test items during Pretest 2. The differences related to age were only noticeable following intervention. One possible explanation for this relationship is the children's individual readiness to accede to the concrete operational level of development.

From a Piagetian perspective, children of approximately 4 - 7 years of age are in the intuitive stage of the preoperational period. Students of this age begin to use logical patterns of thinking but their logic only acts in one direction and is not easily reversed; therefore, problems tend to be resolved intuitively. Children in this stage have difficulty focusing attention on two different dimensions of a problem simultaneously. If they have more than one relationship to consider, then they view those relationships alternately or sequentially, not simultaneously

(Piaget,1947; Bybee & Sund, 1982; Ault, 1977). This process was observed frequently in this research when children attempted to solve the task items but switched their focus of attention from one dimension to another; for example, while considering the dimension of size, one child stated "big, small, big, yellow". Piaget's descriptions of preoperational children's capabilities have been experimentally verified (eg. Halford, 1984) although it has been proposed by many that children in today's society may enter the concrete operational period at 5 or 6 years of age.

The CATM reasoning tasks required simultaneous consideration of 2 or 3 dimensions and, also, an understanding of class inclusion. These abilities are not felt to be present until the concrete operational stage (Trabasso et al, 1978). It is therefore possible that some of the older children were close to accession to the concrete operational stage. When these concepts were introduced and mediated at the child's individual level, older children were able to accommodate and learn to apply these operations. With younger children, these relationships may have been too discrepant for them to accommodate and, thus, they remained at the intuitive level. It was interesting to note that, even on the posttest, few of the children solved the more difficult Level III and IV items which required consideration of more than two dimensions.

One can only speculate as to the reason that the age of instruction group children was negatively correlated with posttest performance. Perhaps, as suggested previously, these children did learn new strategies but applied them inappropriately; that is, since the children did not review the reasons for solution, the new information was not able to be accommodated.

Cognitive Functions of Subjects

Some patterns of cognitive strengths and deficiencies were observed in this heterogeneous population. The majority of deficits observed appeared to be related to the children's tendency to gather information quickly, without stopping to plan, and to respond impulsively in a trial and error fashion. These deficits interfere significantly with performance on this or any similar type of task. It was interesting to find that some of these deficits were modifiable as suggested by the fact that mediation children took longer on posttest and controlled their impulsive responses long enough to gather complete information and select a strategy.

The greatest area of weakness for most of the children was the

output phase as demonstrated by their tendency to respond impulsively in a trial and error fashion. All of these children were language delayed; thus, their weakness in labelling and categorizing objects/experiences and their inability to elaborate on verbal responses was not unexpected. This area was certainly more resistant to modification in the short assessment session. The tendency of the children to give very egocentric responses would be felt by some theorists to be developmentally appropriate (Piaget & Inhelder, 1969). This view has recently been challenged though, (eg. Donaldson, 1978; Light, 1983) and it is now suggested that normal children of this age are capable of recognizing the perspective of their listener. This is likely a true deficit in this population.

The children, on the whole, demonstrated some significant strengths in their elaborative abilities. Information which was understood by the children appeared to be retained and could be retrieved easily when required. Also, many of the children spontaneously compared features of the task and the assessment situation to other objects and experiences which they had encountered. The output deficiencies observed in this population interfered with the children's task performance and, thus, tended to obscure the presence of relatively strong elaborative abilities. It would appear that the mediation approach, which focused

specifically on the individual areas of cognitive deficiency, was effective in identifying areas of strength and weakness and in producing change in performance on this task. It is likely that this type of information, obtained during mediation, would also be educationally relevant and helpful for planning intervention in the classroom.

Summary

Mediational intervention was found to be an effective method for producing change in performance on the Children's Analogical Thinking Modifiability Instrument (Tzuriel & Klein, in press: see Note 1) in a special needs preschool population: instructional intervention was not. Children who received mediation appeared to be able to learn new strategies and to apply them to a near transfer task. Children who received instruction seemed to learn the strategies but did not appear to know when or how to apply them. Possible reasons for this difference have been explored including the importance of having children justify, or be assisted to review, the reasons for their solutions. Age appeared to play a role in determining the extent to which children were able to acquire and retain new cognitive operations.

