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Process Instruction of Inductive Reasoning Skills to Secondary Educable Mentally Handicapped Students

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PROCESS INSTRUCTION OF INDUCTIVE REASONING SKILLS TO SECONDARY EDUCABLE MENTALLY HANDICAPPED STUDENTS

by

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DEDICATION

This work is dedicated to my parents, Lucille and John Scott and Dr. Martin Fine, without whose love and support this would not have been accomplished.

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VITA

The author, Lynda Wait is the daughter of John and Lucille Wait. She was born December 29, 1946.

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CHAPTER I

INTRODUCTION

Public education is designed to prepare individuals to live and work successfully in their cultures. In the United States, education is considered significant for the maintenance of democracy. There are, however, an estimated 25 million individuals in the United States who are reported to be illiterate (U.S. Department of Education, 1983). A disproportionate number of illiterate people live in urban areas, are from minority groups, and are of lower social economic stratum (Costa, 1988). Given that the individuals serving as subjects in the study reported here are students in the Chicago Public School System, it should be noted that the Chicago Public School System has been cited as one of the worst examples of a failing urban educational system contributing to this growing illiteracy rate (Bennett, 1989).

In attempting to instruct today's youth, urban educators have numerous problems to face. Students are often reported to enter school without the prerequisite skills necessary to benefit from formal instruction (Hodges & Cooper, 1981; Lipman, 1977). They are often naive with respect to the necessary skills of comparison and contrast.

Inner-city students often come from homes where education is not seen as a means to become successful in society (Davis, 1948; Gans, 1962). Teachers must teach students who display attentional deficits and are unable to benefit from traditional classroom instruction.

Public schools have developed intricate special educational intervention systems in their attempt to deal effectively with the different entry levels of students. Special education instruction by law (PL 94-142) is designed to augment each individual student's learning style. However, as special education became more and more specialized to accommodate the individual needs of diverse groups of students, many students appeared not to benefit from these specially designed services. In addition, special education was under fire due to reported substandard education for some of the students placed in the programs (President's Committee on Mental Retardation, 1970).

Recent litigation, such as Larry P. v. Riles (793 F.2d 969 (9th Cir 1984)) and the PASE v. Hannon (506 F Supp.831, (N.D. ILL 1980)) in Chicago, serves to illustrate considerable national and local public discontent with special education programs. Teachers of EMH students have been under attack for numerous years due to lack of successful academic gains of EMH students (Dunn, 1968). In addition to this research activity related to the effectiveness of special education programs, many researchers have focused on the disadvantaged student. Programs have met with varying degrees of success. Reuven Feuerstein's (1981) work with Israeli students is one model that is reported to have demonstrated considerable educational potential. Feuerstein attempted to raise the intelligence level of young students functioning in the mildly mentally retarded range through a process of mediated learning activities.

Many factors enter into the current difficulty of estimating academic aptitude among Chicago's secondary EMH students. Traditional definitions of intelligence and resulting assessment procedures of cognitive abilities have contributed to the concerns. Those individuals associated with traditional assessment instruments tended to view intelligence as a fixed ratio, limiting the amount of material that could successfully be taught. However, as the role of the school psychologist changes, so are the function and method of assessment tools (Meyers, 1988; Meyers, Pfeifer & Erlbaum, 1982). Many psychologists are no longer comfortable with static measurements of intelligence, such as the Wechsler Intelligence Scales or the Stanford-Binet, but have supplemented their assessment procedures to include adaptive behavior scales and measures of learning styles (Grossman, 1983). These supplemented measures reportedly make it possible for psychologists to identify strategies that will enhance a learner's performance rather than merely measure it.

As evaluations became more sensitive to individual learning styles, so did labeling requirements (PL 94-142). Feuerstein's model allowed psychologists to think of intelligence as a construct capable of being altered in direct response to intervention and experiences (Feuerstein, 1983). This change appears to have fostered higher expectations for EMH students.

In the present study reported below, an attempt was made to teach the skills necessary to compare and contrast information and to facilitate storing of such information in a group of educable mentally handicapped students. It should be noted that I did not assume that I could raise the intelligence quotients of the EMH students serving as subjects in the study, but I did assume that I could instruct them in cognitive skills which would facilitate problem solving activities. However, it is assumed that an increase in cognitive problem solving abilities may raise measured intelligence on static assessment tools. Students are taught a means of solving problems, viewing contrasts and similarities, and storing information in a meaningful manner in order to facilitate retrieval. These skills seem necessary for success in and out of school. Overall the study was designed to build on existing cognitive structures for storing information which would allow students to develop skills that are applicable to numerous intellectual tasks.

The present study utilizes Feuerstein's approaches to instruction in attempting to increase the reasoning skills of high school age Educable Mentally Handicapped (EMH) students in the Chicago Public Schools. The study is based on the assumption that the public schools can provide appropriate instruction for handicapped students.

Sixty (60) EMH students in the Chicago secondary public school system are the subjects of this research. Students were randomly assigned to either experimental or control groups. The experimental group received twenty (20) process instruction sessions and the control group maintained their required schedules. Process instruction groups focused on teaching inductive reasoning skills. Skills targeted for instruction were visual comparison and contrasting skills, how to solve progressive matrices tasks and verbal analogous reasoning solutions. Pretest and posttest measures were administered prior to and following instruction. Measures used in the pre/posttest phase were Raven's Progressive Matrices (MAT), Visual Matching (VIS) and Analogies (ANA) subtests from the Woodcock-Johnson Psychoeducational Battery, Memory for Designs (DES) from the Detroit Test of Learning Abilities-2, and the Bialer-Cromwell Locus of Control Scale (LOC).

Pretest and posttest measures were analyzed by a multivariate analyses of variance (MANOVA) procedure. Independent variables utilized in the analyses were experimental groups (two), by race (three), sex (two), age (three), and attendance (three).

CHAPTER II

REVIEW OF RELATED LITERATURE

Concepts of intelligence and instructional procedures are closely aligned. How one views intelligence may shape instructional methods and expectations.

The first section will review numerous definitions of intelligence and discuss how these definitions impact on instructional procedures. Next intellectual intervention research will be cited, focusing on procedures and outcomes.

The next five sections will focus on the Educable Mentally Handicapped (EMH) student. First the EMH student will be defined, followed by a discussion of the assessment battery utilized to identify the EMH student in the Chicago Public School System, the Process Assessment for Learning (PAL). Characteristics and teaching techniques of the EMH student will then be discussed. The last section will focus on current educational issues surrounding the EMH student.

The final sections will focus on Process Assessment and Instrumental Enrichment. Definitions and research on process assessment will be discussed. Feuerstein's concept of Instrumental Enrichment (1980) will be presented and related to the current research.

Views of Intelligence

Special education literature reflects a need for programs that are more concerned with the process of performance, and less with the product (Budoff & Gottlieb, 1976; Feuerstein et al., 1979; Gotts, 1980; Hodges & Cooper, 1981). Teachers too often concentrate on the content to be learned instead of the process of learning. They attempt to teach children what to think, but do not help them learn how to think. Contemporary theorists believe teaching thinking skills is significant in revamping special education (Feuerstein et al., 1979).

Many specialists in the field are concerned that special education students are not receiving essential instruction in cognitive strategies (Haywood, 1981; Nickerson, 1981; Sternberg, 1981). This lack of instruction in cognitive strategies may in part be due to numerous misunderstandings regarding the nature and content of "intelligence".

Historically psychologists may have had more success in measuring intelligence than in defining it (Matarazzo, 1976). While many psychologists agree that standardized tests measure a part of a person's ability to perform intellectual tasks, there is little agreement on what intelligence is, or what intelligence tests measure.

Various definitions have been given to the term "intelligence." Traditional views have often stressed the permanent, tangible components of intelligence, such as demonstrated by the terms "IQ" or "innate potential." Contemporary theorists seem to be turning from this narrower concept of IQ to a more educationally significant examination of intelligence as a process, rather than a product (Feuerstein, 1979).

Many definitions of intelligence have been offered by numerous theorists. Pyle (1979) reviewed numerous definitions of intelligence:

Binet: to judge well, to comprehend well, to reason well;

Spearman: general intelligence which involves mainly the 'education to relations and correlates';

Terman: the capacity to form concepts and to grasp their significance;

Vernon: stresses a simple and non-specific definition, such as "all-around thinking capacity" or "mental efficiency";

Burt: innate, general, cognitive ability;

Heim: intelligent activity consists in grasping the essentials in a situation and responding appropriately to them;

Wechsler: the aggregate or global capacity of the individual to act purposefully, to think rationally and to deal effectively with the environment;

Piaget: adaptation to the physical and social environment.

The views of Wechsler and Binet, which focus on processes of intelligence rather than products, seem to encourage educational intervention. Definitions given by Vernon and Burt seem to view cognitive processes as innate, unspecific, and static. These definitions are less likely to encourage educational intervention.

Burt (1970) defines intelligence as "in-born, innate, native ability". Vernon (1970) argued strongly that definitions of intelligence must incorporate the culture in which an individual is reared. However, he attributes much of intellectual functioning to a specific general factor, which remains constant. Jensen (1970) split intelligence into two parts: a measure of the influence of biological factors comparable to inherited abilities, and learned factors. The inherited segment of intelligence was free from the influences of culture, education, and experience, and is believed to be the basis of intellectual pursuit. The second type is a more crystallized intelligence and is considered to be a measure of the outcome of cultural and educational experiences. Both of these theorists stated the learned segment of intelligence was strongly influenced by the innate possibilities.

Piaget (1981), in contrast, saw intelligence as something active and changing. He viewed intelligence as dynamic. From this perspective intelligence is seen as an active, ongoing process, in which cognitive inconsistencies upset the state of equilibrium. As equilibrium is upset the child finds better and more effective ways, of dealing with the world. For Piaget, the nature of intelligence is a process of organizations and adaptations which are forever changing, not a stable entity or quantity.

For the purposes of this research, intelligence is seen as multifaceted and dynamic. Recently psychologists have used theories of intelligence as framework for modifying learning skills through systematic training (Borkowski & Konarski, 1981).

Sternberg (1981, p. 18) states intelligence consists of a set of developed thinking and learning skills used in academic and everyday problem solving. He presents a list of skills needed for adaptive task performance in a great variety of situations. He maintains, to the extent that these thinking and learning skills provide an accurate assessment of at least part of the core of intelligent behavior, they have implications for diagnostic and teaching purposes. Sternberg states that in order to assess and understand the information-processing bases of intelligent performance; the research on instrumentation will have to move in the direction of process measurement, rather than in the direction of refining the instruments now in use.

Reuven Feuerstein (1981) presented an approach to the production and measurement of cognitive change with the Learning Potential Assessment Device (LPAD). However, there appears to be controversy surrounding the definitions of intelligence as demonstrated in the prescribed changes following remediation by Feuerstein's method. Feuerstein's theories and methods will be explored at length in the following sections.

Because definitions of intelligence are numerous, research which results in the improvement of cognitive skills might be accepted as enhancing "intelligence" under some definitions, but not others. This research defines intelligence as a dynamic, global capacity to learn, available to remediation and intervention.

Intellectual Intervention Research

Several studies attempting to intervene in the intellectual development of young children have been conducted. One of the most noted of these studies, Project Headstart, reports limited success. Hodges and Cooper (1981) found evidence on the effectiveness of this project as highly controversial. They concluded the literature suggests short-term effectiveness. Results are inconclusive regarding the long-term effects of early intervention.

The Milwaukee Project focused on small numbers of inner-city children (Garber, 1988). This project has been described as raising IQ's from the dull-normal range to the superior ranges. The final report has not been issued, however, the evidence suggest a decline of the experimental students' IQ to the level of the untreated controls in measures such as school reading (Page & Grandon, 1981).

In a review of the early intervention programs, Gotts (1981) maintains the future would be guided by these early research findings. He believed as a result of these intervention programs there would be a downward extension of the competency education and evaluation movements that would greatly influence early interventions and bring greater financial support. Newer and better models of early assessment would be used and will afford greater understanding of the potential contributions of early intervention in the primary prevention of many kinds of disorders. Chronological age will decrease in importance as the basis for decisions about when children will enter schooling and when they will leave it. Better assessment of parental characteristics will further add to the school's capacity to intervene effectively in the early years. Normalizing experiences will be provided before school entrance to all handicapped children (Gotts, 1981).

In addition to early intervention programs, there are also a number of procedures geared to teach cognitive skills to older, disadvantaged students. Perhaps one of the best known of these programs is Instrumental Enrichment developed by Reuven Feuerstein (1980). This research will utilizes the procedures of Feuerstein to teach inductive reasoning skills to secondary, mildly retarded students.

Instrumental Enrichment (IE) reflects a psychoeducational philosophy, a set of beliefs, educational policies, and procedures which can be subsumed under the more general concept of a theory of cognitive modifiability. This concept is based on the belief that the cognitive behavior of the human organism represents an open system amenable to meaningful structural change. Cognitive modifiability is referred to as a change at a certain point in the otherwise predictable course of the development of the organism. This change represents a departure, more or less acute, from the expected direction of development. Once set in motion, this departure will continue and perpetuate itself, and will orient the life course of the individual in ways that were initially not available (Feuerstein, 1980).

Feuerstein (1979), in an experiment designed to modify the cognitive structures of retarded, disadvantaged, adolescents, found the group made significant gains following intervention on measures of general and specific cognitive tests, scholastic achievement, classroom interaction, and self-concept.

Another research project initiated by Feuerstein

(1981) demonstrated the theory of cognitive modifiability when dealing with the phenomenon of low cognitive performance. Cognitive modifiability occurs when a mediator is interposed between the learner and the environment and interprets the world to the learner. Feuerstein maintains the direct, or proximal, etiology of low performance is lack of mediated learning experiences. Instrumental Enrichment is a phase-specific substitute for mediated learning, with its major goal to enhance cognitive modifiability by sensitizing the learner to formal and informal sources of learning and experience.

Nickerson (1981), posing whether thinking could be taught, quiered: "What can be done to improve student ability to perform intellectually demanding tasks? Surely the answer to that is not nothing." He suggest four types of objectives that are necessary to teach thinking skills which are abilities, methods, knowledge, and attitudes. Abilities are specific things one might want students to be able to do. Methods are structured ways of approaching tasks and includes the notions of strategies, procedures, and heuristics. Knowledge refers to facts, concepts, or principles that one might want students to understand. Attitudes are points of view, perspectives, or opinions that one might want students to adopt. The current research will attempt to employ these criteria into the inductive learning sessions guided by Feuerstien's techniques.

Sternberg (1981) has also attempted to enhance intelligence in those believed as retarded. The concept of training of intelligence here means intervention that has as its goal improvement in individuals' abilities to adapt to their environments, whatever these environments may be. Adaptation may take different forms in different environments, and it is the matching of one's cognitions and behaviors to the demands of the environment in which one finds oneself that constitutes the essence of intelligence.

Lipman (1977) in his publication, Philosophy For Children, attempts to teach students to think for themselves through a series of stories and class discussions which model and then give students the opportunity to practice the use of logical analysis in such tasks as solving syllogisms.

Vye and Bransford (1981) attempted to evaluate the different programs for teaching thinking. They found some similarities among the programs. Each of the thinking skills programs emphasized the importance of making implicit thought processes more explicit. The programs helped students become aware of the thinking processes they used as they attempted to solve problems. This awareness was felt to be important because it prepared students to solve more difficult problems later.

Robert Heiny (1981) sums up the literature on teaching children to think stating "it is currently unclear which concepts of intelligence contribute to student benefits and what adjustments are needed to bring equity to benefits received by all participants in special education." This research will explore the concepts and adjustments that are necessary when applied to secondary EMH students.

The Educable Mentally Handicapped Student

Secondary students identified as EMH were the subjects of the present research. EMH students are classified on the basis of delayed intellectual and adaptive behavioral skills. Currently much controversy has surrounded the EMH label. Contributors to this controversy have come from many sources.

The change from the 1961 to the 1983 American Association on Mental Deficiency (AAMD) definition of mental retardation has spurred changes in assessment and placement. A greater emphasis on the appropriate adaptive behaviors has resulted in a more integrated view of the student's functioning.

Passage of PL 94-142, as well as litigation in cases such as Larry P. (1972) and Diana (1970), have resulted in closer scrutiny of procedures used to label EMH students and how delivery of service is to be implemented.

Due to PL 94-142, assessment procedures, mandatory in the identification of the EMH student, have been revised and attempts have been made to safeguard the rights of students and parents. The Chicago Board of Education, Bureau of Child Study's psychologists under the direction of Dr. Patricia Heaston have developed an assessment battery for the purpose of conducting nonbiased identification procedures for EMH students. The resulting instrumentation, the Process Assessment for Learning, has been used for the identification of the EMH students within the city of Chicago.

As the definition and selection procedures for EMH students have changed throughout the country, so have the characteristics of the EMH student. The number of students identified as EMH has declined markedly and the racial balance of students identified as EMH has improved. In response to these changes, new instructional methods and materials have been designed in an attempt to enhance cognitive functioning.

In response to these vast changes in the identification, assessment, and instruction of EMH students, relevant future issues have been raised and may serve to illustrate the direction and concerns of the future.

Definition

The definition of educable mentally handicapped (EMH) students is directly connected with the history, purpose, and practice of assessment of mental retardation. The assessment of intelligence and the concept of intelligence cannot operationally be defined without one another. Thus, the tautological definition of intelligence prevails: intelligence remains that which is measured by an intelligence test. Current changes in assessment procedures seem to be embedded in changes of the definition of mental retardation, rather than changes in the testing format (Zucker & Polloway, 1987, p. 70).

The definition of mental retardation most commonly referenced is one given by the American Association on Mental Deficiency (Grossman, 1983). The 1983 AAMD definition is as follows: "Mental retardation refers to significantly subaverage general intellectual functioning resulting in or associated with concurrent impairments in adaptive behavior and manifested during the developmental period" (p. 11).

More significant to the definition of mildly mental retardation is the discussion and elaboration on the components of the definition which are as follows:

> General intellectual functioning is operationally defined as the results obtained by assessment with one or more of the individually administered standardized general intelligence tests developed for that purpose. Significantly subaverage is defined as an IQ of 70 or below on standardized measures of intelligence. This upper limit is intended as a guideline; it could be

extended upward through IQ 75 or more, depending on the reliability of the intelligence test used. This particularly applies in schools and similar settings if behavior is impaired and clinically determined to be due to deficits in reasoning and judgment. Impairments in adaptive behavior are defined as significant limitations in an individual's effectiveness in meeting the standards of maturation, learning, personal independence, and/or social responsibility that are expected for his or her age level and cultural group, as determined by clinical assessment and, usually, standardized scales. Developmental period is defined as the period of time between conception and the 18th birthday. Developmental deficits may be manifested by slow, arrested, or incomplete development resulting from brain damage, degenerative processes in the central nervous system, or regression from previously normal states due to psychosocial factors (p. 11).

This definition of mental retardation is not new and versions of the current definition have been introduced previously by the AAMD in 1959 (Heber, 1959) and again, in 1973 (Grossman, 1973, 1977).

