THE EFFECTS OF STIMULUS ENHANCEMENT AND PROVIDED MEDIATORS ON PAIRED ASSOCIATE LEARNING IN LEARNING DISABLED AND EDUCABLE MENTALLY RETARDED CHILDREN

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CHAPTER I

INTRODUCTION

An important key to excellence in teaching is an understanding and acceptance of all children and their individual differences. Consequently, educators are making more provisions than ever before for pupils who deviate from the average. The trend to provide for individual differences is best illustrated through the efforts being made to open the doors of educational opportunity to those who deviate most, namely, our exceptional children. Increasing numbers of teachers now recognize the extremes by which students differ from one another either in their special abilities, or in their unusual limitations--physical, intellectual, social and emotional. In fact, many exceptional pupils vary so far from the average that even such programs, procedures, and materials do not provide adequately for their educational needs. Instead, they require special education services, ranging from a short period of time to a full school life, if they are to be supplied with suitable opportunities.

Equality of educational opportunity, Dunn (1963) believes, is achieved through enabling each student to develop at his pace and as nearly as possible, to the maximum of his potentialities. Therefore, the true meaning of equality of opportunity lies in diversified rather than similar school programs. Even with excellent opportunities, few students fully develop to the upper limits of their capabilities.

However, their chances of nearing such a goal are enhanced when varied teaching, curricula, and facilities are provided--geared to the level, capacity, limitations and characteristics of each individual child.

Many of the problems and issues concerning the validity of various educational methods and procedures for educating exceptional children (e.g. whether deaf children should be taught speech reading or the language of signs, whether blind children should be taught using one procedure or another, etc.) or of various administrative arrangements (e.g. the merits and disadvantages of educating deaf, blind and retarded children in day schools versus residential schools, etc.) stem from too simple a conception of the educational functioning of exceptional children. Dunn (1968), in calling into question the current relevance of much special education practice, argues for the need for developing both tests to measure a child's learning ability and techniques to determine whether special methods or materials will be required to teach him. This problem of methodology in educating exceptional children continues to the present day. And with the recent concerns regarding the justification and efficacy of special education philosophy, programs and practices (Dunn, 1968; Christopoulos and Renz, 1969; Dobson, Gamble and Roubinek, 1971; Glass, 1973), many identified Learning Disability and Educable Mentally Retarded children are spending the majority of their day in the regular, mainstream classroom. Many regular classroom teachers find themselves unprepared to meet the learning needs of these children and hence are in constant conference and consultation with special education teachers for some "helpful hints."

Of all the categories of exceptional children, Children with Learning Disabilities (LD) and Educable Mentally Retarded (EMR) Children

are the ones most often taught within the day school as opposed to residential schools, as well as evidencing a higher incidence rate. Oklahoma State Department of Education (Bulletin S.E. No. 9) reports that on the basis of national estimates about two to three per cent of the total school population are Educable Mentally Handicapped and about five per cent are Learning Disabled.

In 1968, the National Advisory Committee on Handicapped Children (NACHC) of the U. S. Office of Education presented a definition of specific learning disabilities which became part of Public Law 91-320, the Learning Disabilities Act of 1969. It states:

> Children with specific learning disabilities exhibit s disorder in one or more of the basic psychological processes involved in understanding or in using spoken or written language. These may be manifested in disorders of listening, thinking, talking, reading, writing, spelling, or arithmetic. They include conditions which have been referred to as perceptual handicaps, brain injury, minimal brain dysfunction, dyslexia, developmental aphasia, etc. The do <u>not</u> include learning problems which are due primarily to visual, hearing, or motor handicaps, to mental retardation, emotional disturbance, or to environmental disadvantages (USOE, 1968, p. 34).