CHAPTER SIX

Implications and Limitations of the Study

The major objective of this research was to compare the effectiveness of two methods of intervention in producing change in performance on the Children's Analogical Thinking Modifiability Instrument (Tzuriel & Klein, in press: see Note 1). Mediational intervention was found to be an effective method for determining the potential for change in a special needs preschool population: instructional intervention did not produce any change in performance on this task.

The practical implications of this type of result are numerous and should be carefully considered. The implications of these research findings for assessment, for classroom teaching and for future research will now be reviewed.

Implications for Assessment of Preschool Children

While many of the positive results of dynamic assessment and mediation have been highlighted by this study, some of the drawbacks of

this approach must also be examined. Research would seem to support the use of dynamic assessment as a method of differentiating amongst children who present with similar results on normative assessments. Mediation may be a more sensitive approach than other methods to the determination of learning potential in a difficult population; however, experienced and highly trained examiners are required if the mediation is to be effective. One definite disadvantage of this approach is: if a child does not demonstrate change, is it the fault of the examiner or is it a deficit within the child? The theory of mediated learning would suggest that it was the examiner who was unsuccessful in finding a method that would be effective for that child. This may be accurate and suggests that an examiner must keep working to produce change; however, the time limitations under which he must operate can be extremely restrictive when assessing a very young child. Although mediation does not appear to take much longer than other forms of dynamic assessment, it is certainly a much lengthier process that is more difficult to administer than many standardized assessments. It is essential to question whether a procedure as sensitive as mediation is necessary, or even beneficial, for many children given the time and cost involved in the training of the examiner and in administration of the test.

Haywood and Bransford (1983: see Note 2) have proposed a model for a continuum of assessment services for all children. This model is based on the assumption that children may receive similar scores on normative tests for different reasons (eg. cultural disadvantage, lack of exposure to information, etc). In the first stage of this assessment process, standardized assessment instruments are used to assess all children. Children who score at least one standard deviation below the mean are then assessed using a Vygotskian type of prompt procedure that involves graduated provision of hints. It is assumed that children who learn quickly and are able to transfer this learning will do well in regular school programs. Any children who do not learn quickly when given hints, and/or who do not appear to be able to transfer this knowledge, are assessed using a mediation procedure explicitly tailored to the needs of the individual child. Mediation can then be used to identify the specific strengths and weaknesses of children who are truly demonstrating learning difficulties. This cost-efficient approach to assessment would be a very reasonable method for ensuring that the children who really require mediation receive this intervention. This model of assessment is currently being tested at Vanderbilt University in Nashville, Tennessee.

The preschool child who is demonstrating learning and/or behavioral

difficulties should always receive an individualized assessment performed by an examiner who is sensitive to the needs and concerns of young children. An assessment instrument like the CATM is an attractive choice in that the materials are enticing to the child, the required baseline level of competence is quite low, and yet the range of abilities which may become apparent is very wide. As suggested by the Nashville model, it may not be necessary to select a mediational procedure for the assessment of all children; however, mediation may prove to be successful with children for whom normative assessments and other dynamic methods have been found to be ineffective.

An additional implication of these findings results from the fact that the subjects employed in this research were all children with language difficulties. One of the most critical issues in the education of children for whom English is a second language (ESL) is the issue of identification of learning difficulties (Lidz, 1982; Bailey & Harbin, 1980; Chinn, 1979). Dynamic assessments of learning potential have been suggested as a method of assessment with this population in order to differentiate learning from language difficulties (Cummins, 1984). The effectiveness of mediation with language-impaired children would seem to offer indirect support for this proposal. By chance, one of the children

in this study (mediation group) was a four year old ESL child. Through mediation, the examiner was able to identify specific learning difficulties which were present in addition to the language difference. Clearly more research would be needed to study the use of the CATM with young ESL children.