Each of these definitions, however, incorporates performance on a standardized IQ test and each required deficits in adaptive behavior to be apparent before an individual could be classified as mentally retarded. A significant difference, however, was a change in the bottom cutoff score from 85 in the 1959 definition to approximately 70 in the 1983 definition. Changes in these cutoff scores had a profound effect on who was classified as a mentally retarded individual.

Current assessment procedures focus on the two main properties mentioned in the 1983 definition; general intellectual functioning and adaptive behavior. Certainly adaptive behavior became a major focus with the introduction of Mercer's "Six hour retardate" (President's Committee on Mental Retardation, 1970). Mercer maintained many students classified as EMH were labeled only for the convenience of education, and once outside of the school system, they demonstrated few behavioral differences from their non-retarded peers.

Grossman (1983) listed five steps in assessing if an individual was mentally retarded:

1. Recognize that a problem exists (e.g. delay in developmental milestones).

2. Determine that an adaptive behavior deficit exists.

3. Determine measured general intellectual functioning.

4. Make decision about whether or not there is retardation of intellectual functioning.

5. Make decision about level of retardation as indicated by level of measured intellectual functioning (p. 13).

Following the administration of a standardized intelligence test levels of mental retardation were assigned. The categories and their approximate intellectual ranges are as follows:

Mild mental retardation	50-55 to 70 approximately*
Moderate mental retardation	35-40 to 50-55 IQ
Severe mental retardation	20-25 to 35-40 IQ
Profound mental retardation	Below 20 or 25 IQ

*"It could be extended upward through IQ 75 or more, depending on the reliability of the intelligence test used. This applies particularly in schools and similar settings if behavior is impaired and clinically determined to be due to deficits in reasoning and judgement" (Kidd, 1983).

Though it appears the AAMD definition of mental retardation weights equally both intellectual and adaptive behavior, however traditionally more weight has been placed on the intelligence scores. Zucker and Polloway (1987) feel the continuing overemphasis on the IQ testing is due to a lack of psychometric history and stability across setting of current adaptive behavior measures (p. 74). Instruments used in the diagnosis of mild mental retardation will be discussed in a later section.

Public Law, Litigation, and the EMH Student

Central to the definition of the EMH student are the procedures of assessment used to identify a student as in need of special edcuation service. Two sources have spurred the changes and challenges found today in the assessment and placement of EMH students. They are implementation of Public Law 94-142 and preceeding litigation.

Public Law 94-142 (20 USC ss 1401, 1411, et seq), The Education for All Handicapped Children Act continues to have a significant impact on current educational practices. The stated purpose of the Act as stated by Congress in Section 601 (c) are: (1) to insure that all handicapped children have available to them a free appropriate public education; (2) to assure that the rights of the handicapped children and their parents are protected; (3) to assist states and localities to provide for the education of all handicapped children; and (4) to assess and assure the effectiveness of efforts to educate handicapped children (U.S. Department of Education, 1984).

Prior to PL 94-142, two landmark cases, Diana v. State Board of Education (1970) and Larry P. v. Wilson Riles (1984), both brought to court in the state of California, emphasized the disproportionality high enrollments of minorities in EMH programs. Both cases were decided in favor of the plaintiffs and resulted in considerable changes in the identification and educational programming for EMH students. In addition, many of the points made by the plaintiffs in these two cases were eventually incorporated into PL 94-142. In particular, provisions ensuring due process, parental involvement, nondiscriminatory assessment, and placement in the least restrictive environment are direct results of the two aforementioned cases (Macmillan, Hendrick, & Watkins, 1988).

The Larry P. case raised serious questions concerning the identification and placement of EMH children. Standardized intelligence tests were challenged as unconstitutional due to bias. James Cremins (1981) suggested the court's intent was not to abolish standardized testing, but rather EMH classrooms because of the court's emphasis on the limited nature of the expectations set for students labelled EMH. Gilhood and Stutman (1978), as a result of EMH efficiency studies, called for the end of segregated classrooms as an appropriate remedy for over-representation.

Dunn (1968) suggested, after viewing the benefits of self-contained classes, eliminating special education classes, as well as ability groupings. He recommended a moratorium on self-contained EMH special education classes whose primary enrollment is minority and/or disadvantaged youth. Similar conclusions were drawn by other leaders in the special education field. Deno (1970) argued that traditional categorical placement of special education students in self-contained programs was no longer useful. Balow (1972) suggested that labels tended to become stigmatic and deleterious to the children so labeled.

Calhoun and Elliot (1977) report that on measures of self-concept and achievement, EMH students in regular classrooms did significantly better than those assigned to self-contained special education.

A comprehensive review of efficiency studies was conducted by Cegelka and Tyler (1970) and two interpretations for the maintenance of EMH classes were suggested: Research does not support continuation of the EMH special education classroom; and, placement of a child in such classrooms was done for reasons other than enhancing self-concept or achievement.

The educational value of labeling a child EMH was questioned in the Larry P. case. Dunn (1968) suggested that diagnostic tools which led to homogenous grouping did more harm than good. He maintains once labeling has been procured; diagnosis stops and the child, rather than the system, is found wanting. As reported by Rosenthal and Jacobson (1966) labeling can have a profound effect or attitudes and teacher expectations.

Assessment of EMH Students

PL 94-142 requires that no single procedure (e.g. IQ score) may be the only criterion for special education placement. Jukala (1977) found, however, while IQ is no longer the only measured used for special education placement, it was the only variable that correlated significantly with placement decisions.

Section 611 (5)(c) of PL 94-142 (1975) requires states to establish:

> procedures to assure that testing and evaluation materials and procedures utilized for the purposes of evaluation and placement of handicapped children will be selected and administered so as not to be racially or culturally discriminatory. Such material or procedures shall be provided and administered in the child's native language or mode of communication, unless it is clearly not feasible to do so, and not a single procedure shall be the sole criterion for determining an appropriate educational program for a child.

The court cases which were integral to this section of the law were those that related to the use of IQ tests in the placement of minority children into classes for students labeled as mildly mentally retarded (e.g. <u>Larry P. v. Riles</u>, 1972; <u>Diana v. State Board of Education</u>, 1970). Another case that contributed to the concern over assessment procedures was <u>Hobson v. Hansen</u> (1967), which found the "tracking system" in Washington, D.C. Public schools, as a result of evaluation tools standardized on white middle class, classifying students on socio-economic status and not ability.

Mercer (1975) reported that school personnel were relying mainly on measures of intelligence even though official AAMD definition of mental retardation included adaptive behavior. In response Mercer and Lewis (1977) devised the System of Multicultural Pluralistic Assessment (SOMPA), in which an appropriate sociocultural normative group is determined for each child and the IQ scores are derived from this norm. This procedure, however, still relies on a psychometric approach to the identification of mental retardation and has not enjoyed broad acceptance within the profession.

As stated in the previous section, the definition of mental retardation and the assessment procedures are intertwined. The existing use of instrumentation in the identification of mentally retarded students continues to be an area of concern. Howell, Zucker, and Moorehead (1982) identified some common problems in these tests:

1. Test items are not keyed to clearly defined objectives which teachers know students must master.

2. Test items do not measure clearly defined content and behavioral domains.

3. Tests do not collect an adequate sample of behavior on each type of item or teachers to interpret the

results with confidence.

4. Tests do not collect data on the student's rate, so that teachers do not know whether the student can really use the skill in all the situations that demand it.

5. Tests use formats and procedures which are inappropriate or irrelevant to the way instructional materials are formated or the way teachers teach (p. iv).

In an attempt to carry out assessment procedures in a way that will equal the greatest benefit to all segments of society, Polloway (1985) suggested establishing intellectual functioning in accordance with the AAMD definition (Grossman, 1983) because it uses a flexible cutoff point, while emphasizing the importance of careful professional judgement. Adaptive behavior is an important component of the AAMD definition and adaptive behavior should be reviewed both in and out of school. Also, achievement has often been used to be the balance between IQ and adaptive behavior. However, adaptive behavior can serve as a "check against excessive reliance upon measures of intelligence" (Sargent, 1981, p. 3). Adaptive behavior can be the measure used to place a student with an IQ of above 70 in an EMH program or exclude a student with an IQ of below 70 from self-contained placement.

Process Assessment for Learning

All students involved in the current research were assessed with the Process Assessment for Learning (PAL) instrumentation.

This evaluation tool was developed as a direct result of the Parents in Action on Special Edcuation (PASE) vs. Hannon (1980) litigation. Following the Larry P. case in California, a similar class action suit was initiated against the Chicago Public School System. While the issues were essentially the same, the findings were opposed to those presented by Judge Peckham. In Chicago, Judge Grady held that the <u>WISC</u>, <u>WISC-R</u>, and <u>Stanford-Binet</u> tests, when used in conjunction with other instruments in determining appropriate educational programs, did not discriminate against black children (Bersoff, 1982, p. 83). However, the Chicago Board of Education passed a resolution to discontinue voluntarily the use of standardized tests in the screening and evaluation of EMH students (Heaston, 1987, p. 160).

The Board also agreed to re-evaluate all students enrolled in the EMH program within two years. Instrumentation used to re-evaluate the EMH students was further dictated by the Chicago Board of Education. The consent decree stated:

1. All students currently enrolled in EMH were to be reassessed within two years;

2. with instruments designed for the specific purpose of special education eligibility;

3) utilizing independent, local norms (Heaston, 1989).

In response to these guidelines the PAL (1986) was designed and administered to all students placed within the EMH program. Tests within the PAL include measures of verbal and non-verbal reasoning, performance of visual-motor integration skills, a measure of short-term auditory memory, and adaptive behavioral scales. In addition to these essentially traditional modes of evaluation, a test-teach-test method component was added. The test-teach-test method attempts to indicate the amount of intervention necessary to teach an individual student. The evaluation system emphasized the process rather than outcome of an individual learner and the extent of modifiability of instruction necessary to teach a new concept (Heaston, 1987, p. 170).

Characteristics of EMH Students

EMH students are defined as those students with delays in both intellectual and adaptive behaviors (Grossman, 1983). As stated previously, the designated population has changed significantly during the past 30 years. Forness and Polloway (1987, p. 221) found that, with the inception of PL 94-142, the population known as EMH had undergone drastic changes. They found more severely handicapped students enrolled in programs for the mildly mentally retarded, and indicated that different types of related services may become necessary. These conclusions were based on a sample of 84 school age children, and found an elevation of biomedical and psychiatric problems.

Childs (1982, p. 109) explored the impact of equating intelligence with adaptive behavior, formulating a two dimensional concept of mild mental retardation. It was hypothesized that 80% of all students currently receiving EMH services would be declassified. Declassification would mean termination of special education services. Philosophical differences exist in regard to the utility of EMH placement, however, and Child (p. 112) notes that declassification must consider the impact on the life of the child.

As the population of EMH students becomes smaller the children being serviced appear to be in need of more intensive intervention. Polloway, Epstein, and Cullinan (1985, p. 3) found EMH students displaying emotional/behavioral concerns in the areas of low self-esteem, disruptiveness, dependency, and attentional problems.

While we have briefly discussed some characteristics of students in EMH classrooms, two things become apparent: (1) EMH students often display a myriad of problems; and (2) the students remaining in EMH programs are displaying more serious behavioral problems. Macmillan and Borthwick (1981, p. 12) have cited the remaining EMH students as a "more patently disabled group."

Teaching Techniques

Educators face a special challenge when attempting to teach the mentally retarded. Primary educational objectives have been cited by Smith (1968) as an educational overview. Smith maintains the educational program should be designed to assist the mentally retarded child to develop a repertoire of general information which can be retrieved quickly and at appropriate times. The educational program should assist the mentally retarded child to develop skills necessary to become socially, personally, and occupationally self-sufficient through the effective use of a consistent method of problem solving. The following subobjectives are directly related to this primary aim: (a) The educational program should assist the retarded child to develop competency in predicting the consequences of his behavior in areas concerned with the effective social, personal, and occupational interaction with his environment; and (b) emphasis should be placed on conceptual rather than rote understandings by the child (p. 53).

It becomes apparent that mild mentally retarded students must be given more than facts and rote learning experiences, rather they must be given a prerequisite objective to assist them to establish and elaborate associational patterns.

Smith continues to outline fundamental principles of instruction for the mentally retarded (pp. 54-60). These 11 points will be reviewed and briefly discussed:

Readiness for Learning: Included in the factors inherent in the concept of readiness is the general belief that an organism must be mature enough to respond in a consistent and accurate fashion. A child needs to learn certain basic skills before adequate performance can be expected.

Motivation to Learn: If learning is to proceed in a stable fashion at an optimum level, students must perceive a need to learn. Ideally the students need to develop an interest in learning about something, they must have had a history of success in related areas.

Immediate Knowledge of Results and Reinforcement of Success: Activities should be structured so that the retarded child can be successful, with consistent and immediate rewards provided for an accurate performance. Delayed reinforcement has been repeatedly demonstrated to impede learning.

Exercise: Fundamental in teaching the retarded is the advantage in offering them opportunities to repeat and practice experiences in a variety of ways. The chance to practice allows students to view stimuli in a variety of situations in order to become aware of the dimensions of a problem and allow for an opportunity to associate relevant stimuli. Also, wide experience on a number of occasions, and in repeated contexts, will direct the student's attention and help in the development of associational bonds.

Distributed Practice: Distribution of practice should vary according to the characteristics of each student as well as in terms of the type of materials being used.

Active Participation: Active involvement by the learner will facilitate learning. It helps to focus the student's attention on the task at hand, it alerts the student to his importance, in the teaching-learning process, it fosters greater efficiency in learning, it provides a more dramatic source of feedback, and it serves as a more accurate means of diagnosing the extent of learning which has taken place as well as any unusual weaknesses.

Overlearning: This concept is defined as the practice of a task beyond the point of initial mastery.

Stress Accuracy: To control for the effect of students practicing errors, accuracy instead of speed should be stressed. This is necessary in the early stages of learning when new and basic concepts, which later will form the basis for subsequent learning, are formulated.

Reducing Proactive and Retroactive Inhibition: "Proactive inhibition" refers to interference with learning because of some prior experience. "Retroactive inhibition" refers to the interference with learning because of some subsequent experience. During initial learning, materials with different characteristics should be presented in close temporal contiguity.

Minimal Change: Retarded students will learn most effectively if materials are programmed so that abrupt shifting between concept and activities is minimized.

Using the Student's Strengths: All of us are relatively stronger in some skills than in others. Retarded students typically show their greatest strengths in nonverbal activities and exhibit relatively weaker performances in skills requiring verbal competencies.

The 20 instructional sessions attempted to incorporate these 11 principles into the instructional format. The majority of instructional material was non-verbal. The non-verbal material increased the EMH student's motivation to learn due to their history of successful interactions with non-verbal material. Skills were based on a progressive level of difficulty, which allowed the student's to learn materials for which they had acquired a readiness. The exercises were spaced throughout the 20 sessions, which allowed students exercise, active participation, overlearning, and distributed practice. Immediate knowledge of results and reinforcement of success and stressing accuracy was achieved by completing the lessons in a group format, which allowed all students to respond correctly at their own rate. Lessons were designed to expose students to minimal change. These procedures attempted to control for both retroactive and proactive inhibition by offering the students self-contained units and format similar in structure throughout the 20 sessions.

Much research has been conducted on the effects of strategy training when attempting to educate mildly retarded students. Strategies form the underlying structure on which skills can be placed. Competent learners gather information in a systematic fashion that reduces confusion, augments retrieval and integration, and increases chances of success (deBettencourt, 1987, p. 24).

Strategy training has numerous theoretical orientations. The information-processing model stresses capitalization on strengths and compensation for weaknesses. Behaviorists view the child as strategy deficient, therefore they stress a systematic approach to problem solving. Deficits in memory are viewed as a crucial concern. Torgesen and Goldman (1977, p. 56) found teaching poor readers verbal rehearsal as a strategy to facilitate performance was helpful. Selective attention may result in poor performance due to ineffective use of strategies. Individuals who are inattentive were found unable naturally to apply efficient strategies, yet when taught strategies their performance on tasks improved significantly (deBettencourt, 1987, p. 24). Metacognitive theorists report an individual awareness of cognitive performance can be used to increase effective strategy selection (Flavell, 1979, p. 906). Sternberg (1981, p. 165) reports training programs tend to concentrate on executive or metacomponential functions; on components of acquisition, retention, and transfer; or on components of performance in tasks requiring intelligent behavior.

Lloyd (1987, p. 53) developed a program of academic strategy training. He purports by modeling the steps, demonstrating the procedure, providing corrective practice, and rewarding correct performance strategies can be effectively taught.

Deshler's Learning Strategy Model as cited by Lloyd (1979, p. 53) stresses the teaching of techniques, principles, or rules that will facilitate the acquisition, manipulation, integration, storage, and retrieval of information for situations and settings is more facilitative than teaching facts. Deshler gives a 10 step procedure which facilitates strategy training: (1) test to determine current learning habits; (b) describe learning strategies; (c) model the strategy; (d) verbally rehearse the strategy; (e) practice on controlled materials; (f) feedback; (g) test; (h) practice on grade materials; (i) feedback; and (j) test.

Nelson and Cummings (1981, p. 305) stressed the understanding of basic concepts as a prerequisite for many educational activities and experiences. The following concepts for teaching EMH students were abstracted by Nelson and Cummings. Concepts may be taught by pairing method of matching either or pairing divergent concepts. In matching, pairing of an example and an nonexample of a concept are presented. The two examples differ only on the one critical attribute of the concept. Divergent pairing involves the use of two examples of the concept. All concepts should first be presented at the concrete level. Caution should be taken in order to minimize the possibility of the student experiencing failure. Repetition through distributed practice and overlearning may be used to compensate for the EMH student's deficits in short term memory. Finally, the concept may be taught at successively more abstract levels.

Zitlin and Gallimore (1983, p. 176) applied Vygotskian concepts to mentally retarded students and found that these students were able to use higher order cognitive processes in their attempts to comprehend simple texts. The results suggested that special education curricula which does not require higher order processing may be producing less than optimum performance. They suggested that mentally retarded students can be assisted to use high order cognitive processes in their attempts to comprehend simple texts.

Transformational mnemonic strategies were reviewed by Scruggs and Laufenberg (1986, p. 165). They found that mentally retarded students could profit from mneumonic training. Age and ability interacted with the ability to benefit from instruction.

Frank and McFarland (1980, p. 270) suggested that children in small groups may be able to profit by observing their peers in the learning process. Another technique that facilitated the performance of EMH students was presented by Horton (1985, p. 14). He hypothesized that the use of calculators increased the proficiency of mildly retarded students.

Cognitive style differences between typical and mildly retarded children were investigated by Bice, Halpin, and Halpin (1986, p. 93). EMR students were found to be more field dependent and learning environmental accommodations were suggested.

Blackman, Burger, Tan, and Weiner (1982, p. 83) attempted to upgrade the decoding skills for EMR children by teaching cognitive and instructional strategies. The training program resulted in no greater improvements in achievement scores over those students who did not receive training.