Bateman (1964) points out that the learning disabled child's problem is not due to mental retardation, deafness, motor impairment, blindness, faulty instruction, etc. He is best described as "one who manifests an educationally significant discrepancy between his apparent capacity for language behavior and his actual level of language functioning" (p. 168). The author goes on to delineate three major subcategories, although not mutually exclusive of disabilities. The most frequent of all types of learning disabilities is a reading disability. Visual-motor integration problems have been noted often in conjunction with reading problems. The third subcategory is of verbal communication

disorders involving difficulties with the comprehensive or expression of spoken language. An attentional deficit was identified among learning disabled children by Anderson, Halcomb, and Doyle (1973) and Dykman, Ackerman, Clements and Peters (1971) describe an "attentional deficit syndrome" in learning disabled children.

Perhaps the learning disabled child's problem originates in the perceptual learning stage in which attention is essential. Samuels and Anderson (1973) assert that the difference between good and poor readers originates not at the stimulus-response association stage but at the perceptual learning stage. Since it was pointed out earlier that a reading disability was characteristic of the learning disabled (Bateman, 1964), this assertion of faulty perceptual learning among these individuals is feasible.

On the other hand, the difficulties of the educable mentally retarded children are more basic in their deficits. The American Association on Mental Deficiency (AAMD) has published a definition of mental retardation which has received wider acceptance than any other so far introduced: "Mental retardation refers to subaverage general intellectual functioning which originates during the developmental period and is associated with impairment in adaptive behavior (Haber, 1961, p. 3)."

One of their major handicaps is a deficiency in mediational ability. Stevenson (1972) indicates that mediational theorists regard a mediator as

> . . . a response or series of responses evoked by the external stimulus that intercede between the perception of the external stimulus and overt response . . . . In studies of verbal mediation, it is assumed that the external stimuli evoke the verbal mediator and that the

> stimuli produced by the mediator lead to or become associated with, the overt response (p.58).

Thus the ability to spontaneously generate a verbal mediator or verbal link is seen as an integral aspect of the verbal learning process.

The inability among the mentally retarded to facilitate the acquisition of new associations has theoretical (Reese, 1962) and empirical support (Jensen and Rohwer, 1963a, 1963b). Attempts at mediation training provided a brief period of individual instruction in formulating linking sentences or phrases and the results of these experiments have resulted in little (Milgram, 1967, 1968) or no (MacMillan, 1970) facilitation of paired associate learning in children. In these experiments, there is no indication that the subjects actually generated their own mediational links nor any evidence that mediation was used by the subjects.

How to teach these exceptional children is a problem that must be considered by all professional educators--special education teachers and regular education teachers alike--as they attempt to maximize the learning of every student. A better understanding of the learning characteristics of these special students would facilitate the instructional process. Toward this end, several research questions are relevant. "Are the reported learning characteristics of each group idiosyncratic of that particular group or are they present in some degree across the two exceptionality categories?","Is it possible to compensate for the reported deficiencies such that performance on a specific learning task is increased?","Does the special students' learning, under compensated tasks conditions, show a certain preference for materials differing in a concreteness-abstractness dimension?", and

"Is recognition memory a significant factor related to certain types of learning such as Paired Associate Learning and Reading?"

Statement of the Problem

The majority of articles and studies on educable mentally retarded children and children with learning disabilities have indicated basic deficiencies that interfere with relatively successful school performance. For the mentally retarded child, a deficiency in mediational ability is cited, while perceptual learning disorders characterize the learning disabled child. These characteristics of the EMR and LD child give clues as to the possible educational training and compensations that may be successful in aiding their learning. No research was found that examined the effects of compensating for the deficits exhibited by identified LD students on a task such as the Paired Associate Learning (PAL) task. Furthermore, research conducted with EMR subjects and verbal mediation (Milgram, 1967, 1968; MacMillan, 1970) yielded inconclusive findings.

The problem that this study is concerned with focuses on the following questions: If we can help these special education children compensate for their weaknesses, either by internal or external means, will this increase their learning ability? Are these children's learning skills affected by a concreteness-abstractness characteristic of the learning task?