Implications for the Education of Special Needs Children

Literature supported the fact that the instructional method used in this research typified the types of instructional approaches normally used in the classroom setting. This method, as indicated by Tzuriel and Klein's (1985) study, is an effective method of learning for most children. This special needs population, however, has now been shown in two studies to be unable to benefit from this type of teaching. Although the leap to the classroom is fairly large, the implication is that instructional intervention will not be an effective method of teaching for this population. These research findings would seem to suggest that special needs children will require teaching which is individualized to meet their unique learning needs. A mediational style of teaching would not only individualize the teaching but would also ensure: 1) that the children recognized the

meaning of the lesson; 2) that the principles of the lesson were emphasized and generalized to other settings; 3) that each child was an active participant in the learning process; and 4) that the children acquired the skills to review and evaluate their own answers. With this type of intervention, it is anticipated that many special needs children would be able to demonstrate learning potential that had not previously been seen.

Limitations of This Study

This research was limited in a number of respects, including those outlined below:

1. One of the major limitations of this research was the fact that children were not able to be randomly assigned to intervention groups. Although efforts were made to ensure that the groups were matched on all relevant variables, it is not possible to state with certainty that the selection process did not effect the results. Any generalization from these results must, therefore, be made with great caution.

2. The population utilized was very heterogeneous and the criteria used for selection were based, partially, on previously obtained test scores. Unfortunately, although all of the children had been seen at the Alberta Children's Hospital, there was no single test that was uniformally administered. Therefore, although the children were all similar, it was not possible to compare the children or groups on the basis of language skills, intelligence, achievement or other developmental factors which might have influenced these research results. Given the previously discussed problems with the performance of these children on normative assessments, it is doubtful whether this information would have actually reflected the ability levels of the children in the above areas. This limitation may, however, make these results more difficult to replicate in future research.

3. The total age range of the subjects was quite narrow (19 months). Given the effect that age had on performance outcome, it is not known what type of pattern might have emerged had a wider age range of children been utilized.

4. It was not possible to randomly assign subjects within the mediation group to each examiner. When the data from this group was analyzed by examiner, some differences were noted in the

magnitude of change. It is not known whether this effect was attributable to differences in the subjects (eg. discrepancy in mean age levels of the children), differences in examiner style and justification process, a chance effect or other unmeasurable factors.

Suggestions for Future Research

Given the quasi-experimental nature of this research, these results are unable to be generalized, other than by implication, to other groups or populations. It is therefore recommended that this research be replicated with consideration for modifications suggested by this study.

1. In light of the possible effect of age on acquisition of the concepts utilized in this assessment, a wider age range of subjects demonstrating similar learning difficulties should be studied. A related factor which should also be considered is that the higher functioning children were still unable to independently solve the Level III and IV items. It is not known whether more intervention would have improved this performance or whether children of this age are not capable of coping with three or more changing

dimensions. It is recommended that children of 6 - 7 years of age be included who are more likely to be entering the concrete operational stage of development.

2. If mediational intervention produces better comprehension and retention of learned strategies, then the difference between the two groups should become even greater over time. It is recommended that subjects be retested after a period of time (eg. one month) to see whether any strategies have been retained.

3. As outlined in the discussion, it is unknown whether the instructional children would have demonstrated improvement if the posttest items had been identical, not parallel, to those of the pretest. Future research may explore the effect of mediation and instruction on performance of identical items, near transfer items and also on items which required greater generalization.

4. The effect of differences in justification should be addressed more directly in future research. Specifically, comparison should be made of differential performance gains under the conditions of no feedback, elaborated feedback, elaborated feedback plus child verbalization, and child verbalization only.

5. Research is needed which will demonstrate the effectiveness of mediation, used during a dynamic assessment, with other populations such as the mentally retarded and the young ESL child.

CHAPTER SEVEN

Summary and Conclusions

This study compared the effectiveness of two methods of intervention, mediation and instruction, in producing change on the Children's Analogical Thinking Modifiability Instrument (Tzuriel & Klein, in press: see Note 1). Forty-three special needs preschool children were assessed: 27 received contingent mediation and 16 received direct instruction. Mediational intervention was determined to be a more effective method for producing change in this population than instructional intervention.

Special needs preschool children were not found to benefit from additional practice and exposure to the testing items. The age of children at the time of assessment appeared to have no effect on pretest performance but had a slight effect on performance outcome.