Review of Educational Issues

Current issues in educational practices in regard to mild mentally retarded students continue to cause controversy. The effects of PL 94-142 and litigation present continuing concerns for educators.

Mental retardation is a complex condition. Baumeister

(1987, p. 796) relates that uncertainties about causes, expression, and treatment of mental retardation do not yield to simplistic unidimensional models that fail to take into account an array of dynamically interacting biological, social and ecological variables. Certainly in the case of mild mental retardation these concerns are pronounced. Reschley (1988, p. 316) maintains that their declining numbers as well as the continued confusion over diagnostic criteria make generalizations about mildly mentally retarded students particularly hazardous.

In response to PL 94-142, identification of EMH students was challenged due to an overrepresentation of minority students in the program. In response to Larry P. and Diana, policy changes were designed to afford greater educational equity. MacMillan, Hendrick, and Watkins (1988, p. 426) state that entrance into mainstream education has not been beneficial to many students who no longer qualify for EMH services. Entrance into mainstream education appears to have imposed standards on marginally achieving students that almost ensure school failure. Mascari and Forgone (1982, p. 291) found that the majority of dismissed EMH students did not meet with success in the regular classroom environment and they have a high probability of being re-referred. It appears that placing students into mainstream education as they were tested out of EMH has not been beneficial to those students identified as inappropriately placed.

Reschley (1988, p. 316) reports that new litigation (Marshall vs. Georgia, 1984, 1985) ruled overrepresentation as such was not discriminatory, particularly without evidence that minority students were treated differently in the referral, preplacement evaluation, placement, programming, annual review, and re-evaluation phases of classification and placement. In an attempt to improve placement decisions of students in need of service Reschley suggested five intervention strategies. These strategies entailed prereferral interventions; greater learning process assessment; assessment of biomedical factors; emphasis on adaptive behavior; and direct instruction for students even if it is not given in self-contained classes. Reschley (1988, p. 320) reports that the Federal Office of Civil Rights (OCR) distorted and exaggerated statistical significance of the number of minority students in the form of classification practices and the nature and effectiveness of various types of programs (p. 321).

Lambert (1988, p. 297) explored what child is most eligible for special education placements: the child who will profit most from special education and whose achievement will improve after a period of time, or the child who will make less dramatic academic gains. There is a question if the current exodus from special education will deny services to students who would experience the greatest benefits. Dunn (1968) found that special education placement is not justifiable, and that regular and special education students were relatively equal in reading and arithmetic.

As students are released from EMH there is more controversy concerning mainstreaming. Reynolds, Martin-Reynolds and Mark (1982, p. 171) found teachers reported a positive attitude toward mainstreaming. Seven hundred sixty eight elementary teachers were surveyed and results indicated 61.4 percent found EMH students more similar than different from regular education students, 72.4 percent felt that students benefitted from mainstreaming, 92.1 percent of the teachers felt EMH classroom teachers should make student selection, and 95.8 percent were supportive in tutoring mainstreamed mild mentally retarded children.

Another issue raised by the professional community is the use of minimum competency exams for EMH students. Cohen, Safran, and Polloway (1980, pp. 250-255) listed the advantages as establishing standards for program and curriculum development, possible interrelation in achievement motivation, possible reduction in the impact of the exceptional label, and emphasis upon early problem identification through periodic competency testing. Disadvantages were listed as certificates of attendance versus diplomas, discrepancy between teaching methods and testing materials, homogenous remedial groups and discrimination, emphasis on groups of students rather than individuals, unproven relevance of minimal competency testing for adult success, increase in educational barriers, limitations of remedial programs, and detrimental effects on teacher attitudes and motivation.

Process Assessment

The public has scrutinized the practice of school psychology since the 1970's (Dunn, 1968, p. 5). One result of this scrutiny is that psychologists, educators, and related professionals must now re-evaluate traditional assessment tools which have resulted in the overselection of minority students for placement in classes for the mentally retarded (Meyers, 1988). In this same atmosphere litigation has begun to spearhead innovative educational practices and polices (Prasse, 1986, p. 311; Reschly, Kicklighter & McKee, 1988, p. 9). In an attempt to attain appropriate services for all students, parents as well as school systems, began to look to the courts for guidance (Hendrick & MacMillan, 1987, p. 10; Reschly, Kicklighter, & McKee, 1988, p. 39). The very "foundations" of the traditional school psychologist's role have been examined and found wanting.

The "Educable Mentally Handicapped" child has been in the center of much of the controversy (MacMillan & Borthwick, 1980, p. 155; Reschly, Kicklighter, & McKee, 1988, p. 22). Numerous sources have raised questions regarding definition, appropriate services, etiology, and the reality of such a handicapping condition (Childs, 1982, p. 109). The appropriateness of standardized intelligence tests used to identify educable mentally retarded students has been significantly challenged and numerous alternative methods of assessment have been presented (Feuerstein, 1980; Meyers, 1988).

This study does not directly relate to intellectual evaluation of students with the educable mentally handicaps. Rather the study assesses the effectiveness of a teaching strategy that is linked to alternative assessment procedures.

As the criticisms against traditional intelligence testing began to mount, it became apparent a different means of evaluating students was neceesary. The utility of standardized intelligence measures to determine a student's eligibility for special education has been found limited. Standardized intelligence measures do not relate to curriculum or classroom instruction (Feuerstein, Miller, Rand, & Jenson, 1981, p. 201; Martinez & Lepson, 1989, p. 73; Meyers, Pfeiffer, & Erlbaum, 1982, p. 1). They do not always identify a student's educational strengths and weaknesses, and they provide little relevance in relation to the "day to day" functioning of the instructional format.

Public Law 94-142 (1975) came into being as these new procedures were being explored and developed. This law was reviewed as a culmination of a progressive public concerned with educational services and reform (Forness & Polloway, 1987, p. 221). This mandate served further to dictate the parameters of an appropriate psychological evaluation and to safeguard student and parent rights. The Education for all Handicapped Children Act (94-142) mandated tests and testing procedures that were not culturally or racially biased. In addition, no educational decisions were to be based solely on a single measurement instrument (Berdine & Blackhurst, 1985, p. 20).

Another component of 94-142 guaranteed each student an individualized educational program. Psychological evaluations, often efficient in assessing the current cognitive functioning level of a student, do not always provide information regarding the learning styles of these students in terms applicable to classroom instruction (Meyers, 1988, p. 123). Thus, as a result of a psychological assessment much information is available to the teacher regarding the student's current levels, but there is little information that can be directly applied to classroom instructional procedures. This has been of continuing concern to teachers, as well as psychologists (Meyers, 1988, p. 123). Current assessment procedures are attempting to provide teachers with information that is useful in the classroom setting (Manni, Winikur, & Keller, 1984; Sewell, 1981).

The experiment attempts to bring psychological testing procedures into the classroom, thus providing an ongoing process of assessment followed by interventions that will provide improved performance on future assessments. The experimental goal is not to only improve performance on future assessments, but to increase the child's cognitive processes in those tasks that are essential for academic advancement.

The term process assessment, borrowed from Haywood, Filler, Shipman and Chatelanat (1975), Kratochwill and Stevenson (1977), and Meyers, Pfeiffer and Erlbaum (1982) refers to a method of assessment which focuses on the process of learning, rather than the product. The goals of process assessment are to determine an individual's characteristic learning processes, the extent to which a learner's functioning can be modified, and the approach necessary to create this change (Meyers, 1982). Process assessment attempts to identify the learning characteristics of a student and utilize those identified characteristics to facilitate teaching techniques.

Process assessment differs from traditional models of assessment in that traditional assessment focuses on the material the learner has mastered, rather than how the learner incorporated the material. Formal IQ testing gave little attention to visual and auditory processes, storage and retrieval methods, and how these modalities effect individual achievements. Process assessment attempts to gain access to a learner's style and mode of gaining information (Meyers et al., 1982).

Research on Process Assessment

This section will examine alternative modes of assessment currently being explored by Meyers et al. (1982).

Learning Potential Assessment

Haywood et al. (1975) describes standardized testing as "product oriented", seeking to explore the areas of competence and deficits as reflected when compared to others. Information from this type of evaluation is viewed as limited. Traditional assessment does not account for prior learning, does not identify the individual's characteristic learning mode, nor does it explore the extent of intervention necessary to effect a change (Meyers et al., 1982, p. 13). The ultimate goal of the learning potential assessment is the "prescription of intervention procedures designed specifically to modify these processes in order to enhance the efficiency of learning" (Haywood et al., 1975, p. 100). This type of intervention is process oriented and seeks to employ those learning strategies which will lead to the acquisition of new information and skills (Kratochwill, 1977, p. 300). This assessment generally utilizes a test-teach-test format.

The Nashville Interventions

Haywood and his colleagues have studied verbal abstraction in mildly retarded students. They found that when these students were presented with several examples of the abstractions to be formed their ability to correctly respond was increases. For example, rather than asking "How are an apple and an orange alike?", the question would be reworded to present more than two examples of the concept to be abstracted. Thus, a student may be asked "How are an apple, orange, pear, lemon, lime, and pineapple alike?" Haywood et al. (1975) maintain these mild mentally retarded students who scored low on traditional verbal analogies subtests were not necessarily displaying a lack of ability to form verbal abstractions, but rather an information input deficit. This deficit may be overcome by increasing the amount of information available to the student from which to draw (Haywood et al., 1975, p. 105).

The Cambridge Interventions

Budoff's work in exploring learning assessment has focused on delineating between mild mentally retarded students and those who are educationally handicapped. Budoff defines intelligence as the ability to benefit from experience. He believes that many students who have been found EMH during standardized assessment are in fact not retarded due to their ability to profit from experience. Budoff contends that students from lower socioeconomic status homes may be deprived of the necessary skills to succeed on formal evaluation tools, but are able to function adequately in their own environments. Budoff's learning potential assessment method is to initially present a non-verbal instrument followed by presentation of strategies necessary to correctly find a solution, and finally to retest the child on the initial instrument. He has used instruments such as the Koh's Bock Design (Budoff, 1967), Wechsler Performance Scale (Budoff, 1969), Raven's Progressive Matrices (Budoff, 1969), and a modification of Feuerstein's Learning Potential Assessment Device (Budoff & Hutten, 1971).

The Israel Intervention

Feuerstein has worked with disadvantaged youth in Israel. He conceptualized intelligence as the capacity to use existing cognitive structure to adjust to new situations. In Feuerstein's system modifiability is defined as the "ability of an individual to acquire information that can be used in novel situations" (Haywood et al., 1975, p. 114). Feuerstein (1970) distinguished two types of learning: direct exposure learning and mediated learning. He believes the cause of delayed intellectual development among culturall familialy retarded children is due to insufficient mediated learning experiences (1970). This lack of mediated learning results in deficits: input, output, and elaboration.

Feuerstein has developed the Learning Potential Awareness Device to identify intellectual deficits, as well as the amount of time necessary to induce modification.

While Budoff's work is essentially task-specific, Feuerstein's work seeks to improve cognitive operations while assessing strengths and weaknesses. Feuerstein also stresses the significance of the tester-testee relationship in providing mediated learning experiences to the student which will facilitate future successes and progress.

The Russian Interventions

In Russia, Vygotsky (1978) theorized a "zone of proximal development" which is utilized in assessment procedures. Vygotsky distinguishes between a student's actual or current developmental level of performance which "characterizes mental development retrospectively" and the zone of proximal development which "characterizes mental development prospectively" (p. 87). Vygotsky defines the zone of proximal development as "the distance between 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 is considered as measure of potential learning. Again a test-teach-test method is utilized. The child is presented a task unaided. If the student is unable to complete the task, the instructor provides cues until a correct solution is reached. Another corresponding task is presented and the number of cues needed to correctly complete this example are totaled. Comparison of the number of prompts necessary to solve correctly the presented tasks serve as an indication of the width of the zone of proximal development (Brown & France, 1979). This method is purported to be useful in distinguishing between mild mentally retarded and learning disabled students. While both groups may appear similar on standardized evaluations, learning disabled students need fewer prompts and are more proficient at transferring the teaching experience to implementation (Budoff, 1979). Vygotsky, as Feuerstein, utilized the interpersonal relationship between tester and testee.

Mediated Learning Experiences

Central to Reuven Feuerstein's concept of cognitive modifiability is the concept of mediated learning experiences. The concept of mediated learning experience, described as the proximal determinant of differential cognitive development, is based on the assumption that human development can be neither conceived of as a sole determinant of physical maturation nor as simply the product of environmental interaction (Feuerstein, 1980, p. xvii). The deficiencies responsible for retarded cognitive performance are conceived of as belonging to the syndrome described of by Feuerstein as cultural deprivation. In this context, "culture" is not defined as a static inventory of behaviors but, rather, as the process by which knowledge, values, and beliefs are transmitted from one generation to the next. Thus, cultural deprivation is the result of a failure on the part of a group to transmit or mediate its culture to the new generation (Feuerstein, 1980, p. 13).

Cultural deprivation is defined as a state of reduced cognitive modifiability of the individual, in response to direct exposure to sources of stimulation (Feuerstein, 1978; Feuerstein & Rand, 1974). Thus what distinguishes individuals at different levels of cognitive development is the extent to which they are able to become modified, or to learn by direct exposure to stimuli (Feuerstein, 1980, p. 15).

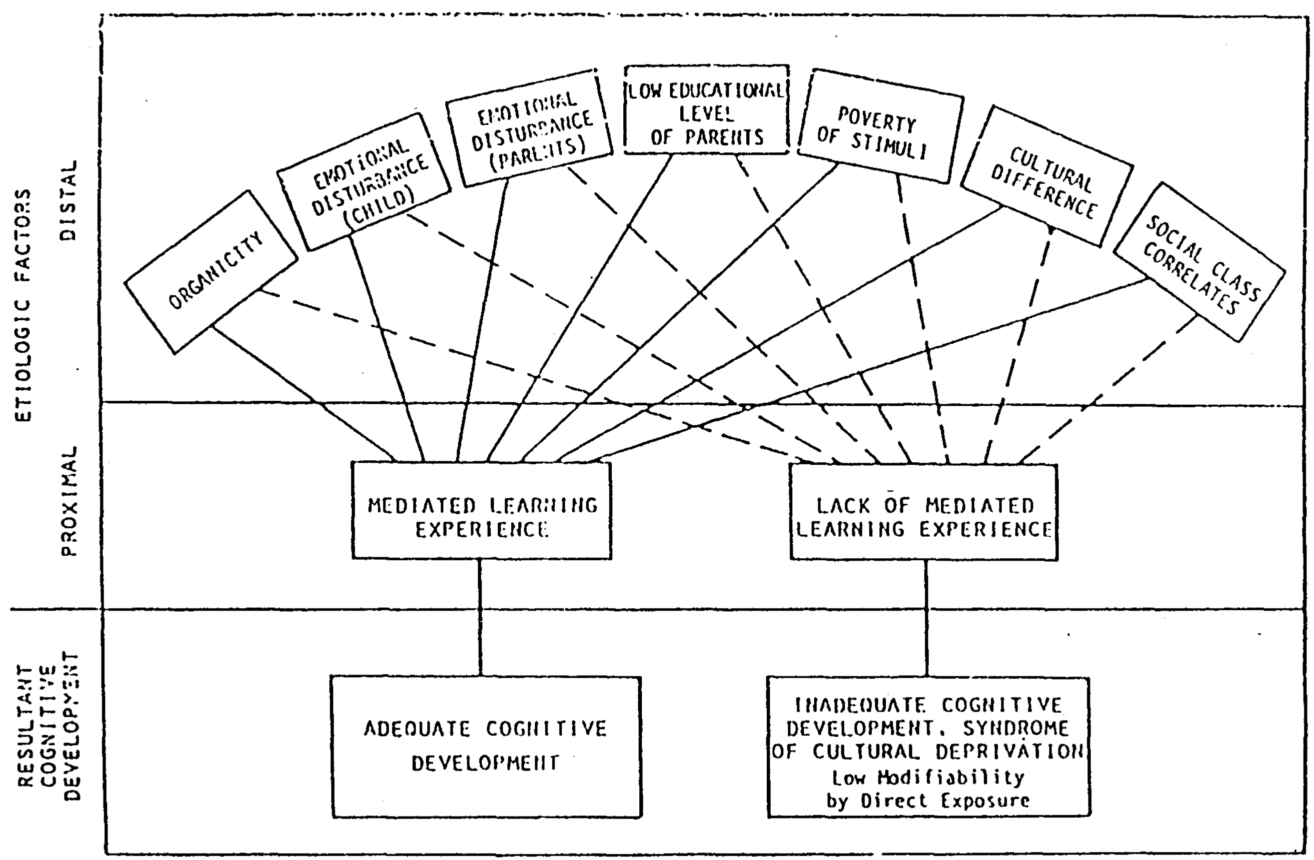
Mediated learning experiences are the way in which stimuli presented by the environment is transformed by a "mediating" agent, usually a parent, sibling, or other caregiver. This agent selects and organizes the world of stimuli for the child. To Feuerstein the cognitive development of the child is not only the outcome of the process of maturation of the organism itself and its independent interaction with the real world. Rather, it is the combined result of direct exposure to the world through the individual's interactions and interpretation of events by a significant other, or mediating agent.

Feuerstein, Miller, Hoffman, Rand, Mintzker, and Jensen (1981, p. 270) further described cultural deprivation as a state of low modifiability; that is, an inability or reduced ability to learn by direct exposure to environmental events. The defining characteristics of a mediated learning experience are an intention, not necessarily conscious, on the part of the mediator to interpret to the child the experienced world, and to transcend the experience and the need of the immediate here and now by the mediated learning.

Feuerstein, Rand, and Hoffman (1979) have suggested that cognitive skills are acquired by most children in the normal course of development without deliberate and programmed teaching. They are acquired through successive interactions between the children and their environment and, most importantly, through the mediation of adults who interpret the child's experiences in such a way as to lead to the formation of structured concepts, rules and cultural understandings. This is done in many different ways. For example, adults categorize and label events, interpret them, associate causes and effects, and explain what is acceptable, what is exceptional, and what are the rules for classes of situations. Some children fail to acquire these meaningful interactions due to either proximal or distal causes (see Figure 1), and these causes result in a lack of mediated learning experiences.

Figure 1

Distal and Proximal Etiologies of Differential Cognitive Development



Harth (1982, p. 2) delineates between the distal and proximal causes of retarded cognitive performance. The distal etiology includes things we traditionally assume to be the causes of retarded cognitive performance, hereditary/genetic factors, organicity, reduced environmental stimuli, socioeconomic status, emotional problems of child/parent, and so on. Feuerstein maintains these are not necessarily the direct causes of retarded performance, rather they trigger the proximal etiology, a lack of mediated learning experiences (MLE). The lack of MLE is directly responsible for the cognitive deficit, regardless of the nature of the distal etiology. The significant factor in this theory is that if we apply mediated learning experiences we can overcome the factors preventing mediation and restore normal cognitive growth.