Theoretical Approach to the Problem

The theoretical underpinning for this study is the thinking of Allan Paivio (1971) in the area of imagery and verbal processes. Paivio defines imagery as "nonverbal memory representations of concrete objects and events, or nonverbal modes of thought (e.g., imagination) in which such representations are actively generated and manipulated by the individual" (p. 8). Verbal symbolic processes involve implicit activity in an auditory-motor speech system. Paivio views image and verbal processes as alternative coding systems, or modes of symbolic representation which are linked, over time and experience, with concrete objects and events as well as with language. At any given instance, the images or verbal processes may be aroused in the sense that an object or event is represented in memory as a perceptual image and a word as a perceptual-motor trace, or they may be jointly aroused as, for example, an object elicits its verbal label (or image of other objects) and a word similarly arouses verbal associates or image of objects. In addition, it is assumed that sequences of symbolic transformations can occur involving either words or images, or both, and that these can serve a mediational function in perception, verbal learning, memory and language.

Theoretically, the arousal and mediational functions of both processes, especially of images, are related to an abstract-concrete dimension of stimulus meaning of task characteristics. The more concrete or "thing-like" the stimulus, the more likely it will evoke memory images. These evoked images can then be useful in mediating appropriate responses in that situation. Verbal processes are presumed

to be less dependent on concreteness for their arousal and use, hence they are relatively more useful as the task becomes more abstract. Restating, both symbolic modes are readily aroused and useful when the situation is relatively concrete but as the situation becomes more abstract, the verbal process will be favored.

The dimension of concreteness-abstractness is elaborated upon by Paivio (1971) using the definition of abstractness referring to the "directness with which the stimulus denotes particular objects or events" (p. 16). In relating the symbolic processes and the concrete-abstract dimension of stimulus attributes, task attributes and psychological functioning, Paivio argues that:

> . . . imagery develops as a symbolic capacity or mode of thought through the individual's perceptual-motor experiences with concrete objects and events, and remains particularly functional in dealing symbolically with the more concrete aspects of situations. Verbal processes develop through language experience, including associative experiences involving words and concrete objects, as in the act of reference, as well as through intraverbal associative experiences. Like imagery, verbal thought remains functional in coping with concrete situations but surpass imagery in its capacity to deal with abstract tasks requiring the integration and manipulation of spatially and temporally remote objects or events, or tasks involving abstract reasoning (p. 18).

This theoretical approach provides the rationale for examing performance on paired associate learning task with imagery level being manipulated. Perhaps learning disabled and educable mentally retarded children will demonstrate better facility with different imagery levels. Perhaps the effects of stimulus enhancement and/or provided mediators will interact with imagery levels.

Assumptions of the study

The following assumptions are necessary for this proposed study:

1. Both imagery and verbal symbolic processes can be aroused by the paired associate learning task.
2. The mediating sentences provided by fourth grade students are comprehensible by all subjects.
3. Special Education subjects were accurately diagnosed and placed.
4. Uncontrolled variables are randomly distributed.

Limitations of the Study

One limitation of the present study concerns the generalizability of the results. The special education subjects utilized in this study may or may not be similar to other special education students since the criteria for identification as learning disabled or educable mentally retarded may vary from state to state. However, for states adopting the NACHC definition of Learning Disabilities and the AAMD definition of Mental Retardation, the obtained results should be relevant.

No attempt was made to control for the amount of time spent in special class placement. However, the majority of special education classes were recently instituted, and function on a part-time basis.

Value of the Study

This study is believed to be of value and importance on the basis of its ability to accomplish the following objectives:

1. To provide additional information regarding the learning characteristics of learning disabled and educable mentally retarded children.
2. To provide additional information regarding the effect of compensating for various learning deficiencies characteristic of the two exceptional groups.
3. To provide additional information regarding the subjects' learning proficiency across the concrete-abstract dimension of stimulus and task attributes.
4. To provide additional information to aid both special class teachers and the regular classroom teachers in individualizing and correcting instruction based on learner strengths and weaknesses.
5. To provide further data on the efficacy of the paired-associate learning task as an index of learning ability.