The two methods of intervention were found by an independent rater to be distinct, regardless of examiner style. Mediation did not take substantially longer to administer than instruction. Children who received mediation, however, were found to take longer to perform the posttest.

Factors which may have influenced the effectiveness of the two methods of intervention have been examined. Specific feedback by the examiner and justification of the process required for solution have been proposed as critical variables influencing the ability of special needs children to generalize their learning to a near transfer task.

In conclusion, mediation is an effective method of intervention to use with special needs preschool children during a dynamic assessment procedure in order to delineate a child's strengths and weaknesses and to determine his potential for change.

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Reference Notes

Note 1: Permission received in July, 1985 from D. Tzuriel, on behalf of the authors, to use the unpublished version of the Children's Analogical Thinking Modifiability Instrument (CATM) for research purposes. Permission also obtained to make reference to unpublished descriptions of the CATM, to include figures as examples of this instrument and to modify the CATM for this research.

Note 2: Haywood, H. C., & Bransford, J. D. (1983). Permission received to discuss the unpublished research proposal entitled, "Dynamic Assessment of Intellectually Handicapped Children: Evaluation of a Model for a Continuum of Assessment Services", submitted to Special Education Programs in 1983 by J. F. Kennedy Centre for Research on Education and Human Development, Nashville, TN.

Note 3: Klein, P. S. (date unknown). Criteria for observation of mediated learning experiences in infancy and early childhood. Unpublished manuscript. (Available from C. S. Lidz, United Cerebral Palsy Association, Philadelphia, PA.)

Note 4: Mearig, J. (1985) Feuerstein's dynamic assessment in American school psychology. Unpublished manuscript. (Available from J. Mearig, School Psychology Program, St. Lawrence University, Canton, NY.)

APPENDIX A

Procedural Methods Employed in the Baseline, Pretest, Intervention and Posttest

PROCEDURE FOR ADMINISTRATION OF THE CHILDREN'S ANALOGICAL THINKING MODIFIABILITY INSTRUMENT

In this appendix, exact procedures are outlined for adminstration of the four phases of the CATM (as developed by this researcher, based on the work of Tzuriel and Klein, 1985). The format should be followed precisely; however, the wording may be altered slightly, at the convenience of the examiner, providing the meaning is still conveyed. All procedures, except the mediational style of intervention, are scripted and should be carried out as written.

Baseline Procedure

1. Create Matrix

   A. Show Big Red Circle. WHAT COLOR IS THIS? _____ THAT'S RIGHT. THIS IS A BIG RED CIRCLE. Place circle to child's upper left.

   Show Big Yellow Circle. WHAT COLOR IS THIS? _____ GOOD. THIS IS A BIG YELLOW CIRCLE. Place circle to child's upper middle.

   Show Big Blue Circle. WHAT COLOR IS THIS? _____ THAT'S RIGHT. THIS IS A BIG BLUE CIRCLE. Place circle to child's upper right.

   Point to all three circles. HOW ARE THESE ALL THE SAME? _____ THAT'S RIGHT. THESE ARE ALL CIRCLES.

   Note: If child is incorrect or does not answer, provide labels and mediate as required.

   B. Show Big Red Square. WHAT COLOR IS THIS? _____ GOOD. THIS IS A BIG RED SQUARE. I AM GOING TO PUT THE RED SQUARE UNDER THE RED CIRCLE. Place square middle row, left.

Baseline Procedure, continued.

Show Big Yellow Square. WHAT COLOR IS THIS? _____ THAT'S RIGHT. THIS IS A BIG YELLOW SQUARE. WHERE DO YOU THINK IT SHOULD GO? Child indicates. GOOD. IT BELONGS UNDER THE YELLOW CIRCLE. Place square middle row, middle column.

Show Big Blue Square. WHAT COLOR IS THIS? _____ GOOD. WHERE SHOULD THIS BLOCK GO? Child indicates. THAT'S RIGHT. IT BELONGS UNDER THE BLUE CIRCLE. Place square middle row, right.

Point to all squares. HOW ARE THESE ALL THE SAME? _____ GOOD. THESE ARE ALL SQUARES.

C. Repeat section B, substituting large triangles.

Note: Provide labels and mediate the above as required until the child recognizes consistency of shapes across rows and consistency of colors along columns. Do not proceed until these concepts are achieved.