Osborn and Sherwood (1985) compiled a list of nine potential components in a mediated learning interaction. They cited three of these components: intentionality, meaning and purpose, and transcendence; as necessary in making an interaction a mediated learning experience. The other six components are non-essential, elected to be used by a mediator at different times depending on the situation. The components of a mediated learning interaction are:

INTENTIONALITY: This is achieved by the mediating agent placing himself/herself between the child and the situation and by organizing the learning experience.

MEANING AND PURPOSE: Provide reasons for experiences and life event. Include reasons why adults may behave the way they do.

TRANSCENDENCE: Relate the child's experiences, immediate needs and concerns, beyond here and now in space and time. Ask the child to reflect on what is being done and how it relates to other experiences.

COMPETENCE: Facilitate the child's self esteem by pointing out the things already mastered. Focus on the thought processes and problem solving strategies rather than just their products.

SHARED PARTICIPATION: The mediating agent is to participate in the activity as a learner, describing his thought processes.

REGULATION OF BEHAVIOR: Encourage the child to think about familiarity with the situation, the complexity of the situation, and preferred modality before deciding how to approach a task.

GOAL SEEKING: Facilitate the child's need and ability to set goals and make a plan to meet those goals.

NOVELTY: Encourage a child's curiosity and the ability to seek, recognize and respond to new situations.

INDIVIDUATION: Look for and praise individual effective learning styles.

The performance of individuals who have not received

MLE is characterized by a deficiency in the cognitive functions considered to be prerequisites to operational, internalized representational thinking. Over many years Feuerstein has identified a number of these deficient functions. Figure 2 represents a listing of the deficient functions identified thus far: the impaired deficient functions are categorized into the input, output, and elaboration levels.

At the input level, the impaired cognitive functions represent the things that affect the quality and quantity of data gathering as an individual begins to solve a given problem. The elaboration level includes deficient functions that prevent individuals from making efficient use of the data available to them. Output level factors lead to inadequate communication of the results of the elaboration process (Harth, 1982, p. 4).

Cognitive modifiability allows individuals to overcome the deficient functions, which are not fixed. The Mediated Learning Experience theory proposes that deficient functions are amenable to change, regardless of the individual's age or development level.

Figure 2

Deficient Cognitive Functions From Instrumental Enrichment

Input:

1. Blurred and sweeping perception
2. Unplanned, impulsive, and unsystematic exploratory behavior
3. Lack of, or impaired, receptive verbal tools and concepts which affect discrimination
4. Lack of, or impaired, spatial orientation, including the lack of stable systems of reference which impair the organization of space
5. Lack of, or impaired, temporal orientation
6. Lack of, or impaired, conservation of constancies (i.e., in size, shape, quantity, orientation) across variations in certain dimensions of the perceived object
7. Lack of, or deficient need for, precision and accuracy in data gathering
8. Lack of, or impaired capacity for considering two sources of information at once, reflected in dealing with data in a piecemeal fashion rather than as a unit of organized facts

Elaboration:

1. Inadequacy in experiencing the existence of an actual problem and subsequently defining it
2. Inability to select relevant, as opposed to irrelevant, cues in defining a problem
3. Lack of spontaneous comparative behavior or limitation of its appearance a restricted field of needs
4. Narrowness of the mental field
5. Lack of, or impaired, need for summative behavior
6. Difficulties in projecting virtual relationships
7. Lack of orientation toward the need for logical evidence as an interactional modality with one's objectal and social environment
8. Lack of, or limited, interiorization of one's behavior
9. Lack of, or restricted, inferential-hypothetical thinking
10. Lack of, or impaired, strategies for hypothesis testing
11. Lack of, or impaired, planning behavior
12. Non-elaboration of certain cognitive categories because the necessary labels either are not part of the individual's verbal inventory on the receptive level or are not mobilized at the expressive level

Figure 2 (continued)

<u>Output</u>:

1. Egocentric communicational modalities
2. Blocking
3. Trial and error responses
4. Lack of, or impaired, verbal tools for communicating adequately elaborated responses
5. Deficiency of visual transport
6. Lack of, or impaired, need for precision and accuracy in communicating one's response
7. Impulsive acting-out behavior, affecting the nature of the communication process

From <u>Instrumental Enrichment</u> (Feuerstein, 1980, pp. 73-74).

<u>Instrumental Enrichment</u>

Instrumental Enrichment (IE) is a program designed by Feuerstein to remediate cognitive deficiencies. The structured lessons attempt to provide the learner with mediated learning experiences. The program was conceived for the development and training of cognitive learning ability in the culturally deprived adolescent. The IE program is conceived as a set of activities and exercises to strengthen deficient mental operations, the presence of which is fundamental to the learning process.

Feuerstein enumerates the major goal of Instrumental Enrichment and the six subgoals (1980, p. 115). The major goal of IE is to increase the capacity of the human organism to become modified through direct exposure to stimuli and experiences provided by encounters with life events and with formal and informal learning opportunities.

The subgoals serve as guidelines for application. These goals as defined by Feuerstein are:

Goal I. The correction of the deficient functions that characterize the inefficient cognitive structure of the culturally deprived individual.

Goal II. The acquisition of basic concepts, labels, vocabulary, operations, and relationships necessary to overcome cognitive deficits.

Subgoal III. The production of intrinsic motivation through habit formation.

Subgoal IV. The production of reflective, insightful processes in the student as a result of his confrontation with both failing and succeeding behaviors.

Subgoal V. The creation of task-intrinsic motivation through correctly solving problems that are difficult even for adult problem solvers. Another aspect of task-intrinsic motivation is the enjoyment of a task for its own sake.

Subgoal VI. This subgoal deals with the attitude of the retarded performing individual toward himself as an individual able to generate information and readiness to function as such, as a result of this self-perception.

Feuerstein developed a list of instrumental enrichment cognitive functions in response to the input, elaboration, and output deficiencies (see Figure 3).

Figure 3

Instrumental Enrichment Cognitive Functions

I. Gathering all the information we need (Input)
   1. Using our senses (listening, seeing, smelling, tasting, touching, feeling) to gather clear and complete information (clear perception).
   2. Using a system or plan so that we do not skip or miss something important or repeat ourselves (systematic exploration).
   3. Giving the thing we gather through our senses and our experience a name so that we can remember it more clearly and talk about it (labeling).
   4. Describing things and events in terms of where and when they occur (temporal and spatial referents).
   5. Deciding on the characteristics of a thing or event that always stay the same, even when changes take place (conservation, constancy, and object permanence).
   6. Organizing the information we gather by considering more than one thing at a time (using two sources of information).
   7. Being precise and accurate when it matters (need for precision).

II. Using the information we have gathered (Elaboration)

   1. Defining what the problem is, what we are being asked to do, and what we must figure out (analyzing disequilibrium).
   2. Using only that part of the information we have gathered that is relevant, that is, that applies, to the problem and ignoring the test (relevance).
   3. Having a good picture in our mind of what we are looking for, or what we must do (interiorization).
   4. Making a plan that will include the steps we need to take to reach our goal (planning behavior).
   5. Remembering and keeping in mind the various pieces of information we need (broadening our mental field).
   6. Looking for the relationship by which separate objects, events, and experiences can be tied together (projecting relationships).
   7. Comparing objects and experiences to others to see what is similar and what is different (comparative behavior).

Figure 3 (continued)

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8. Finding the class or set to which the new object or experience belongs (categorization).
9. Thinking about different possibilities and figuring out what would happen if you were to choose one or another (hypothetical thinking).
10. Using logic to prove things and to defend your opinion (logical evidence).

III. Expressing the solution to a problem (Output)

1. Being clear and precise in your language to be sure that there is no question as to what your answer is. Put yourself into the "shoes" of the listener to be sure that your answer will be understood (overcoming egocentric communication).
2. Think things through before you answer instead of immediately trying to answer and making a mistake, and then trying again (overcoming trial-and-error).
3. Count to ten (at least) so that you don't say or do something you will be sorry for later (restraining impulsive behavior).
4. If you can't answer a question for some reason even though you "know" the answer, don't fret or panic. Leave the question for a little while and then, when you return to it, use a strategy to help you find the answer (overcoming blocking).

The 20 intervention lessons utilized in this research were based on Feuerstein's concept of Instrumental Enrichment, but did not utilize the instructional material per se.

Summary

How one views intelligence has an impact on educational practices. If intelligence is viewed as a hereditary, innate ability (Burt, 1970), the effectives of educational intervention may be negligible. However, if intelligence is viewed as a dynamic exchange between an individual and his environment (Piaget, 1981), intervention procedures are possible. Reviewed theorists and research indicate that intelligence may not be a fixed concept, and may be amenable to intervention.

The Educable classification of mental retardation has been the center of much controversy and was reviewed in this section. Recent litigation has found EMH programs in need of revision.

Revisions and interventions that might be utilized by EMH populations are cited. Certainly process instruction seems a viable means to augment current EMH curriculums. This research attempts to increase inductive reasoning skills of EMH students through process instruction.

CHAPTER III

METHOD

Hypotheses

The following null hypotheses were tested:

1. There is no difference in the Raven's Progressive Matrices, Analogies and Visual Matching subtests of the Woodcock-Johnson Psychoeducational Battery, and the Memory for Designs-subtest of the Detroit Test of Learning Aptitudes-2, and the Bialer-Cromwell Locus of Control Scale scores across groups.

2. There is no relationship between gains on the five dependent measures and sex (male/female).

3. There is no relationship between gains on the five dependent measures and race (White, Black, Hispanic).

4. There is no relationship between gains on the five dependent measures and age (15-16/17-18+).

5. There is no relationship between gains on the five dependent measures and attendance (20-18 sessions/17-15/14-0).

Subjects

Sixty students from five divisions of classes in which they were classified as Educable Mentally Handicapped were included in the study. The classification of EMH is an

Illinois state reimbursement special education category. Students are found eligible for placement in EMH programs by means of a complete case evaluation including an evaluation conducted by a state certified school psychologist. It should be noted that all the students included in this research project had been recently re-evaluated for inclusion in the EMH category using the specially designed Process Assessment for Learning inventory (PAL).

These sixty students identified as eligible for EMH placement received all instructional components offered within the EMH department. It should be noted that while instructional classes are housed within the EMH department, students are allowed to take some courses outside of the EMH curriculum. Classes such as gym, home economics, art, and music are taken in mainstream education.

Thirty-three percent of the participating students were male and the remaining 67 percent were female. Forty-three percent of the study population were Black, 27 percent were Caucasian and 30 percent were Hispanic. Of the students who were involved in the project 83.3 percent received intervention, and 16.7 percent of the students received only the assessment phase of the research. The students who did not receive intervention were either placed in work-study programs and were unable to attend the sessions, or withdrew from school. Table 1 presents a numerical description of the subjects according to student sex, race, and age levels.

Table 1

Sex, Race, and Age of Students

	Age			
	15-16	17	18+	Totals
Females				
Black	5	8	3	16
Caucasian	5	1	2	8
Hispanic	3	5	8	16
Males				
Black	2	3	5	10
Caucasian	3	1	4	8
Hispanic	1	1	0	2
Totals	19	19	22	60

Procedure

The research project was conducted within the Educable Mentally Handicapped program at a Chicago Public High School. During the time the research project was conducted, the school enrollment was approximately 2,900 students. Approximately eight percent of the school population received special education services.

When the research project was initiated there were a total of 71 EMH students enrolled at the high school. All EMH students were invited to participate in the project. Each parent received a brief explanation of the project and a request for permission to participate (see Appendix A).

Fifty-nine students returned signed parental consent forms. Thus, 83 percent of the students enrolled in the EMH program at this one high school participated in this study. It should be noted that one student transferred into the high school after the Pretest phase of the study was completed. This student was included in the Posttest 1 and Posttest 2 statistics and the intervention phase of the investigation.

All participating students (n = 60) with signed consents were scheduled to receive process instruction of inductive reasoning skills within the January to June period. Each of these students was scheduled to receive a total of three evaluations during this period. A pretest battery was administered to all participating students.

Pretest Battery

The pretest consisted of the 1985 edition of the Raven's Progressive Matrices (all odd numbered problems of sections B through E). In Section A problems 1 and 2 were given to all students as part of the instructional procedures. Thus Section A contained seven questions, and the remaining four sections, B through E, contained six questions, for a total of 31 questions presented. The evaluators terminated the testing when a student received a total of seven consecutive incorrect responses during this section. The students were also administered sections of the 1977 Edition Woodcock-Johnson Psychoeducational

Battery (i.e., Analogies and Visual Matching sections). These two (2) subtests were administered according to standardized procedures.

The Memory for Designs test, taken from the Detroit Test of Learning Aptitudes-2 (1985), was also administered. The fifth pretest measurement was the Bialer-Cromwell Children's Locus of Control Scale. The students completed all items within this scale. Thus, each student received an individualized pretest battery of five instruments.

Evaluation and Posttest

PostTest 1 and PostTest 2, did not differ from the Pretest procedures with the exception of the Raven's Matrices. In Posttest 1 all even numbered questions were presented. As in the Pre-test procedures questions A1 and A2 were administered to all students as part of the instructional procedures. As in the Pre-test a total of 31 Matrices were presented. In the Posttest 2, however, all matrices were presented for a total of 60 items. The remaining four measures did not vary in administration from Pretest to Posttest 1 and Posttest 2. All items were individually administered by classroom teachers carefully trained by the investigator. The tests were given in the following order: Raven's; Analogies; Visual Matching; Memory for Designs; and, the Locus of Control measure.

Three certified EMH teachers were involved in the Pretest procedures. Teacher 1 completed 36 Pretests, Teacher 2 completed 17 Pretests, and Teacher 3 completed six Pretests. The two Posttest evaluations were completed by Teacher 1 and 2. Teacher 1 completed 43 evaluations and Teacher 2 completed the 17 initially tested in both Posttests.

Table 2

Number of Students Receiving Pre and Posttest Measures

Pre and Posttest 1 & 2	54
Pre and Posttest 1	1
Pretest	4
Posttest 1 & 2	1
TOTAL	60

The project involved five special education, EMH divisions. Division lists were placed in alphabetical order. All students who had returned signed consent slips were included in the selection pool. Each division list was counted off by twos. The first student in each division list was placed in the experimental group and the second student was placed in the control group. Thus all odd numbered students were in the experimental group and all even numbered students were placed within the control group. As previously stated, a total of 60 students were involved in the initial preassessment phase. All students involved in the project were assigned a two-digit identification number and this number was used throughout the investigation. Pre and posttest packages were assembled and numbered according to division and identification numbers. Each assessment package was completed and collected during a scheduled assessment period. The evaluator had no access to these scores prior to completion of the experiment.

It should be noted that though 60 students were involved in the assessment phase, only 50 students received intervention. Ten students were unable to attend classes during the course of the study. Five students were enrolled in work-study programs and were unable to attend intervention classes during the periods when intervention took place. The remaining five students transferred to another school.

Intervention Strategies

The intervention segment of the experiment took place in two phases, Intervention 1 (I-1) and Intervention 2 (I-2). The students randomly selected for the experimental group (I-1) received 20 forty-minute sessions of intervention followed by the control group (I-2) receiving a 20 session intervention program. Intervention was offered to all students, control as well as experimental, due to the potential benefit of the project to academic performance. The experimental group contained 30 students and the control group contained 20 students. Thus, the experimental group received instruction from January 21, 1989 through March 16, 1989, and the control group received instruction from April 4, 1989 through June 1, 1989. The three assessment periods were from January 9th through the 20th for the Pretest, March 20th through the 31st for the Posttest 1, and Posttest 2 was conducted from June 5 through the 16th.

Instruction periods were based on student and instructor availability. Seventy-four percent of the students were taken from instructional periods and 22 percent of the students received intervention during scheduled study halls. Four percent of the students received intervention during lunch periods. Eighty-two percent of the students attended at least 13 of the 20 intervention sessions. Attendance patterns are summarized in Table 3.

Table 3

Intervention Group Attendance

Sessions Attended	Number of Students	Percentages
20 Sessions	8	12.7
19 Sessions	5	7.9
18 Sessions	4	6.3
17 Sessions	6	9.5
16 Sessions	4	6.3
15 Sessions	5	7.9
14 Sessions	3	4.8
13 Sessions	3	4.8
Less than 13	12	18.0

*Eighty-two percent of students attended at least 13 of the 20 sessions.

Instructional procedures were based on Feuerstein's mediated learning model. Students were taught to solve systematically inductive reasoning tasks of increasing difficulty. All problems were presented by the instructor and solved through group effort. All answers were discussed in relationship to the processes necessary to produce a response. In an attempt to increase class participation as well as "think-aloud" procedures, an errorless learning approach was used. Instruction was group-oriented and all responses were regarded as correctly illustrating a student's approach to solving the task presented. The effect of deficiencies in academic prerequisite skills was slight because minimal independent reading skills were necessary. The structure of mediated learning instruction is designed to minimize student failures.

Intervention consisted of worksheets and chalkboard instruction. Each student received a folder which contained worksheets. New worksheets were added to the folder as the intervention sessions continued. In an attempt to control for contamination due to work outside the classroom, instructional folders were not made available to the students until all intervention sessions were completed for both the experimental and control groups.

Worksheets were taken directly from published workbooks. A list of the workbooks, publishers, and pages used can be found in Appendix B. No material used in the assessment phase was presented during classroom instructional periods.

An examination of Table 4 indicates that a total of eight instructional groups were included in both phases of intervention.

Table 4

Number of Students in Process Instructional Groups

Period	Number of Students
Intervention 1 (I-1) Experimental Group	
1	6
2	7
3	7
5	7
6	3
Intervention 2 (I-2) Control group	
1	5
3	9
4	6

Classroom instruction of inductive reasoning skills spanned 20 sessions. The sessions were broken into four categories. Each category was viewed as a prerequisite to the following category.

The first six sessions consisted of tasks requiring visual comparisons and contrasts. These comparisons became progressively more discrete. The first sessions asked students to breakdown shapes into separate components. The next two sessions required students to find an identified shape within a design. The designs became more complex as the two instructional periods continued. The third and fourth sessions required students to find similar shapes.

The shapes were consistent, but orientation in space varied. The fifth and sixth sessions required students to identify which components of a design completed the presented model.

The second section of instruction was based on analogous reasoning skills. Students were asked to compare and contrast design. They were instructed to find the differences and similarities between presented pictures. Four variables were discussed throughout the sessions devoted to this distinction. The dimensions students were asked to identify were: shape; size; color; and direction. During these sessions they were also required to compare two designs and locate the type of differences between them. Once the differences were located the student was asked to identify which of the four dimensions were different. The second phase of instruction continued for six sessions.

The third instruction phase presented verbal analogous reasoning tasks and continued for four sessions. Students were asked to solve progressively more difficult verbal analogous reasoning tasks. Initially pictures accompanied the words presented, however pictures were faded as the sessions continued.

The last four sessions presented matrices. The first two sessions asked the student to draw which design would come next following three pattern models. The students were asked to formulate a hypothesis regarding a developing pattern and project, through a drawing, how the next figure would appear. The final two sessions required students to solve matrices similar to those presented in the Raven's Progressive Matrices. Five different types of matrices were introduced.