CHAPTER II

SELECTED REVIEW OF RELATED LITERATURE

This chapter presents a review of selected articles pertinent to the major variables of this study: mediational deficiency in the educable mentally retarded; perceptual learning and attentional deficits in the learning disabled; imagery and sentence mediation in paired associate learning and stimulus recognition in paired associate learning.

Mediational Deficiency in the Educable, Mentally Retarded

Luria (1960) has suggested that mentally retarded children suffer from a mediation deficit. This suggestion is based on an analysis of the role of speech in the regulation of normal and abnormal behavior. Employing this hypothesis, Sanders, Ross and Heal (1965), compared normal and retarded subjects on reversal and nonreversal shift learning. These authors reasoned that if normal children with the aid of mediation learn a reversal shift faster than a nonreversal shift, then a retarded group with mediational deficits should solve the nonreversal shift faster. The results for the normals indicated that the reversal problem was found to be significantly easier than a nonreversal problem for the majority of the normal children past the age of six. On the other hand, there was no significant reversal-nonreversal difference for retardates. Nevertheless, Sanders, Ross and Heal state that their results are

consistent with the notion that the mentally retarded children's mediation deficit prevented them from learning the reversal faster than the nonreversal problem.

While it appears that the mediational processes were utilized by the normals in the Sanders et al. study, it is not quite so clear that the retardates were completely unable to use mediational processes. Penny, Seim and Peters (1968) utilized a three-stage, paired associates mediational task to study the mediational deficiency of mentally retarded children. In addition to studying this variable, the study examined mediation from a developmental point of view as well as the effect of varying lengths of anticipation intervals. It was thought that the longer anticipation interval would be more beneficial for retardates than for normals. One experimental paradigm used in studies of mediation utilize three lists of stimuli which are generally labelled A, B, and C. If the subject learns paired associates involving lists A and B, and then one involving B and C, mediation theory predicts that the subsequent learning of paired associates involving lists A and C will be facilitated due to the prior learning experience. Penny et al. (1968) in employing a AB-BC-AC paradigm obtained results indicating that mentally retarded children are mediationally deficient relative to normal children when a relatively short (six seconds) anticipation interval is employed during the mediation test. On the other hand, when the anticipation interval is lengthened (12 seconds) the retardates' mediation is facilitated whereas normals' mediation is detrimentally affected.

In another study of mediation, Berkson and Cantor (1960) advanced the following predictions: (a) the normal subject would learn lists of paired associates more quickly and with fewer errors than would the

retarded subjects; (b) both the retarded and normal subjects would be capable of mediation behavior; and (c) a difference in IQ level would not affect the degree of facilitation achieved through the mediation process. Utilizing the AB-BC-AC paradigm, the first prediction that normals would learn paired associates more efficiently than retardates was only partially confirmed. The results also show that both the normal and retarded mediation groups were significantly superior to the controls in speed and accuracy in learning the list, thus supporting the second prediction. The failure to obtain a significant interaction involving the intelligence groups and the experimental-control treatments indicates that there is no evidence in this experiment for a relationship between IQ and degree of facilitation associated with mediation. The implication of this finding for classroom teachers is that the teacher must train retarded pupils longer to reach a given level of verbal learning, but once that level is achieved, mediation based on such learning will occur in the same degree for retarded as well as normal children.

Borkowski and Johnson (1968) utilized the same three-stage chaining paradigm that Berkson and Cantor (1960) had employed and controlled for some methodological problems noted in the earlier study. The results indicated that the paired associate learning of retardates was inferior to controls when mediators were not made available. However, when mediating links were provided, retardates utilized these associations as well as normal mental age equivalents but not as efficiently as same chronological age subjects.

These results lend some support to the conclusion of Berkson and Cantor (1960) that the degree of facilitation associated with mediation

is not directly related to I.Q. However, significant differences were found in the mediational activity of retarded and chronological age control, a finding contrary to the earlier study.