D. Show Small Red Circle. THIS IS A SMALL RED CIRCLE. I AM GOING TO PUT IT ON TOP OF THE BIG RED CIRCLE. Place circle upper left, on top of big red circle.

Show Small Yellow Circle. THIS IS A SMALL YELLOW CIRCLE. WHERE DO YOU THINK THIS BLOCK SHOULD GO? Child indicates. GOOD.

Show Small Blue Circle. WHAT ABOUT THIS BLOCK? Child indicates. GOOD. LET'S SEE IF YOU CAN FIGURE OUT WHERE TO PUT ALL OF THESE. Push all small squares and triangles within child's reach.

Baseline Procedure, continued

Note: Do not allow child to proceed independently until the big/small concept has been mastered. Do not overly emphasize a relationship between large and small blocks of same shape. It is essential that the child realize: 1) that there are two sizes of blocks; and, 2) that small blocks are placed on top of large blocks. Continue mediation until matrix (see Figure 2) is successfully completed.

E. Mediate as required regarding the strategies of searching for missing blocks and learning to turn blocks over. For example:

THERE IS SOMETHING SPECIAL ABOUT THESE BLOCKS. THEY HAVE COLORS ON BOTH SIDES. Demonstrate turning blocks over. IF YOU DON'T SEE THE COLOR YOU NEED . . . . . TRY TURNING THE BLOCKS OVER.

2. Check

With matrix in front of child, ask him/her to indicate the items on checklist. Reinforce all correct responses with verbal statement such as GOOD. Mediate incorrect responses as required. For example:

Examiner requests child to find another Big Blue Triangle. Child indicates that there are none present. DO YOU REMEMBER WHAT IS SPECIAL ABOUT THESE BLOCKS? IF YOU DON'T SEE THE COLOR YOU NEED, FIND ANOTHER BLOCK THE SAME SIZE AND SHAPE AND TURN IT OVER. Continue with parallel examples until child is able to independently turn blocks over in order to find a missing block.

3. Introduce Analogical Reasoning Problems

WE ARE GOING TO WORK ON SOME PROBLEMS TODAY. HERE IS THE BOARD THAT WE USE. Place board in front of child. I AM GOING TO CHOOSE THE BLOCKS THAT GO IN THE FIRST THREE BOXES. (point) YOU HAVE TO LOOK REALLY HARD AND DECIDE WHAT THE BEST BLOCK

Baseline Procedure, continued.

WOULD BE TO MAKE A PATTERN. YOU FIND THE BLOCK THAT YOU NEED AND PUT IT HERE (point to 4th box).

LET'S TRY IT. Display Example 1. Place first 3 blocks, pause briefly and then place 4th block. YOU SEE, WE MADE A PATTERN. LET'S TRY ANOTHER ONE. Repeat using Example 2.

Note: Do not teach comparison or analogical reasoning at this stage.

Child passes baseline: Proceed to Pretest.

Child does not pass baseline (maximum time allowed 30 minutes): Child does not proceed any further.

Pretest Procedure

Ensure that matrix of blocks is cleared away and that blocks are within reach of child but not in any specified array. Begin with first set of analogical problems (Set A, B or C, as designated for research).

I AM GOING TO GIVE YOU SOME PROBLEMS TO SOLVE. (Alternate approach: refer to problems as though playing a game. NOW WE ARE GOING TO PLAY THE GAME.) REMEMBER, I WILL PUT DOWN THE FIRST 3 BLOCKS AND YOU CHOOSE A BLOCK THAT WILL FINISH THE PATTERN.

Proceed, presenting each item to child and recording the child's verbal and nonverbal response on score sheet. If child hesitates or asks for help: I KNOW THESE ARE GETTING TOUGH. IF YOU'RE NOT SURE, MAKE THE BEST CHOICE THAT YOU CAN. Continue to prompt as required but do not provide additional hints or feedback.

Pretest Procedure, continued

Reinforce correct responses with verbal comments such as O.K., GOOD WORK.

When Pretest 1 is complete, give child a short play or juice break. Proceed with Pretest 2 using same format.