Examples of how materials were presented in the instruction are included in Appendix F. A list of publishers through which materials can be ordered is included in Appendix E.

Student discussions were encouraged throughout all 20 sessions. Discussions were guided by Lipman's work as outlined in his Philosophy in the Classroom (1977). A good discussion is defined as one that marks a definite progress as contrasted with conditions that existed before the instructional period began. All questions were in principal answerable. Eleven teacher behavioral goals were identified to help students participate in classroom discussions. These goals were in view of the teacher and students throughout the 20 sessions. The following techniques were utilized to draw students out during the instructional sessions. Teacher goals were:

1. Elicit student views or opinions;

2. Help students express themselves through clarification and restatement. Statements such as "You appear to be saying..." or "Could it be that..." were used;

3. Attempt to explicate student views. Explication is viewed as lying between undistorted restatement and interpretation;

4. Interpretation, such as inferring logical implications as well as what is suggested;

5. Seek consistency;

6. Request definitions;

7. Search for assumptions;

8. Indicate fallacies;

9. Request reasons for answers;

10. Ask students to tell how they know; and,

11. Elicit and examine alternatives.

Instrumentation

The subjects were assessed three times during the experimental phase. The same instruments were used during each assessment and an attempt was made to utilize the same evaluator for each of the assessment. Five measurements were used.

Raven's Progressive Matrices

The Raven's Progressive Matrices (1985) was used to evaluate the student's non-verbal reasoning skills. This tool was designed by J.C. Raven, J.H. Court, and J. Raven. The test can be described as "tests of observation and clear thinking" (Raven, 1985, p. G3). Each problem in a scale is really the source of a system of thought, while the order in which problems are presented provides the standard training in the method or working (Raven, 1985, p. G3). In the Standard Progressive Matrices Test everyone is given the same problems arranged in the same order, and is asked to work at his or her own speed from the beginning to the end of the scale, without interruption. The scale is divided into five sets of 12 problems. Each set starts with a problem which is, as far as possible, self-evident, and it develops a theme which becomes progressively more difficult. In this, one can deduce the consistency of a person's intellectual activity in five successive lines of thinking. Each of the five sections is intended to measure an individual's ability to develop a non-verbal theme. This test was not designed as a test of "general intelligence," but rather an indication of one's ability to generalize a cognitive theme nonverbally. The test designers advise coupling it with a measure of verbal skills (Raven, Court, & Raven, 1983, p. SPM 18). The Analogies section of the DRLA-2 was utilized to balance the non-verbal aspects of the Raven's.

The Raven's was also chosen because the Progressive Matrices are employed by Feuerstein in his Learning Potential Assessment Device procedures (Haywood, In Press).

Woodcock-Johnson Psychoeducational Battery-Analogies (1977)

The Analogies subtest of the Woodcock-Johnson Psychoeducational Battery (Woodcock & Johnson, 1977) was used to assess verbal reasoning skills. Analogies test the subject's verbal ability by requiring the subject to complete phrases with words that indicate appropriate relationships. A measure of reasoning with analogies was chosen as the counter-part to the matrices assessment. Students are asked to correctly complete an analogy with a word of their own choosing. An example of problems presented in the analogies section is "Orange is to apple, as carrot is to __________." The student is asked to supply an answer that is aligned with carrot in the same manner that orange and apple are alike.

This test was chosen because the students were able to offer their own responses and were not limited to selections. Also, instruction was offered in analogous reasoning during the intervention phase of the research. During the instructional phase students were presented with analogies that supplied a visual component. It was hypothesized that the students' ability to correctly solve the analogy when a visual component was available would facilitate verbal recall when no visual cues were available.

Detroit Test of Learning Aptitudes-2

Memory for Design (1985)

Memory for Design from the DTLA-2 (Hammill, 1985) was used as a measure for visual skills. Design reproduction measures attention, manual dexterity, short-term visual memory and spatial relations (Hammill, 1987, p. 5). In this test the examinee is shown a complex design for a short period of time, the design is withdrawn from view, and the subject is asked to draw the design from memory. The individual's drawing is scored according to its likeness to the original figure. Intervention instruction was expected to facilitate visual memory due to the subject's ability to differentiate the presented shape from models stored in the subject's memory. The thrust of process instruction is to allow students to compare and contrast existing information to new information being processed for the first time.

Woodcock-Johnson Psychoeducational Battery

Visual Matching (1977)

Visual matching evaluates the subject's ability to identify two numbers that are the same in a row of six numbers (Woodcock & Johnson, 1977). The task proceeds in difficulty from single-digit numbers to five-digit numbers. The test has a two-minute time limit.

This test was selected to be used in the assessment research phase in an attempt to determine if the subject was more able to retain a number presented visually after the intervention. The ability to compare and contrast ideas and non-verbal concepts was expected to improve significantly as a result of the training.

Bialer-Cromwell Children's Locus of Control (1961)

The Bialer-Cromwell Children's Locus of Control measure was used to determine through 22 questions if the subject was externally or internally controlled (Bialer, 1960). Though the intervention phase of the experiment had no component of formalized instruction in locus of control it was hypothesized that students would begin to feel as if they were able to exert more control over surroundings as their ability to see contrasts and comparisons improved.

CHAPTER IV

RESULTS

First of all, a multivariate analysis of variance was used to test for differences in the scores from the dependent measures across the independent conditions. The independent variables employed were treatment groups (2-Experimental/Control), race (3-White/Black/Hispanic), sex (2-Male/Female), age (3-15-16/17/18+), and attendance (3-20-18/17-15/14-0). The four dependent measures utilized in the analysis were the pre and post scores from the Raven's Progressive Matrices test (MAT), the Woodcock-Johnson Psychoeducational Battery, the Verbal Analogous Reasoning (ANA) and Visual Matching (VIS) subtests, and the Detroit Test of Learning Aptitudes-2, Memory for Design (DES). It should be noted that the Bialer-Cromwell Locus of Control (LOC) measure was administered to the groups, however, the data was not used in the analysis because it was considered to be inappropriate for an EMH population. This LOC measure relied heavily on verbal comprehension and listening skills. The evaluators reported that students often did not seem to understand the instructions, as well as many of the questions. Therefore, the measure was dropped from the final analysis.

Group means and standard deviations for the treatment groups and dependent variables are presented in Table 5. overall, both experimental and control group scores increased over time, however, greater gains were found in the experimental group. Gain scores are presented in Table 6. Experimental group gain scores exceeded control group gain scores on all four dependent measures.

Table 5

Experimental and Control Group Means and Standard Deviations

	Experimental Group		Control Group	
	Pre	Post	Pre	Post
Ravens Matrices				
Mean	10.414	12.552	9.737	10.211
S.D.	3.718	4.925	3.462	2.898
Analogies				
Mean	13.828	15.379	13.737	14.579
S.D.	3.733	3.698	4.420	3.322
Visual Matching				
Mean	18.345	19.759	19.421	19.474
S.D.	2.159	3.043	3.517	3.204
Memory for Design				
Mean	10.897	16.586	11.526	15.526
S.D.	6.349	6.560	6.620	6.132

Table 6

Experimental and Control Group Mean Gain Scores From Pre to Post Testing

	Experimental Group	Control Group
Ravens	+2.138	+0.474
Analogies	+1.551	+0.842
Visual Matching	+1.414	+0.053
Memory for Design	+5.689	+4.000

Hypothesis 1: There is no difference in the Raven's Progressive Matrices, Analogies and Visual Matching subtests of the Woodcock-Johnson Psychoeducational Battery and the Memory for Designs-subtest of the Detroit Test of Learning Aptitudes-2 scores across groups.

The results of the multivariate repeated measures MANOVA analysis are shown in Table 7. No significant effect was found for treatment (2) x time (2) ($F = 0.153$). Therefore, hypothesis 1 is not rejected. This indicates that the process instruction sessions did not make a significant difference in performance.

A non-significant effect of treatment (2) x time (2), usually precludes interpretation of the univariate analysis of the dependent variables. However, since F levels did approach significance with two of the dependent measures, the analyses of these two dependent measures are presented for examination.

Table 7

<u>Multivariate Analysis of Variance (MANOVA) of Treatment Groups</u>

Test Name	Value	Exact *F*	Hypo DF	Error DF	Sig of *F*
Pillais	.14110	1.76608	4.00	48.00	.153
Hotellings	.16428	1.76608	4.00	48.00	.153
Wilks	.85890	1.76608	4.00	48.00	.153
Royes	.14110				

The Raven's Matrices (MAT) and the Visual Memory (VIS) dependent measures approached significance. The univariate analyses for MAT and VIS are shown in Table 8. While there were no significant effects due to treatment, the F scores did approach significance (p = 0.091) and p = 0.074) respectively. This may indicate that the experimental group did in fact receive some advantages from instruction.

Table 8

<u>Univariate F-Test of Treatment Groups by Two Dependent Measures</u>

	F	Significance of *F*
Raven's Matrices (MAT)	2.97150	.091
Visual Memory (VIS)	3.35067	.074

Hypothesis 2: There is no relationship between scores on the four dependent measures, treatment groups, and sex.

The results of the four dependent measures, MAT, ANA, VIS, and DES, treatment groups, and sex of the students are shown in Table 9. No significant interaction was found between the four dependent measures, groups, and sex of the students (p = 0.181). Therefore, hypothesis 2 is not rejected. This indicates that sex of the subject did not make a significant difference in performance.

Table 9

Multivariate Analysis of Variance (MANOVA) of Treatment Groups By Sex

Test Name	Value	Exact F	Hypo DF	Error DF	Sig of F
Pillais	.13837	1.64607	4.00	41.00	.181
Hotellings	.16059	1.64607	4.00	41.00	.181
Wilks	.86163	1.64607	4.00	41.00	.181
Royes	.13837				

Hypothesis 3: There is no relationship between scores on the four dependent measures and race.

The results of the four dependent measures, MAT, ANA, VIS, and DES, treatment groups, and race are shown in Table 10. No significant interaction was found between the four dependent measures, treatment groups, and race (p = 0.860).

Therefore, hypothesis 3 is not rejected. This indicates that race of the subject did not make a significant difference in performance.

Table 10

Multivariate Analysis of Variance (MANOVA) of Treatment Groups by Race

Test Name	Value	Approx *F*	Hypo DF	Error DF	Sig of *F*
Pillais	.09337	.43974	8.00	80.00	.860
Hotellings	.10052	.47747	8.00	76.00	.869
Wilks	.90769	.48576	8.00	78.00	.864
Royes	.08004				

F statistic for Wilk's Lambda is exact.

Hypothesis 4: There is no relationship between scores on the four dependent measures, treatment groups, and age.

The results of the four dependent measures, MAT, ANA, VIS, and DES, treatment groups, and age are shown in Table 11. No significant interaction was found between the four dependent measures, groups, and age ($p = 0.30$). Therefore, hypothesis 4 is not rejected. This indicates that the age of the subject did not make a significant difference in performance.

Table 11

Multivariate Analysis of Variance (MANOVA) of Treatment Groups by Age

Test Name	Value	Approx *F*	Hypo DF	Error DF	Sig of *F*
Pillais	.21274	1.19030	8.00	80.00	.316
Hotellings	.26126	1.24098	8.00	76.00	.287
Wilks	.79038	1.21694	8.00	78.00	.300
Royes	.19688				

F statistic for Wilk's Lambda is exact.

Hypothesis 5: There is no relationship between scores on the four dependent measures, treatment groups, and attendance.

The results of the four dependent measures, MAT, ANA, VIS, and DES, groups, and attendance are shown in Table 12. No significant interaction was found between the four dependent measures, treatment groups, and attendance (p = 0.136). Therefore, hypothesis 5 is not rejected. This indicates that the number of sessions attended at the process instructional intervention did not make a significant difference in performance.

Table 12

Multivariate Analysis of Variance (MANOVA) of Treatment Groups by Attendance

Test Name	Value	Approx *F*	Hypo DF	Error DF	Sig of *F*
Pillais	.22921	1.61799	8.00	100.00	.129
Hotellings	.26195	1.57170	8.00	96.00	.143
Wilks	.78286	1.59593	8.00	98.00	.136
Royes	.14723				

F statistic for Wilk's Lambda is exact.

CHAPTER V

DISCUSSION

While this research did not result in significant findings, it did lend promise to the concept of process instruction and educational intervention procedures. The experimental group gains exceeded the control group gains on all dependent measures. Two of the dependent measures approached significance. Performance on the Raven's Progressive Matrices approached a significance level of F = .091. Process instruction sessions were closely aligned with this measure, and it appears the experimental group did, in fact, make progress, illustrating the positive benefits of instruction. A second dependent measure, close to the significance level was Visual Matching (F = .074). This concept was not directly taught during the sessions, however much of the instruction was geared toward establishing visual comparisons and contrasts. I interpret a near significance level in this dependent measure as meaningful. It seems to illustrate that general improvement in visual skills was a direct result of the intervention. Near significance on the matrices task illustrated improvement with instruction. However, near significance on the visual matching task indicates more global improvement on a skill that is not as defined as matrice solutions. Performance on the visual matching dependent measure by the experimental group indicates improvement in a basic visual, cognitive skill.

According to Feuerstein's theories this improvement in visual matching skills will result in the student's ability to gain greater information from the environment and result in improved performance in numerous areas. Thus, the student's cognitive structures have been modified and new learning will have a different impact than previous learning, prior to the modifications.

Subjects

Subjects chosen from the population were appropriate for the purposes of this study. However, the initial sample size may have been too small. Basing research on a small sample population increases the likelihood of a Type II error, (the acceptance of a false null hypothesis), and it appears this may have occurred in the current research. Few public schools have the number of EMH students necessary to increase the experimental population, or to maintain an adequate control group, therefore, future research may have to encompass more than one secondary school.

All subjects were evaluated in accordance with the AAMD 1983 definition (Grossman, 1983) of mild mental retardation. To include students that have not beeen assessed in accordance with these guidelines may result in inflated significance levels. These spurious significance levels may be the result of students enrolled in EMH programs who are, in reality, functioning on a higher level.

Current research indicates the number of students receiving education intervention due to mild mental retardation has declined sharply since 1978 (Walker, Singer, et al., 1988, p. 393). This raises the question of where these students are being serviced. The Larry P. v Riles (1984) case resulted in many students being removed from EMH programs. Former EMH students no longer meet the criteria for placement. However, this does not eradicate their need for academic intervention. Though the number of students receiving service has decreased, the need for intervention remains. Altering the requirements for entrance into the EMH program may have served to deny students needed support and instruction. Process instruction may be an appropriate intervention for EMH students, as well as those students no longer meeting the qualifications for special education placement. This type of intervention may be appropriate for inclusion in the basic level English programs. If slight gains, though non-significant, can be detected on a "patently more disabled group" (MacMillan et al., 1981), such as existing EMH students, higher functioning, non-special education students; who continue to experience significant academic delays, may also benefit from process instruction procedures.

Design and Statistical Analysis

The statistical design utilized in the first half of this study was a Randomized Control-Group Pretest-Posttest Design. This is a classical experimental design which did not allow for the second intervention, providing process instruction to the control group.

Data were analyzed using a multivariate repeated measures analysis of variance. Employing this type of procedure decreases the number of Type I errors that may be observed in an ANOVA design.

In review of the findings from the statistical analysis reported here, it becomes apparent standard deviations increased from the pretest to the posttest for the Experimental group, and decreased for the Control group in three of the four measures. It may be hypothesized that this increase in dispersion was due to gains from instruction experienced by some students enrolled in the process instruction groups (see Table 13 for details). The EMH groupings were hetereogenous, therefore the more able students may have benefited from the intervention, while the more handicapped students were unable to profit as greatly from the 20 session intervention. Control group standard deviation decreased in all four measures, indicating decreased variance from pre and post testing. Exposure to the pre and post measures may have served as a practice factor, decreasing variance through time, for the control groups.

Table 13

Standard Deviation Gains from Pre and Post Testing on Experimental and Control Groups

	Experimental	Control
MAT	+1.207	-0.564
ANA	-0.035	-1.098
VIS	+0.884	-0.313
DES	+0.211	-0.488

In an attempt to further explore the possibility that intelligence may have contributed to the findings, further data were collected concerning the cognitive functioning of the students included in the research. Three teachers who were knowledgeable of the students were asked to rate each of the 60 students relative to one another. Each teacher was given a student list and asked to place a number one (1) next to those students who in their opinion were the highest intellectually functioning in the group. Next, they were asked to rate the lowest intellectually functioning students in the group with a number three (3). The remainder of students were assigned a number two (2), as examples of neither the highest nor lowest. Instructions to the teachers are included in Appendix H. Results of the ratings were compiled and the students were grouped according to the number they were assigned most frequently. Four of the students received ratings from one to three. These four students were assigned the number two. An analysis of the data resulted in eleven of the students being categorized as number 3's by all ranking teachers, and nine students being categorized as number 1's by all ranking teachers. Only one student received 2's by all three teachers.

A multivariate repeated measures MANOVA analysis was completed on the four dependent measures by groups (2) by intelligence (3) by time (2) and no significance was found (Table 14). There was no significant interaction (p = .550) between the four dependent measures, groups, intelligence, and time.

Table 14

Multivariate Analysis of Variance (MANOVA) of Treatment Groups with Intelligence

Test Name	Value	Approx *F*	Hypo DF	Error DF	Sig of *F*
Pillais	.16218	0.88246	8.00	80.00	.535
Hotellings	.17794	0.84521	8.00	76.00	.566
Wilks	.84383	0.86392	8.00	78.00	.550
Royes	.10477				

Crossbreaks were done to determine if greater gains were made in the experimental groups, exploring the possibility of intelligence contributing to the increased standard deviation in the posttest measures. Table 15 illustrates greater standard deviation differences were found in the experimental groups for all three levels of intelligence on the MAT and the VIS. Standard deviation was greater for the middle level of intelligence on the ANA dependent measure, and the lowest level of intelligence for the DES measure.

Table 15

Standard Deviations Between Dependent Measures Experimental Groups, and Intelligence

	Experimental			Control		
Intelligence	High	Med	Low	High	Med	Low
PreMAT	3.65	3.92	3.60	4.40	1.00	3.19
PostMAT	4.57	5.13	3.65	3.58	1.52	2.61
PreANA	3.62	3.42	4.22	5.18	1.00	3.74
PostANA	2.63	4.10	4.06	3.20	3.51	2.77
PreVIS	1.96	2.47	1.88	3.66	3.22	2.17
PostVIS	2.50	3.62	2.52	2.70	3.51	2.78
PreDES	4.75	6.65	6.68	6.89	2.65	6.42
PostDES	4.83	5.49	6.52	6.01	1.16	7.15

Table 16 illustrates the differences between the posttest and pretest standard deviations. Greater gains are apparent in nine of the 12 experimental/control group comparisons.

Table 16

Posttest-Pretest Standard Deviations Differences for Dependent Measures by Experimental Groups, and Intelligence

	Experimental			Control		
Intelligence	High	Med	Low	High	Med	Low
MAT	+.92	+1.21	+.05	-.92	+.52	-.58
ANA	-.99	+.68*	-.16	-1.98	+2.51	-.97
VIS	+.54*	+1.15	+.64	+.96	+.29	+.61
DES	+.08	-1.16	-.16*	-.88	-1.49	+.73

*A greater gain was not observed in the experimental/ control group comparisons.