Another study that has shown that some form of task-relevant verbalization facilitates discriminative or associative learning in the mentally retarded was conducted by Jensen and Rohwer (1963a). The purpose of this study was to determine the effect of verbal mediation on the retention of paired associates one week after the original learning. The experimental procedure of verbal mediation utilized the aural presentation of a short sentence which related the stimulus and response objects. Subjects were required to repeat the sentence while looking at the two objects together. Examples of the sentences employed were as follows (stimulus and response objects in capital) "The CUP wore GLASSES." "The BOAT is full of SCISSORS." "The BALL wore a WATCH." "The COMB is in the GLASS."

The experimental group (those receiving sentence mediators) and control (no sentence mediators) learned the six items paired associate task to a criterion of one errorless trial. Results indicated that the control group took almost five times as many trials to attain the criterion as the Experimental Group (16.3 trial compared to 3.5). However, retention by the Experimental Group, as measured by relearned paired-associated after an interval of one week, was not significantly superior to that of the Control Group.

The full extent of any facilitative effect of verbalization on learning would have a better chance of showing if the learning task were considerably more difficult than the one used in the Jensen and Rohwer (1963a) study. A more difficult learning task would be one

employing nouns differing in the degree of abstractness, and not limited to the concrete nouns employed by Jensen and Rohwer (1963a).

One further research conducted by Ross and Ross (1973) suggests that the educable mentally retarded child is capable of long term storage of mediational links and can effectively retrieve these links with a consequent improvement in retention of associative learning task. The mediational links utilized in this study are those that the retardate has formulated himself.

This section reviewed selected research in the area of mediation in mentally retarded individuals. The findings are equivocal, with researchers suggesting such deficits do exist, (Penny, Seim and Peters, 1968), and others (Berkson and Cantor, 1960; Borkowski and Johnson, 1968; Ross and Ross, 1973) indicated that these subjects have the ability to formulate mediational links. Also, researchers have demonstrated the facilitative effects of providing mediational links in paired associate learning (Jensen and Rohwer, 1963a), as well as indicating the need to evaluate such facilitation on more difficult learning tasks. Such findings are encouraging in that they would suggest that certain learning deficits of retarded individuals, if they do indeed exist, could be modified by providing the appropriate mediational supports.

Perceptual Learning and Attentional Deficits in Learning Disabled

As Bateman (1964) has pointed out the most frequent problem of learning disabled children is that of a reading disability and the closely related disability involving visual-perception problems.

Research utilizing poor readers as subjects will be reviewed in this section on learning disabilities, as well as the research available on attentional deficits among this population.

Samuels and Anderson (1973) point out that many beginning reading tasks such as learning letter names and letter sounds involve paired associate learning. Learning vocabulary words of the English language as well as foreign languages appear to be closely related to the paradigm of paired associate learning. Keppel (1968) indicates that one model explaining the paired associate task fractionates the association process into overt attention, perceptual learning, memory, mediation and response learning stages.

Failure to master a reading subskill that involves paired associates learning may be due to difficulty with one or more of the components in this multi-stage process. Samuels and Anderson (1973) attempt to determine the role of visual memory in associational learning as well as in poor readers. Three hypotheses were tested.

The first hypothesis was that on paired associate learning task, children with high scores on a visual recognition memory test would be superior to children with low scores. The second hypothesis was that good readers would be superior to poor readers in visual recognition memory. The third hypothesis was that there would be a difference between good and poor readers in the kinds of errors made on a visual memory task: good readers would make fewer errors than poor readers in recognizing previously seen stimuli, but there would be no difference between them in recognizing transformations of the previously seen stimuli. Results indicated that performance on the visual recognition memory test was significantly correlated with performance on the hard

paired associate task (transformed stimuli). This hard task required good focal attention and visual memory. It was also found that those who were superior in visual recognition memory were also superior at learning the hard paired associates. On tasks of visual memory the good readers were found to be significantly superior. These researchers contend that "this ability to recognize a previously seen stimulus, is what is important in paired associate learning and in many beginning reading tasks" (Samuels and Anderson, 1973, p. 160).