After all items have been presented, reassure child regarding task difficulty. THE PROBLEMS THAT YOU DID TODAY WERE REALLY TOUGH. YOU TRIED REALLY WELL AND DID A GOOD JOB. WHEN YOU COME BACK TO SEE ME AGAIN WE ARE GOING TO WORK ON THE PROBLEMS TOGETHER. I'LL HELP YOU WITH ALL THE TOUGH ONES SO THAT YOU WILL LEARN HOW TO DO THEM BY YOURSELF.

Intervention Procedure

Instruction Method:

Lay out first 3 blocks in problem 1. TELL ME WHAT YOU NEED TO PUT HERE? (point to 4th square)

A. Child makes correct choice. GOOD WORK. THAT WAS THE BEST ANSWER. Proceed directly to next item.

B. Child makes incorrect choice. Use transformational approach:

LET'S TAKE ANOTHER LOOK. (remove block) THIS _____ (size), _____ (color), _____ (shape) BECOMES A _____ (size), _____ (color), _____ (shape) THIS _____ (size), _____ (color), _____ (shape) SHOULD BECOME A _____.

Child states descriptors. If no response, repeat once.

Intervention Procedure, continued (Instruction Method)

1) If child states correctly: THAT'S RIGHT. CAN YOU FIND A BLOCK THAT LOOKS LIKE THAT?

i) Correct choice. Reinforce and proceed to next item.

ii) Incorrect choice. YOU TOLD ME THAT YOU NEEDED A _____ (size), _____ (color), _____ (shape). Child chooses. Proceed to next item.

2) If child states incorrectly or does not state: Use analytical approach.

LET'S TAKE A LOOK AT THE SIZE. THIS BLOCK IS (#1), (#2), (#3), (pause). Examiner point to blocks and emphasizes the size of each in a rhythmic fashion. For example, BIG, small, BIG, (pause).

NOW LET'S TAKE A LOOK AT THE COLOR. THIS BLOCK IS (#1), (#2), (#3), (pause).

NOW LET'S LOOK AT THE SHAPE. THIS BLOCK IS A (#1), (#2), (#3), (pause).

Note: On each item, if child does not answer or responds incorrectly, repeat and pause again. If the response is still incorrect, provide answer. WE NEED A _____ (size), _____ (color), _____ (shape). CAN YOU FIND A BLOCK LIKE THAT?

i) Correct choice. Reinforce and proceed to next item.

ii) Incorrect choice. Examiner locates block, says HERE IT IS and puts it in place. THAT'S THE BEST ANSWER. Proceed to next item.

Repeat above procedure for each subsequent item.

Intervention Procedure, continued

Mediation Method:

Mediation is a style of intervention that is provided contingently upon a child's behavior and performance. At each step, the examiner makes a decision as to the particular strategy anticipated to be the most helpful to the child. These decisions are based upon clinical judgement and experience with this assessment instrument.

The following is not a script but is an example of the type of intervention which might occur during the provision of mediation.

Lay out first 3 blocks in the problem. TELL ME WHAT YOU NEED TO PUT HERE? (point to 4th square)

A. Child makes correct choice. THAT'S RIGHT. CAN YOU TELL ME WHY YOU NEEDED A _____, _____, _____?
size color shape

Child justifies answer. Examiner assists and questions for clarification as required. Reinforce and proceed to next item.

B. Child makes incorrect choice. Examiner decides whether to begin with transformational or analytic approach, depending upon child's error. For example:

LET'S TAKE ANOTHER LOOK. (remove block)

FIRST LET'S LOOK AT THE SIZE. THIS BLOCK IS (*1), (*2), (*3), (pause). Examiner points to blocks individually and emphasizes the size of each in a rhythmic fashion. eg. BIG, small, BIG, ... WE NEED A SMALL ONE.

NOW LET'S LOOK AT THE COLOR. WHAT COLOR IS THIS? (point to Block *1) THAT'S RIGHT. IT IS YELLOW. WHAT COLOR IS THIS ONE? (point to Block *2), etc. Continue until color of answer is determined.

Intervention Procedure (Mediation Method)

SO WE KNOW THE SIZE AND THE COLOR. WHAT SHAPE DOES THIS BLOCK NEED TO BE? Child indicates.