Appendix I presents figures of standard deviation gain scores between the experimental and control groups by intelligence. Appendix J presents tables of dependent variable mean scores between experimental and control groups by intelligence. It appears that greater overall variability did occur in the experimental group in three of the four dependent measures.

The differences between experimental and control groups by intelligence are illustrated in Figure 2 for MAT, Figure 3 for ANA, Figure 4 for VIS, and Figure 5 for DES. Experimental gains are clearly shown in MAT, ANA, and DES dependent measures, while they are not found in the VIS dependent measure. Gains in the aforementioned variables may be due to the instruction, which was presented in the intervention phase, on matrix and analogy solution, as well as visual memory for shapes. The lack of formal strategy training in visual matching of numerals may have resulted in this measure not being sensitive to intervention.

Figure 4

Pre/Post Matrice Means for Groups by Intelligence

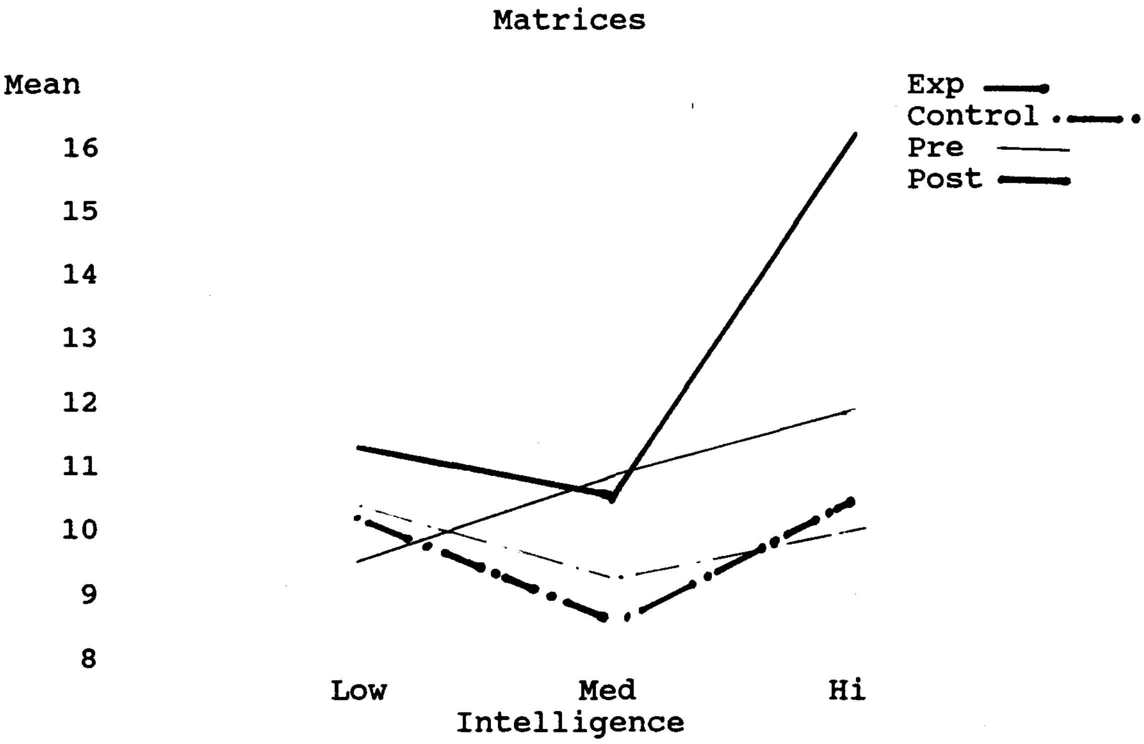


Figure 5

Pre/Post Analogous Reasoning Means for Groups by Intelligence

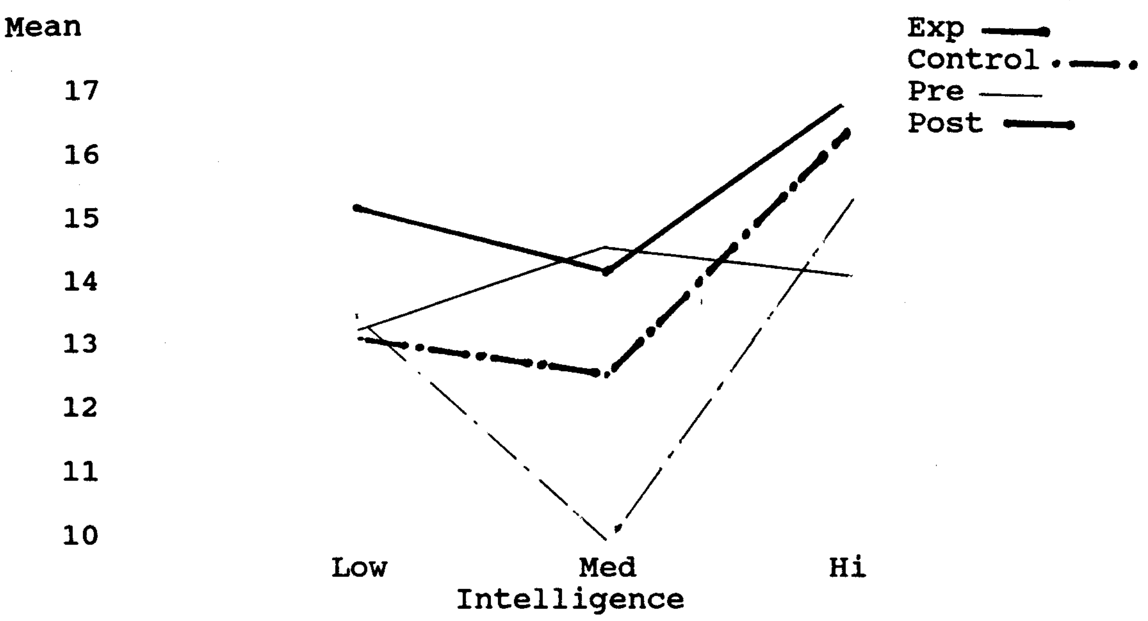


Figure 6

Pre/Post Visual Matching Means for Groups by Intelligence

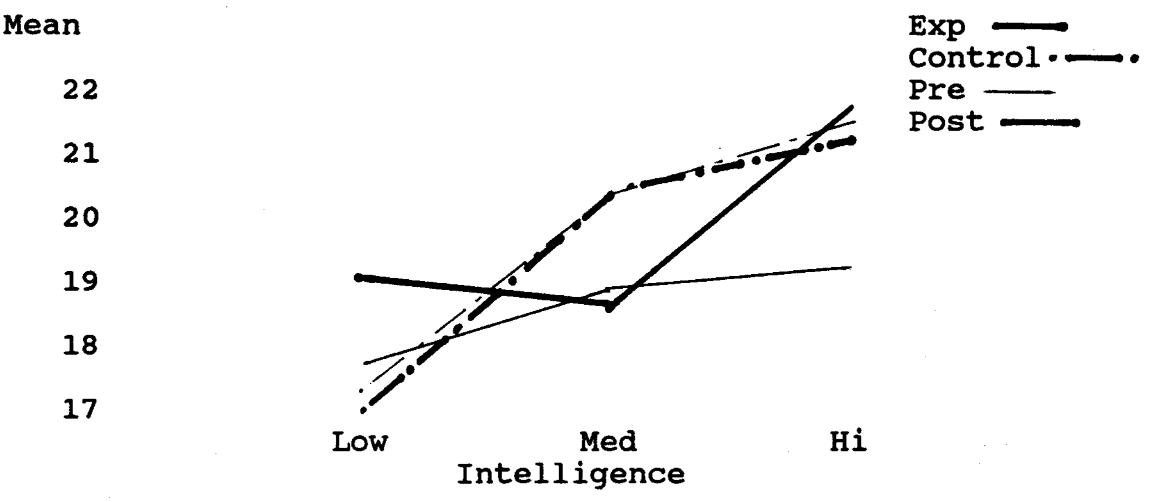
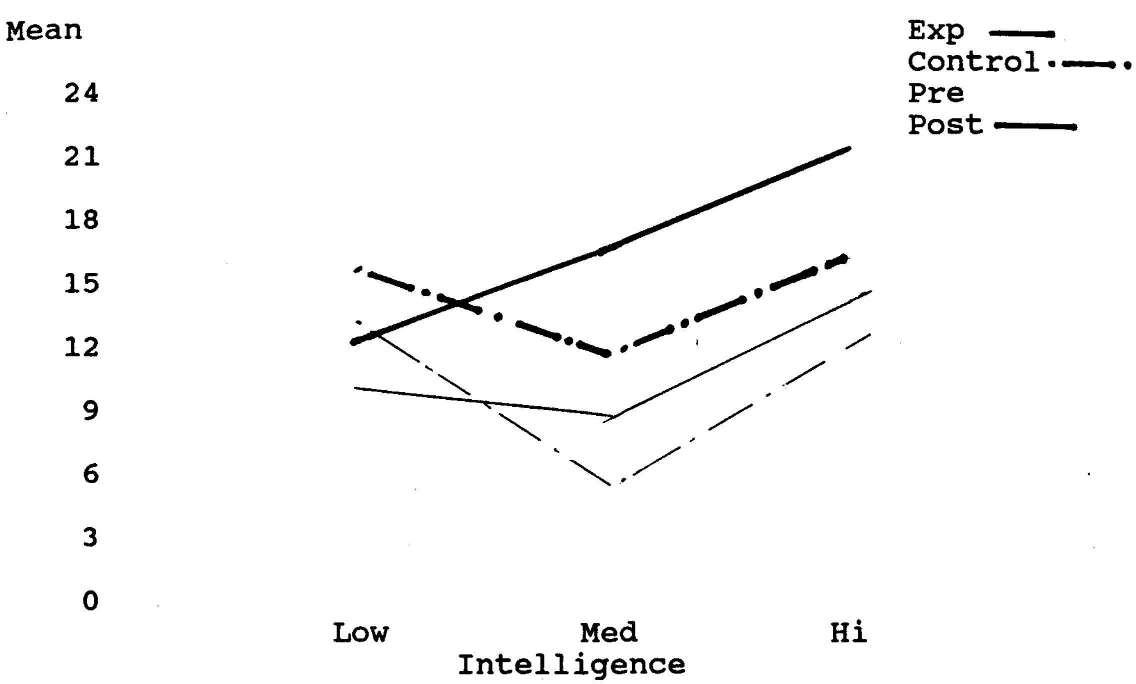


Figure 7

Pre/Post Memory for Design Means for Groups by Intelligence



Instrumentation

Instruments chosen as dependent measures may have contributed to the lack of significance.

I believe that the Raven's Progressive Matrices was a useful evaluation choice because the process instruction focused on how to correctly solve matrices. Instruction was geared directly toward the solution of matrices and may explain why this measure approached significance. Materials were readily available to instruct students on matrix solution, increasing the generalizability of this type of measure. Feuerstein utilized matrices in his

Learning Potential Assessment Device (LPAD), and he provides detailed descriptions of the type of errors students often exhibit. These illustrations of common student errors, as well as appropriate intervention strategies contributes to the validity of this tool (see Appendix F).

Analogies

The Analogies section of the Woodcock-Johnson Psychoeducational Battery was also used during the assessment phases. This analogies subtest was initially chosen because it allowed subjects to formulate their own responses by not offering multiple choices from which to choose. However, many of the students involved in this research displayed depressed vocabulary skills. Due to significant language deficiences, open-ended questions may not have been the best format.

Analogious reasoning skills were presented during the instruction, however most instruction provided stimulus choices. These choices served to limit inappropriate responses. The open-ended format may have served to highlight vocabulary deficiencies, rather than a lack of verbal reasoning skills. Future researchers may wish to utilize an evaluative tool which supplies stimulus choices, thus allowing the student a means to utilize the process of elimination, deleting incorrect responses.

Visual Matching

The Visual Matching subtest of the Woodcock-Johnson Psychoeducational Battery was also utilized as a pretest-posttest-folotest measure. This subtest purports to measure visual accuracy, speed, and impulsiveness. Though visual matching was an appropriate measure, its contribution to the overall research may have been minimal. This type of task was not included in the formal instruction. A task requiring students to match visual shapes may have been more appropriate, as well as more sensitive to the intervention techniques.

Memory for Design

Memory for Design, from the Detroit Test of Learning Aptitudes-2, was also included as a dependent measure. This measure was indirectly related to the intervention strategies. Visual skills of comparing and contrasting were an integral component of the non-verbal instructional format, though no visual memory instruction took place, per se.

This subtest was relevant because EMH students often lack the means to store sensory input, both auditory and visual. Improved visual memory skills may serve to enhance overall academic functioning.

Other Appropriate Measures

Future researchers may wish to utilize other measures which seem appropriate. Teacher questionnaires regarding subjects' behaviors in the classroom may have been appropriate, perhaps pre and post intervention ratings of classroom behaviors, such as attending skills. Certainly an appropriate component of this research is to determine if process instruction has improved overall learning habits. Future researchers may wish to explore the generality of process instructional techniques to other structured learning environments.

Instruction

The 20 classroom lessons utilized in the intervention were taken from numerous sources and compiled by the evaluator. These worksheets are available for duplication and the research can be reconstructed. However, instructional teaching procedures may vary from individual to individual, presenting replication concerns.

Process instruction is a teaching technique which can be utilized in all educational settings and with numerous materials. The classroom teachers of the students involved in this research were initially given little information on process instruction so as not to confound test results. Following the termination of the research the five EMH teachers were given inservices in the components of process instruction. Each teacher was given examples of techniques that could be directly applied to classroom situations. An actual demonstration with students however, was not presented and may have been beneficial.

While there were no significant gains in the dependent variables in the experimental group, group means were higher in all of the four measures. Perhaps, the effects of 20 training sessions were too slight to be measured, and a longer, more intensive, instructional period would have produced a significant difference.

Future Directions

Overall, the process instruction approach, providing mediated learning experiences to slow learners, did not produce expected results. These insignificant results may be due to weaknesses inherent in the research project reported here, as opposed to weaknesses in the concept of mediated learning. Even though these results were not significant, the concept of process instruction does appear educationally promising (Budoff, 1969; Feuerstein, 1981; Haywood, 1975; Vygotsky, 1978). This teaching technique can be applied to almost all instructional programs. As a result in part, of the decreased enrollments in EMH programs, numerous students are placed in mainstream education who demonstrate significant academic and learning concerns. This method may allow some students to be exposed to, and to incorporate, learning strategies they lack, and are necessary to succeed in formalized educational settings.

As a result of the "least restrictive alternative" clause in PL 94-142 more special education students will be served in mainstream education. As these special education students become a part of integrated school environments, programs must be designed to allow EMH students, as well as low functioning non-special education students, to receive maximum benefit from existing educational opportunities. Many students are doomed to failure without supportive services and educational innovations. One of the concerns of the future may be with educational content, rather than classification.

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APPENDIX A

PARENT CONSENT FOR PARTICIPATION

TITLE: PROCESS INSTRUCTION OF INDUCTIVE REASONING SKILLS

I, ____________________________, the parent or guardian of ______________________________, hereby consent to his/her participation in a research project being conducted by Lynda Wait, School Psychologist at Schurz High School. As a participant in this project my child will receive twenty 40 minute periods of instruction in deductive reasoning skills. A potential benefit of this type of instruction may be an increase in independent reasoning skills, as well as problem solving ability. The process instructional groups will be led by Lynda Wait, a certified EMH teacher. I understand that no risk is involved, but that in any case I may withdraw my child from participation at any time without prejudice.

____

Signature of parent or guardian

____

Date

APPENDIX B

OUTLINE OF TEACHER'S ASSESSMENT MANUAL

Included in this Appendix is the table of contents for the PROCESS INSTRUCTION OF INDUCTIVE REASONING SKILLS TO SECONDARY EDUCABLE MENTALLY HANDICAPPED STUDENTS, TEACHER MANUAL, basic teaching procedures, and the instructions for the administration of the Raven's Matrices. All other instructions are taken from the manuals for the individual subtests. Therefore, the Woodcock-Johnson Psychoeducational Battery Analogies and Visual Matching instructions and the Memory for Design Test from the Detroit Test of Learning Aptitudes-2 were included verbatim in the teacher's manual. Examples of scoring, as well as administration, were also included.

Table of Contents

Basic Testing Procedures

The examiner can assume a reliable administration of the tests by adhering to several simple rules.

1. Become thoroughly familiar with the contents of the test manual.

2. Study carefully the samples for scoring.

3. Practice administering the test.

4. Administer the test in an environment that is free from distractions, well-ventialated, well lighted, quiet, private, and comfortable.

5. Establish rapport with the examinee by exploring the purpose of the test and approaching the testing situation as a pleasurable undertaking.

6. Be alert to the examinee's level of fatigue and cease testing if he or she shows signs of tiring or losing interest.

7. Consistently praise and encourage the examinee, but avoid prompting or otherwise deviating from testing procedures. Remarks such as "YOU SEEMED TO LIKE THAT" or "YOU DID THAT QUICKLY" are appropriate. However, comments that appear to reflect on the accuracy of the examinee's response, such as "VERY GOOD" or "THAT's RIGHT" should be avoided, as some examinees quickly come to expect these comments and become disturbed when the examiner does not say them.

Test 1

<u>Pre/Post-test Raven's Progressive Matrices</u>

Basal Begin at item number 1

Ceiling Seven consecutive incorrect responses

Place the test page in front of the student on page Set A, A_1 and say:

"YOU SEE WHAT IT IS. THE TOP PART IS A PATTERN WITH A BIT MISSING. EACH OF THESE PIECES BELOW (point to each in turn) IS THE RIGHT SHAPE TO FIT THE SPACE, BUT THEY DO NOT ALL COMPLETE THE PATTERN. NUMBER 1 (point to the piece and then to the pattern) IS QUITE THE WRONG PATTERN. NUMBERS 2 AND 3 ARE WRONG - THEY FIT THE SPACE, BUT THEY ARE THE WRONG PATTERN. WHAT ABOUT NUMBER 6? IS IT THE RIGHT PATTERN (illustrate that the pattern is the same as the pattern above), BUT IT DOES NOT GO ALL OVER. PUT YOUR FINGER ON THE ONE THAT IS RIGHT."

If necessary explain more fully, and then say "YES, NUMBER 4 IS THE RIGHT ONE."

Turn to A_2 and say:

"YOU SEE WHAT IT IS. THE TOP PART IS A PATTERN WITH A BIT MISSING. EACH OF THESE PIECES BELOW (point to each in turn) IS THE RIGHT SHAPE TO FIT THE SPACE, BUT THEY DO NOT ALL COMPLETE THE PATTERN. THE RIGHT ONE OF COURSE IS NUMBER 5." "ON EVERY PAGE IN THIS SECTION THERE IS A PATTERN WITH A BIT MISSING. YOU HAVE TO DECIDE EACH TIME WHICH OF THE PIECES BELOW IS THE RIGHT ONE TO COMPLETE THE

PATTERN ABOVE. WHEN YOU HAVE FOUND THE RIGHT BIT POINT TO IT. THEY ARE SIMPLE AT THE BEGINNING AND GET HARDER AS YOU GO ON. THERE IS NO CATCH. IF THE PAY ATTENTION TO THE WAY THE EASY ONES GO YOU WILL FIND THE LATER ONES LESS DIFFICULT. WORK AT YOUR OWN PACE. NOW LET'S BEGIN."

Pre-test 1a	Begin with Number A_3 and continue until seven consecutive incorrect responses are given.
Post-test 1b	Begin with Number A_4 and continue until seven consecutive incorrect responses are given.

*Note Items A_1 and A_2 are administrated in both the pre and post tests.

APPENDIX C

OUTLINE OF STUDENT ASSESSMENT MANUAL

The Process Instruction of Inductive Reasoning Skills to Secondary Educable Mentally Handicapped Students, Student Manual included the five dependent measurements. The Raven's Matrices test was divided into even and odd problems. The posttest assessment phase included matrices A1 and A2 and all even number matrices. All other student material was reproduced as it is presented in the individual test manuals.

APPENDIX D

OUTLINE OF STUDENT INTERVENTION

PACKET

VISUAL CONTRASTS AND COMPARISONS (6 Classroom Instructional Periods)

Black, Howard and Sandra (1984). Figural Similarities B-1. Pacific Grove, Ca: Midwest Publications, Pages 1 to 17.

Black, Howard and Sandra (1985). Building Thinking Skills, Book-3 Figural. Pacific Grove, Ca: Midwest Publication, Pages 1 to 31.

VISUAL ANALOGIOUS REASONING (6 Classroom Instructional Periods)

Black, Howard and Sandra (1985). Building Thinking Skills, Book-3, Figural. Pacific Grove, Ca: Midwest Publication, Pages 103-108; 191-199; and 233-240.

Black, Howard and Sandra (1981). Figural Analogies, Book A-1. Pacific Grove, Ca: Midwest Publication, Pages 1-16.

VERBAL ANALOGIOUS REASONING (4 Classroom Instructional Periods). Reading and Thinking Skills, Primer Level, 1 and 2. (1966). Continental Press, Inc.: Elizabethtown, Pa., Pages, Level 2, 1-3, and 10-12.

Reading and Thinking Skills, First Reader, Level 1 and 2. (1966). Elizabethtown, Pa: Continental Press, Pages Level 1, 1-3, 15-18; and Level 2, pages 1-3, 15-17.

Reading and Thinking Skills, Second Reader, Level 1 and 2.

(1965). Elizabethtown, Pa: Continental Press, Pages Level 1, 10-11, and Level 2, pages 1-2, 19-22.

Reading and Thinking Skills, Third Reader, Level 1 and 2. (1965). Elizabethtown, Pa: Continental Press, Pages Level 1, 1-2, 12-13; and Level 2, pages 1, 6-7.

Reading and Thinking Skills, Fourth Reader, Level 1 and 2. (1965). Elizabethtown, Pa: Continental Press, Pages Level 5-7; and Level 2, pages 5-7.

MATRICES (4 Classroom Instructional Periods)

Harnadek, Anita. (1979). Figure Patterns, Inductive Thinking Skills. River Grove, CA: Midwest Publications, Pages 1-28.

Feuerstein, R., Rand, Yaacov, R., Haywood, H.C., Hoffman, M., and Jensen, M.R. L.P.A.D. Variations of Progressive Matrices, I and II. Jerusalem: Hadassah-Wizo-Canade-Research Institute.

APPENDIX E

PUBLISHERS OF MATERIALS USED IN THIS RESEARCH

Midwest Publications

P.O. Box 448

Pacific Grove, CA 93950

Fax 408-372-3230

Telephone: 1-800-458-4849

The Continental Press

Elizabethtown, PA 17022

Feuerstein, R., Rand, Yaacov, R., Haywood, H.C., Hoffman, M. and Jensen, M.R. L.P.A.D. Variations of Progressive Matrices, I and II. Jerusalem: Hadassah-Wizo-Canade-Research Institute.

APPENDIX F

An example of intervention as illustrated by R. Feuerstein et al. The material utilized in this illustration is the first twelve puzzles presented in <u>Raven's Coloured Progressive Matrices</u> (1984). This example is taken from <u>L.P.A.D.: Learning Potential Assessment Device Manuel</u> (Feuerstein et al., 1979, 1980).

PROTOCOL OF LPAD ADMINISTRATION OF RAVEN'S COLOURED PROGRESSIVE MATRICES

[illegible]AMINER	RATIONALE	SUBJECT RESPONSE	INTERPRETATION OF RESPONSE
[illegible]:			
[illegible] at this [illegible]. What will [illegible] have to do [illegible]?	Request for definition of problem. The adequate recognition of a problem and its definition requires that the subject grasp the disequilibrium that exists in the	1a. (No response) or I don't know.	May indicate: 1a. Resistance to the demand for active participation and/or an attempt to remove pressure of the question.

6.3

EXAMINER	RATIONALE	SUBJECT RESPONSE	INTERPRETATION OF RESPONSE
	given situation. The response should indicate a reflection on the source of incongruity and a need to restore the equilibrium by filling in the whole with one of the six alternatives offered at the bottom of the page.		The hypothesis that has been generated is discrepant from the given information, leaving the subject at a loss.
	From the response to this question the examiner may obtain an initial impression of the cognitive behavior of the subject.	1b. Color it in.	Ib. Appropriate cognitive functions have not been mobilized to adequately and completely gather and elaborate information.
	Incorrect, incomplete or inappropriate answers to the above question require the examiner to ask questions that lead to an explicit analytic perception of the task and appropriate data gathering.		The attempt to solve the problem is inappropriate to the reality constraints of the task. No relationship has been established between the missing part and the pieces at the bottom of the page.
		1c. Fill it in.	Ic. Either an incomplete response or elaborated response.
2. Look at the rectangle. What do you see in it?	Focuses attention on source of information. Explicit request for an analytic perception of a whole with a missing part, rather than a response based on pure perception or intuition.	2. It's green with some lines.	2. Description based on perception of the salient color and pattern. Does not perceive and/or consider relevant the part that is missing.
	Analytic perception is brought in here to prepare for later, more complex tasks in which such perception is necessary for solution. Although this task can be solved by a Gestalt closure, subject is asked to find logical evidence to support his hypothesis. Because this is preparatory and essential for later tasks, even an adequate definition of the problem and proposed solution is followed by a request for the basis for the response and its justification.		
You're right in describing the color as green and the pattern as black lines.	Acceptance of that part of answer which is correct, while probing for more complete, more precise response and the perception of the missing part.		
3. But is all of it green with black lines, or is part of it missing?	The concept 'missing' produces a need for completion and closure.	3. No. Here it's white. There's a part missing.	3. Correct response to direct question. Does not go beyond the perceived data. May indicate a cognitive passivity, rather than an inability to generate information.

EXAMINER	RATIONALE	SUBJECT RESPONSE	INTERPRETATION OF RESPONSE
4. So what must we do to make it whole? Look at the bottom of the page. What do you see there? (or: you will see 6 pieces).	Have the subject gather and synthesize the necessary information from the top and bottom of the page. The relationship between the whole and the missing part must be established.	4a. I can use one of these and put it in. 4b. I have to choose a piece from the bottom to fill in the missing part.	4a and 4b. A relationship has been established between the task and the alternatives given for its solution.
5. Which one will you choose?		5. No. 2 or No. 6.	5. Incorrect response. Only one source of information has been used: only color in No. 2; only pattern, but not size, in No. 6.
No. 2 is almost good. It is the right color, but something is missing. What will we add to 2 to make it good?	In responding to an error the emotional weight of the error is minimized so as to reduce the negative valence of failure. The examiner as teacher is vitally concerned with the success of the child, so errors are used for learning by seeking their source. The subject is always given a chance to correct his answer.		
6. What else is needed besides green?	Request for precise analysis of partially correct answer.	6. Must add lines.	6. By comparing the incorrect alternative to the task figure, the subject discovers what is missing. The process of analytic perception has been initiated.
7. No. 6 is not good. Why?	In asking for reasons why a response is incorrect, the examiner always prefaces his question with a statement that the answer is not right. Since the responses of many children are very vulnerable, any questioning is apt to be interpreted by them as an indication that they have made an error.	7. It's no good because it's not big enough. There's a part missing.	7. Additional information has been gathered. Subject starts to develop insight into the source of his errors.
Very good. A part is missing. It is not complete.	Whether consequent to an incorrect response or subsequent to a correct answer, partially correct answers are analyzed precisely as to the components that are correct and those that render them incorrect. An active generative mode of thinking as to what might be done to render incorrect responses correct is encouraged.		

VAR

XAMINER	RATIONALE	SUBJECT RESPONSE	INTERPRETATION OF RESPONSE
. There is an swer that is ich better than y you have entioned. Look t each answer n the bottom of he page to find he one you need o fill in the igure.	The examiner can model systematic exploration by pointing to each alternative in turn, so that the subject will focus on each possible answer. This task introduces a different operation, involving the process of analogical thinking. It will require intervention aimed toward training the principles of analogy, including the concepts: (a) transformation, (b) similarity, (c) constancy, and (d) variation.	8. No. 4.	8. Correct response.
Very good.	Positive reinforcement.		
9. Now could you show me which one of these answers is the worst of all? I want you to tell me which is the worst, and give me two reasons why it is the worst. (Holds up two fingers for emphasis).	There are three goals for this question: a. To produce an analytic perception and bring two dimensions simultaneously to bear (i.e., color and shape) on the solution. b. to produce the need for logical evidence on an elementary level by requiring that statements be supported by a reason. c. to differentiate between reasons by enumerating, 'first....; second....'.	9. No. 3. 9a. Incorrect response.	9. Correct identification, but no spontaneous attempt is made to indicate reasons in support of answer. 9a. With incorrect response, examiner should elicit what is partially correct in response and request an answer that is even worse. When the correct answer is given, it should be compared with the one that was incorrect.
10. That's right. No. 3 is the worst of all. Now give me two reasons.	Positive response to incomplete answer. Repetition of request.	10. It doesn't have green.	10. Uses only one source of information.
11. That's true. It has no green. And the other reason.?	Acceptance of the part of the answer that is correct.	11. It has black.	11. Inappropriate response because the figure is needed. The relevant dimension is the shape of the color. Attention has not shifted from the dimension of color to another suitable dimension for comparison.
12. Look at the figure again. Isn't there any black in it?	Explicit instruction to scan the model and focus on the source of information.	12. Yes, it has black lines.	12. Correct response after additional investment in the input phase.
13. That's right. The lines are black. Can you give me the	To elicit response based on a comparison between newly perceived and previous information.	13. It doesn't have the lines.	13. There was difficulty in spontaneous comparative behavior. Response required a specific elicitation.

VAR 7

EXAMINER	RATIONALE	SUBJECT RESPONSE	INTERPRETATION OF RESPONSE
second reason why No. 3 is not good?			
14. That's right. It has a different form. It has squares. Again, what are the two reasons why No. 3 is the worst one?	Introduces superordinate term for dimension of pattern. Request summation from the subject.	14. It's white and it doesn't have lines.	14. The summary is given in task-specific terms.
15. Very good. It is a different color and a different form.	Rephrases in superordinate terms. Models a more generalizable level of communication.		
A-2			
1. What will you put in here?		1. No. 5.	
2. Why are the others not good?		2. They are missing the lines.	
A-3			
1. What goes in here?		1. No. 1.	
2. Why is No. 3 not good?		2. A part is missing.	
3. You're right. It's not complete.			
A-4			
1. Which answer is the good one?		1. (Points to No. 2).	1. Correct. A gestural mode of communication is used.
2. Very good. It's No....?	Request for shift from a gestural to coded mode of communication.	2. No. 2.	
3. Could you show me which is the worst of all?	Elicit hypothetical, analytical thinking.	3. (Points to No. 3).	3. and 4. There is no systematic exploration of all alternatives. The first response to catch the eye is chosen, with no further attempt to explore or to compare alternatives. The difficulty is on the input level, not elaboration.
4. There is one that is worse, one that is not good at all.	Require continued exploration until an appropriate answer has been found.	4. (Points to No. 1).	

VAR 8

EXAMINER	RATIONALE	SUBJECT RESPONSE	INTERPRETATION OF RESPONSE
. There is one hat is even vorse than this.		5. Oh! No. 6.	5. A previously unconsidered part the field has been discovered and immediately recognized as the corre. response.
. No. 6 is the vorst of all. Why s it the worst?	Request for analytic thought, logical evidence.	6. Because it is completely black. You can't see the yellow or the dots.	
7. And why is No. 1 a bit better than No. 6?	Elicit comparison of two alternatives and their proximity to standard.	7. Because it has lines.	7. No distinction is made betwe relevant and irrelevant dimensions. It is the color which makes it better; the pattern is incorrect.
8. But the lines are not good. What part makes it better than No. 6?	Elicit a distinction between relevant and irrelevant dimensions for response.	8. It's got the yellow.	
9. That's right. The color makes No. 1 better than No. 6, although the lines are not good.	Summarize response, rephrasing in superordinate terms.		
10. Why is No. 3 not good?		10. It doesn't have enough dots.	
11. How many dots do you need to have? Count them.	Elicit the use of number concepts and produce specific analysis of number, rather than Gestalt. Observe carefully the method that is used for counting (e.g., '4 X 3 = 12, and 1 more is 13'). Is grouping used? Is counting systematic by rows or columns? Does the subject follow the dots one by one with his finger or does he count at random with an undefined starting or end point? Is there a lack of one to one correspondence? Are numbers approximate or guessed? Systematic counting should be taught, if necessary.	11. (Counts the dots). Thirteen.	
12. How many dots do you have in No. 3?		12. Four.	

VAR 9

EXAMINER	RATIONALE	SUBJECT RESPONSE	INTERPRETATION
13. So how many dots would we have to add to No. 3 so it will be all right?		13. (Tries to cover 4 dots with finger) Counts the others, one by one, but misses one partly obscured by finger). You need 8.	13. The process used indicates a grasp of the concept of subtraction, though the operation is not well established and the answer given is incorrect.
14. You thought very well, but there was a small error in counting. Please count them again.	The process is praised, but precision is required.	14. There are nine.	
15. Very good. How many would we need to add to No. 4 to make it right?	Easier to answer than thirteen minus four. Check for use of appropriate strategy and precision in use of numbers.	15. (Covers one dot and counts the rest). Twelve.	The process is overemphasized since answer could probably be given without counting. However, use of a newly learned strategy is an important indication of modifiability.
Very good.			
A-5			
1. Which answer is the right one?		1. No. 6.	
2. Very good. No. 4 is not good. Why?		2. Because it has two flowers and we need six.	2. Note spontaneous, precise use of number following investment in A-4.
3. And how many will we need to put in so it will be good?	Reinforce previously taught concepts.	3. Four.	
4. Give me two reasons why No. 5 is not good.		4. Because it has only one flower and it should have six.	4. Use of one dimension. Number was the most recently emphasized dimension and so is the first to be considered.
5. And what is the second reason that No. 5 is not good?		5. Because.... there aren't enough. It needs more.	Repetition of same dimension though in different words. Note the vulnerability of the precision.
6. This you've said. There is another reason. Look at this one (No. 5) and this one (No. 6). What is another	Elicit explicit comparative behavior.	6. This one is bigger than these.	6. A new dimension, size, is introduced. The distinction and consideration of various discrete parameters such as color, shape, number, size, etc. affect later problem-solving by producing dimensions for gathering data. The

VAR.

EXAMINER	RATIONALE	SUBJECT RESPONSE	INTERPRETATION OF RESPONSE
reason that No. 5 is not good?			relative use of or resistance to var... parameters should be observed... determine potential sources... difficulty on later tasks.
7. It is different in both number and size.	Summary and rephrasing in superordinate terms.		
A-6			
1. Which one will you choose?		1. No. 3.	
2. That's right. No. 1 is not good. What are two reasons that No. 1 is not good?		2. Here it goes up (No. 1), and here it goes sideways (No. 3).	2. Note the level and specificity of t... terms used. The dimension has be... correctly identified and adequate... communicated. Some subjects may respon... idiosyncratically (e.g., 'lines ar... straight.'). Although a person may still operat... despite inappropriate or imprecis... terms, the existence or provision o... appropriate labels will aic... generalization.
3. That is one reason. Now tell me the second reason.	If necessary, the examiner can return to A-4 and reinvoke use of number as a dimension in comparing alternatives No. 2 and No. 3.	3. No. 1 has more lines than No. 3.	3. The concept of number may be less readily accessible and increased awareness may be needed to produce the use of number as a discriminating dimension.
4. How many more?	Reinforce precision in the use of number.	4. (Counts black lines). This one has five and this one has three.	4. During the process of gathering the information, the purpose is forgotten, so data is not elaborated once attained.
5. How many more are five than three?		5. Two more.	
6. Now tell me the two reasons.	Request for summative behavior.	6. These are going across and these are going up. Here you have three and here you have five.	6. Adequate summary though limited to specific task-bound terms, rather than expressed in superordinate terms.

EXAMINER	RATIONALE	SUBJECT RESPONSE	INTERPRETATION OF RESPONSE
7. Very good. Now, you've said that the lines in No. 1 go up and the lines in No. 3 go across. I want to teach you more precise words. (Holds pencil vertically). The lines in No. 1 are like this. We call it vertical. (Holds pencil horizontally). We call this horizontal. Now the pencil is vertical and now it is horizontal. What kind of lines are in No. 6?	This intervention introduces horizontal vs. vertical as orientations that depend on the relationship of a line to one's body axes. Interchangeable terms can be used. The subject must learn appropriate descriptive terms, but is not limited to 'correct' words. The terms 'standing up' and 'lying down' may be more accessible to some children, depending on their age and sophistication.	7. Vertical.	
8. And the lines in No. 2?		8. Horizontal.	
9. (Draws horizontal line on a piece of paper in front of subject). What kind of line is this?	This exercise (9 - 11) constitutes an opportunity to demonstrate that while it is good to learn a principle, one must learn that principles are not universally applicable or immutable. It introduces the notion of relativity and begins to teach the individual that he can change the orientation in space simply by changing the relationship between the paper and the axes of his body.	9. Horizontal.	
10. Can you make this line vertical?		10. (Tries to draw a vertical line).	Preference for action over thinking, and concrete behavior over hypothetical thought.
11. No. I don't want you to draw it. How else could you make it vertical without drawing it?		11. (After a pause, turns the paper).	This response occurring spontaneously indicates representational and flexible thinking.
12. Find some vertical lines in this room.			
Where are some horizontal lines?	When a concept, principle or operation is taught, opportunities	12. (Can point out the door or	

AMINER	RATIONALE	SUBJECT RESPONSE	INTERPRETATION OF RESPONSE
	generalized application must be provided. Although this can be be done only in a limited manner during an assessment, it is important that the individual be able to generalize to various modalities, languages, contents, etc. The examiner can asssess the differential preference for and/or effectiveness of various modalities of presentation.	window surfaces, chair or table parts, or any other appropriate examples).	
(If examiner itting at a t angle to the ect, he can cate an edge the table in nt of the ject). What ald you call s line?		13. Horizontal.	
. And what uld I call this e?		14. Vertical.	14. Indicates a grasp of the notion of relativity of orientation to a giver point of reference.
·7			
. Which one will ou need here.?		1. No. 4.	1. Response based on a sweeping perception. There are two vertical lines in the figure, but the distance between them has not been conserved nor has the missing part been precisely located.
. No. Look arefully at what s missing.	Return attention to the data for a more precise definition of what is needed.		
3. What will you need to put in No. 1 so that it will be right? Use the word you have learned.	Reevoke learned vocabulary.	3. A horizontal line.	
4. What must you add to No. 2 to make it good?		4. A vertical line.	