GOOD. SO WE KNOW THAT WE NEED A _____, _____, _____
size color shape

CAN YOU FIND A BLOCK LIKE THAT?

i) Correct choice. THAT'S THE RIGHT ANSWER. CAN YOU TELL ME WHY THAT IS THE VERY BEST ANSWER?
Child justifies answer. Examiner clarifies and assists child in justification process, as required. Reinforce and proceed to next item.

ii) Incorrect choice. Examiner questions to arouse conflict.
YOU TOLD ME THAT YOU NEEDED A _____, _____, _____
size color shape

THIS (point to choice) IS A _____, _____, _____, (pause).
size color shape

Examiner continues to assist child by focusing, helping child to proceed through problem in a different way, assisting child to check answer to determine error, etc. depending on child's needs. When correct choice is made, examiner reinforces choice by helping child to justify answer.

Other strategies which may be used during the mediation procedure are approaches which transcend this specific task situation. Problem identification (WHAT DO YOU NEED TO FIGURE OUT?), sequencing and organizing (WHAT DO YOU NEED TO DO FIRST?), comparison of blocks on the basis of attributes (THESE ARE THE SAME SHAPE. HOW ARE THEY DIFFERENT?), and summation of information already acquired (SO WE KNOW THAT THE BLOCK HAS TO BE BIG AND BLUE. WHAT SHAPE DO WE NEED?) are all examples of strategies which might be used to help the child develop a systematic approach.

Intervention Procedure, continued (Mediation Method)

Throughout the entire process, the examiner encourages the child, through an inquiry process, to be an active participant and to feel competent and secure about his choices. The child is helped to check and justify his answers and, in doing this, reviews the process used to derive the answer. The use of precise labels is facilitated since children can become confused by their own imprecision.

The above procedure is continued throughout the intervention phase.

Posttest Procedure

Procedure is identical to that used in the Pretest Phase but only one set of analogical reasoning problems is administered.

After all items have been presented, progress is reviewed with child. For example: WHEN WE STARTED, YOU FOUND THESE REALLY HARD. NOW YOU KNOW HOW TO DO THEM AND YOU WERE ABLE TO DO THE TOUGH ONES ALL BY YOURSELF, (etc.).

APPENDIX B

Checklist of Cognitive Functions

ID# _____

Date _____

COGNITIVE FUNCTIONS

	N	-2	-1	0	1	2
1. Gathers clear and complete information.						
2. Exhibits systematic exploration.						
3. Uses labels to identify objects/events.						
4. Uses spatial systems of reference.						
5. Exhibits temporal concepts.						
6. Conserves constancies of objects.						
7. Is precise and accurate when needed.						
8. Considers 2 or more sources of information.						
1. Recognizes and defines problem.						
2. Selects relevant vs non-relevant cues.						
3. Spontaneously compares objects/events.						
4. Able to remember/retrieve required info.						
5. Exhibits summative behavior.						
6. Projects learned relationships - bridges.						
7. Uses logic to prove things.						
8. Forms mental picture of objects/behavior.						
9. Uses hypothetical thinking.						
10. Uses strategies for hypothesis testing.						
11. Makes a plan to achieve goal.						
12. Able to categorize new object/experience.						
13. Perceives relationships among events.						
1. Communication reflects awareness of the information/perspective of listener.						
2. Uses strategies to overcome blocking.						
3. Thinks before answering (no trial & error)						
4. Able to elaborate on verbal responses.						
5. Visual transport of image.						
6. Perceives need for clear, precise responses.						
7. Restrains impulsive behavior.						

N = not observed 0 = sometimes
-2 = never/rarely 1 = frequently
-1 = occasionally 2 = always

APPENDIX C

Comparative Analysis of Analogical Reasoning Problems from the Children's Analogical Thinking Modifiability Instrument

COMPARATIVE ANALYSIS OF ANALOGICAL REASONING PROBLEMS FROM THE CHILDREN'S ANALOGICAL THINKING MODIFIABILITY INSTRUMENT

This appendix provides illustrative examples of the types of items contained in the CATM. The items have been individually analyzed in order to determine the exact nature and frequency of comparisons required on each task item. All three sets used in testing contain identical types of comparisons at each level: an example of each is given.

For each item, the specific dimension(s) which changes is outlined and the number of comparisons required in order to complete the analogy are stated. The following key is used for the examplar items.

Key

First letter: B = big, S = small
Second letter: B = blue, R = red, Y = yellow
Third letter: C = circle, S = square, T = triangle

Vertical (|) and horizontal (_) lines are used to indicate the exact point of comparison required in order to complete the analogy.

CATM ITEM ANALYSIS

Item Number	Changing Dimension(s)	Number of Comparisons	Set	Example Item
Level 1				
1	size	1	A	SRC | BRC SRC BRC
2	shape	1	B	SYS | SYC SYS SYC
Level 2				
3	color & size	2	C	BBC || SYC BBC SYC
4	size & shape	2	A	BBS | SBS | BBT SBT
5	size & shape	2	B	SRS | SRC | BRS BRC
6	color & shape	2	C	BYC BYC || BBS BBS
7	color & shape	2	A	BRC || BBS BRC BBS

CATM ITEM ANALYSIS

Item Number	Changing Dimension(s)	Number of Comparisons	Set	Example Item
Level 3				
8	color, shape, size	3	B	SRC | SYC || BRS BYS
9	color, shape, size	3	C	BYS | SYS || BBT SBT
10	color, shape, size	3	A	SBS | SBC || BRS BRC
Level 4				
11 Top	shape	1	B	SYC | SYT SYC SYT
11 Bottom	color & shape	2		BRT | BRC | BBT BBC
12 Top	shape	1	C	SYT | SYC SYT SYC
12 Bottom	shape	1		BRT | BRC BRT BRC
13 Top	color & shape	3	A	SYC | SRS SBC SYS
13 Bottom	color & shape	3		BRT BYT | BYC BBC

APPENDIX D

Essential Components of Mediation/Instruction

Essential Components of Mediation Method

1. INTENTIONALITY: Examiner intends to assist child to improve performance on this analogical reasoning task and, therefore, creates an open, friendly environment and develops a rapport with the child.

2. MEANING: Examiner communicates to the child the intent of the session. He/she begins each task item by ensuring that the child's attention is focused on the task.

3. TRANSCENDENCE: Examiner transcends this situation by emphasizing the process, principles and strategies required to perform this or any similar task. This should include:

   a) Use of transformational and/or analytical approaches.
   b) Use of superordinate terms.
   c) Sequence of items always proceeds from child's left to right.
   d) Sequence always proceeds in order of size, color, shape.
   e) Summation of required attributes, once determined.
   f) Continual emphasis on general strategies and principles such as problem identification, sequencing, organizing answer, etc.

4. COMPETENCE: Child is perceived as a competent and active participant and is involved throughout the entire process. Examiner is required to always attempt to elicit answer from child before providing it. Examiner attempts to provide specific feedback regarding aspects of child's behavior that contributed to response. Examiner does not proceed without indication of child's active participation in task process (verbal or non-verbal).

5. REGULATION OF BEHAVIOR: Examiner regulates child's behavior as required and assists child to become more responsible for own behavior and performance.

Essential Components of Instruction Method

1. Examiner intends to teach the child how to perform this analogical reasoning task and, therefore, creates an open, friendly environment and develops a rapport with the child.

2. Examiner communicates to the child the intent of the session. He/she begins each task item by ensuring that the child's attention is focused on the task.

3. The examiner has a pre-established method for instructing this task. If the child is unable to derive a solution independently then the examiner teaches the task. This should include:

   a) Use of transformational and/or analytical approaches.
   b) Use of superordinate terms.
   c) Sequence of items always proceeds from child's left to right.
   d) Sequence always proceeds in order of size, color, shape.
   e) Summation of required attributes, once determined.
   f) Immediate feedback regarding all correct responses.

4. Examiner verbally reinforces all correct answers. Examiner provides assistance to child whenever incorrect responses are given. This may include teaching of task and/or provision of answer, as outlined in instruction procedure.

5. Examiner regulates child's behavior, as required, in order to ensure child's active participation in task.