VAR.

EXAMINER	RATIONALE	SUBJECT RESPONSE	INTERPRETATION OF RESPONSE
2. Look at the lines where they will cross the missing part. Look both vertically and horizontally.		2. No. 2.	
3. Tell me why No. 6 is not good. What must you add?		3. One vertical line.	3. Responses should include number and orientation.
(Continue for No. 1, No. 3, and No. 4).			
A-9			
1. This is a harder one. In order to succeed you will have to pay close attention.	The subject must spend enough time looking at the figure to insure proper input. It is necessary to focus on points of reference, the white line at the left, and the thin white line at the tip.	1. No. 1.	
A-10			
1. This is a difficult one. Pay close attention. Look at each of the answers and compare them with the missing part. After you have done that and when you are sure, tell me the one that is right.	Explicit request for systematic exploration. Elicit focused attention to data to avoid an impulsive response. Elicit comparative behavior. The difficulty in this task is its complexity and the problem of representing what is needed to aid visual transport.	1. No. 6.	1. This is the opposite, based or imprecise perception and definitio what is needed. There is a diffic in visual transport.
2. No. Look here again and see what is missing.		2. No. 3.	2. Correct.
(If not self corrected): Look carefully at how many lines you will need and in which direction they are going.	Provide a cue as to how to internally represent the relevant dimensions as an aid to comparison and visual transport.		

EXAMINER	RATIONALE	SUBJECT RESPONSE	INTERPRETATION OF RESPONSE
3. Why is No. 5 not correct? No. 6?	Reinforce analytic thinking; use of two sources of information; use of number and orientation as dimensions for comparison.	3. The black lines are pointing in the wrong direction.	
4. Give me two reasons why No. 2 is not good.		4. The lines are going up and they need to go across. And here there are three black lines and you need two.	
A-11			
1. Look a long time at the missing part. Do not look down at the answers until you know exactly what you need. Look at all of the answers from 1 to 8, one at a time and compare them.	Explicit instructions on how to go about solving the task, with an attempt to bypass input or output difficulties and focus on the elaborative process. The examiner may cover the alternatives to force the subject to focus on gathering the data needed. The difficulty here will be improper input, impulsivity, and deficiencies in visual transport.		
Which one should go there?		1. No. 2.	1. Use of one source of information. Identity formed with intersection at upper right.
2. Look again at the figure. You must look at the lines that go across (points across rows), and the lines that go down (points along columns).	Model data gathering from two sources.	2. No. 4.	
3. What happened? Why did you make an error?	Produce analytic, reflective thinking and insight into source of error.	3. I didn't look well. I only looked this way.	3. Indicates awareness of process used. Source of error properly identified.
4. Why is No. 2 not good?	Request for analytic thinking, logical evidence.	4. Here these lines are going in and they need to go out.	4. Correct identification of vertical lines as the incorrect part.

VAR 16

EXAMINER	RATIONALE	SUBJECT RESPONSE	INTERPRETATION OF RESPONSE
5. Show me here (points to blank space), with your finger how it must be.	Request for motor representation of what is needed.	5. (Traces correctly).	
6. How do you know the lines will have to go out?	Request for sources of evidence to support hypothesis.	6. Because this goes out (traces across missing part).	6. Tautological reasoning: It must go out because it does.
7. But why? Perhaps we should choose No. 5?		7. No, because these lines have to go in (indicates horizontal lines).	7. Use of two dimensions that must both be correct, but does not identify the source of the information.
8. Let me show you how you know. (Traces horizontal lines across top row, and then across bottom row). We look here at the top row. This will be the same below. These lines go in. From where do you know that the other lines must go out?	Models for the subject. Teaches how to identify and communicate sources of evidence. This can be a complex task to teach since many individuals do not feel compelled to support their statements with logical evidence. The need must be created.	8. Because these go out here (left column), so they will need to do the same here.	
9. Part of No. 2 is correct. Which part of No. 2 is good and which part is not good?	Elicit analytic perception, breaking the figure into its component parts and differentiating between correct and incorrect elements.	9. The lying down lines are OK, but the standing lines are going in and they should be going out.	
A-12			
1. This is the hardest one yet. We can work on it together. Look a long time at the part where something is missing. Then look for the right	This task requires (a) a very precise use of two sources of information; (b) great precision in the perception of size in order to overcome the misleading perception that the red spots are the same size, (c) establishing a relationship between the solid red spots and the convergence of the lines.	1. No. 4.	

VAR 17

EXAMINER	RATIONALE	SUBJECT RESPONSE	INTERPRETATION OF RESPONSE
answer. Compare each answer carefully with the figure. Be careful because there are several tricky places in this one.			
2. No. 4 is partially correct, but partially wrong.		2. No. 6.	
3. No. Look more closely at the place where the part is missing. (Points to empty space to indicate lines that converge).		3. No. 1.	3. Attended to the two sets of lines, but failed to include the red spot. A narrow mental field limits the number of pieces of information that can be processed simultaneously. There is a loss of previously acquired fragments when the focus of attention is shifted.
4. Let's look again. No. 4 is not good and No. 6 is not good. Point with your finger to the part in No. 4 that is not good and to the part in No. 6 that makes it not good.		4. (Points to the vertical lines in No. 4 and to the horizontal lines in No. 6).	
5. Look again and find one that is good.		5. No. 5.	
6. That's right. No. 1 was almost right, but what was missing?		6. It didn't have the solid red spot.	

APPENDIX G

A SAMPLE OF MEDIATIONAL PHRASES USED IN THE INTERVENTION CLASSES

Below is a small sample of the many questions and comments that can servie as good mediational phrases.

1) What do you need to do next?
2) Tell me how you did that.
3) What do you think would happen if __________?
4) When you have done something like this below?
5) How would you feel if __________?
6) Yes that's right, but how did you know it was right?
7) When is another time you need to __________?
8) Stop and look carefully at what you're doing.
9) What do you think the problem is?
10) Can you think of another way we could do this?
11) Why is this one better than that one?
12) Where have you done that before to help you solve a problem?
13) Let's make a plan so we don't miss anything.
14) How can you find out?
15) How is __________ different (like) __________?

APPENDIX H

FEBRUARY 21, 1990

DEAR ____________,

THERE ARE 60 FORMER AND CURRENT EMH STUDENTS ON THIS LIST WITH WHOM YOU HAVE WORKED. PLEASE GO THROUGH THE NAMES AND PLACE A NUMBER ONE (1) NEXT TO STUDENTS WHO IN YOUR OPINION ARE THE HIGHEST INTELLECTUALLY FUNCTIONING STUDENTS IN THE GROUP.

NEXT, GO THROUGH THE LIST AND PLACE A NUMBER THREE (3) NEXT TO THE STUDENTS WHO IN YOUR OPINION ARE THE LOWEST INTELELCTUALLY FUNCTIONNING STUDENTS IN THE GROUP. I WILL ASSIGN THE REMAINING STUDENTS A NUMBER TWO (2), EXAMPLES OF NEITHER THE LOWEST NOR THE HIGHEST FUNCTIONING EMH STUDENTS.

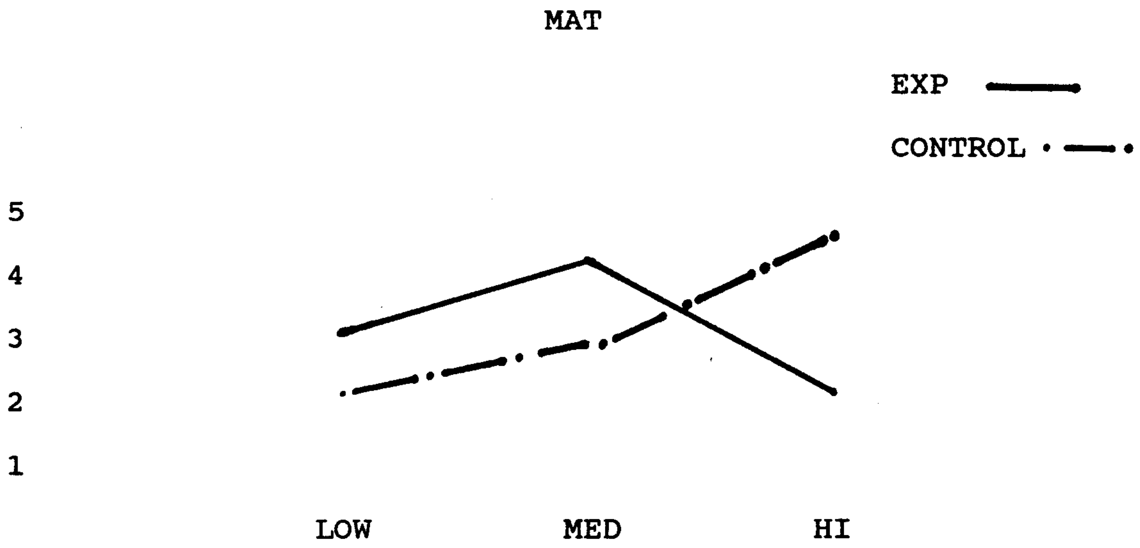
I AM COMPILING A TEACHER ESTIMATE OF THE COGNITIVE FUNCTIONING OF THE 60 STUDENTS INCLUDES IN MY RESEARCH. IT HAS BEEN FOUND TEACHER EVALUATION IS OFTEN MORE RELIABLE THAN OTHER, MORE STRUCTURED, FORMS OF EVALUATION.

THANK YOU AGAIN FOR YOUR HELP AND SUPPORT.

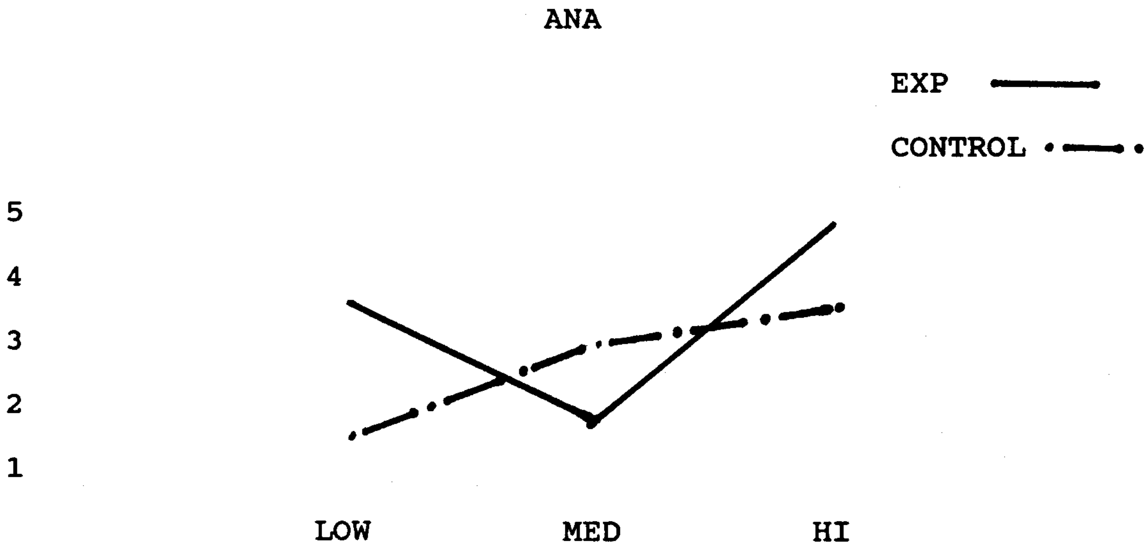
SINCERELY,______________________

APPENDIX I

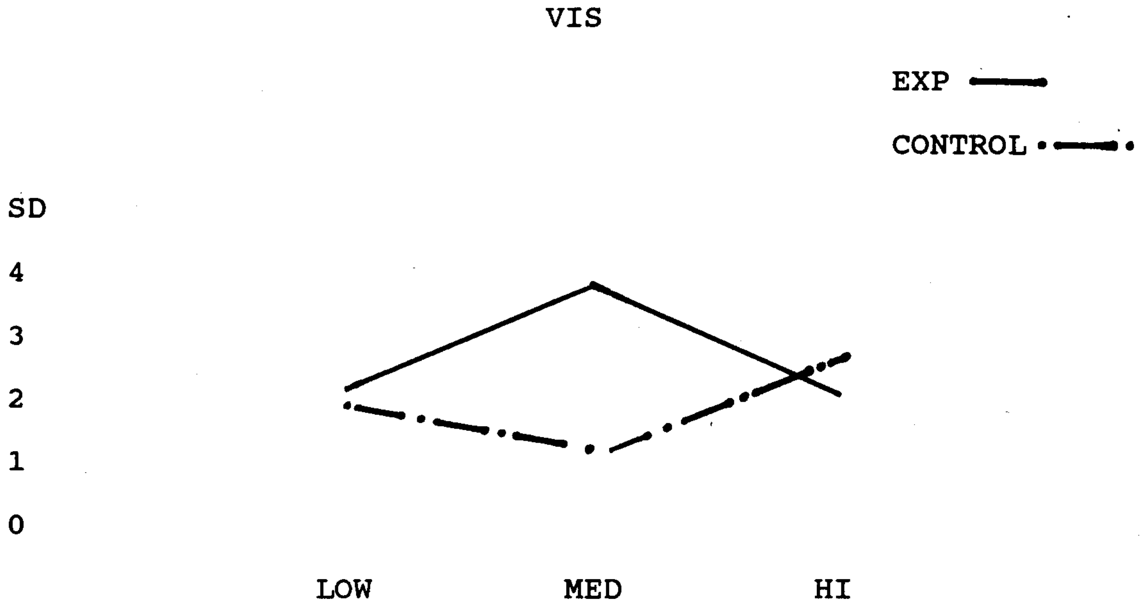
MAT STANDARD DEVIATION GAIN SCORES FOR EXPERIMENTAL AND CONTROL GROUPS BY INTELLIGENCE



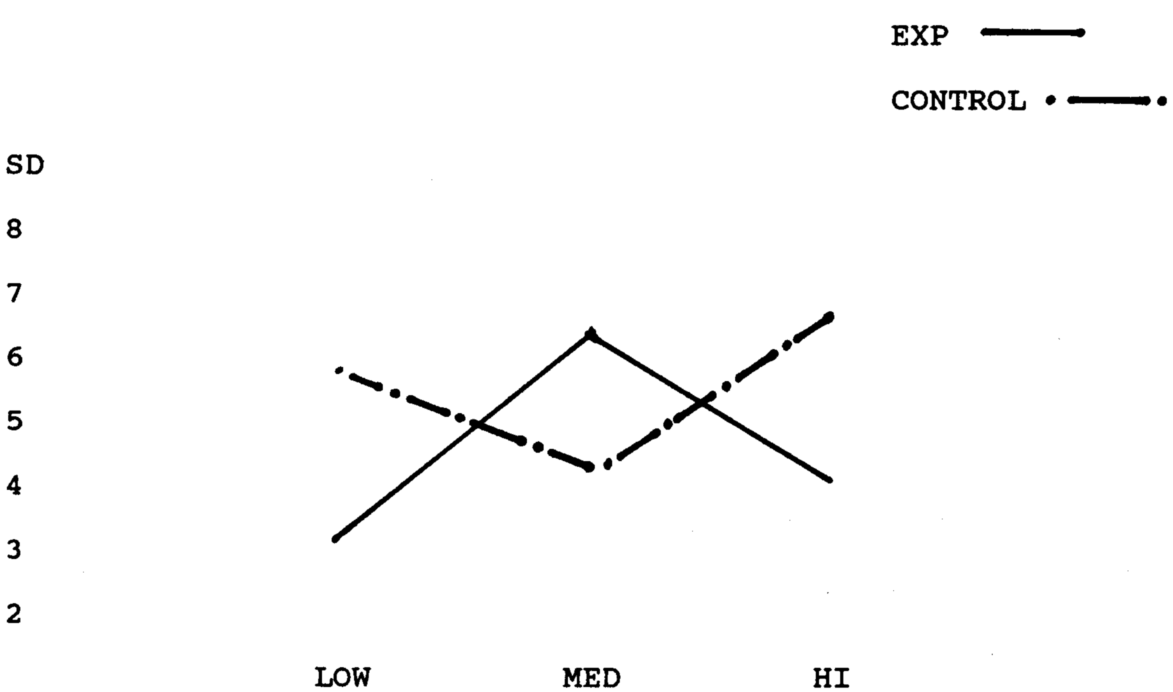
ANA STANDARD DEVIATION GAIN SCORES FOR EXPERIMENTAL AND CONTROL GROUPS BY INTELLIGENCE



VIS STANDARD DEVIATION GAIN SCORES FOR EXPERIMENTAL AND CONTROL GROUPS BY INTELLIGENCE



DES STANDARD DEVIATION GAIN SCORES FOR EXPERIMENTAL AND CONTROL GROUPS BY INTELLIGENCE



APPENDIX J

Comparisons of Means and Intelligence on Pretest and Posttest Dependent Variables

Dependent Measure	Intelligence					
	Low		Med		High	
	Exp	Con	Exp	Con	Exp	Con
MAT						
Pre	9.58	10.25	10.78	9.00	11.89	9.50
Post	11.25	10.44	10.50	8.67	16.11	10.38
ANA						
Pre	13.25	13.50	14.44	10.00	14.11	15.38
Post	15.08	13.11	14.25	12.33	16.78	16.38
VIS						
Pre	17.42	17.13	18.89	20.33	19.11	21.38
Post	19.00	17.11	18.75	20.33	21.67	21.13
DES						
Pre	10.08	13.13	9.22	5.0	14.11	12.38
Post	13.00	15.78	16.88	11.33	21.11	16.13

APPROVAL SHEET

The dissertation submitted by Lynda Wait has been read and approved by the following committee:

Dr. Joy Rogers, Director
Professor, Counseling and Educational Psychology, Loyola

Dr. Patricia Heaston
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Dr. Ronald Morgan
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The final copies have been examined by the director of the dissertation and the signature which appears below verifies the fact that any necessary changes have been incorporated and that the dissertation is now given final approval by the Committee with reference to content and form.

The dissertation is therefore accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy.

April 12, 1990
Date

Joy Rogers
Director's Signature