The research of Bernbach (1967) and Martin (1967) indicated that if a subject in a paired associate task could not recall the simulus as one seen before, the probability of a correct response was at the chance level.

Gibson (1969) has documented the developmental changes in strategies of attention and perceptual learning. Her theory emphasizes an active discovery of distinctive features rather than the passive absorption of stimulus information. She goes on to suggest that the discovery of distinctive features, achieved while looking for differences between objects, precedes and is perhaps necessary to the formation of adequate memory images.

This "active discovery of distinctive features" may account for the attentional deficits that are the most distinguishing characteristic of children with learning disabilities (Clements, 1966). These attention difficulties include distractibility and short attention span. Dykman, Ackerman, Clements and Peters (1971) have suggested that the effects of attentional deficits on learning's efficiency are detrimental although relatively little research has been focused on using experimental methodology to examine the problem.

Anderson, Halcomb and Doyle (1973) have developed a new methodological procedure for investigating attentional deficits. The subject is directed to respond to visual signals which occur randomly within a temporal sequence of visual events noted as a pattern of flashing lights. The procedure successfully differentiated between children with learning disabilities and normal control subjects. The learning disabled children made consistently fewer correct detections and more false alarms than the nondisabled. The learning disabled had more difficulty in attending to the task but they responded to extraneous and task irrelevant stimuli at a higher rate than the control subjects. These findings provide objective data to support the contention that children with learning disabilities are different from normals on the behavioral manifestations of the attention-distractibility dimension.

The research of Bartel, Grill and Bartel (1973) provides some support for the notion that memory and attention factors are possible explanations for the imputed language deficits to children with learning disabilities (Johnson and Myklebust, 1967, McCarthy and McCarthy 1969, Myers and Hammill 1969). While it is suggested by these learning disability experts that these children have deficits and disabilities in the language area, there is a dearth in the literature on precisely how children with learning disabilities handle specific language-related tasks.

Bartel et al. (1973) in using a free word association task with learning disabled children and normals, found that the imputed linguistic deficits of children with learning disabilities apparently do not stem from the possible delayed shift from syntactic (sequential) to paradigmatic (same form-class) responses as suggested by Samuels (1968).

The results of their study indicate that learning disabled children develop linguistic categorization strategies at approximately the same ages for normal children. The researchers cite memory and attentional factors as possible explanations for these findings.

The above selected research on learning disabled children points out the kinds of perceptual and attentional deficits characteristic of this population. Samuels and Anderson (1973) emphasize the necessity of word recognition memory in reading tasks. Gibson (1969) theorizes on the perceptual activity in the discovery of distinctive features. It may well be that this process characterizes the difficulties of the child with high distractibility and short attention span. If attention and memory are important in learning and perception is closely allied, it is necessary to alter the instructional process so that stimuli are distinctive enough to hold the attention of these children with learning disabilities.

Imagery and Sentence Mediation in Paired Associate Learning

It has long been known that human subjects routinely use their linguistic skills to facilitate learning and memory, but systematic investigation has occurred only recently. In studies where mediators were inferred from subjects' reports following learning, they have uniformly found a positive relation between reported use of mediators and performance in learning and recall situations. Mediation can fall into several categories such as the use of mnemonics, verbal associations, verbal elaborations and imaginal elaboration (Paivio, 1971). Both verbal elaboration and imaginal elaboration are of importance to

this current study.

Verbal elaboration involves the embedding of word pairs in sentence strings while imagined elaboration, probably the most complex strategy, involves the use of visual images to combine word pairs. Verbal mediation has been demonstrated to facilitate paired associate learning. As cited earlier, Jensen and Rohwer (1963a) provided sentence mediators to retarded adults and their resultant learning of the word pairs to the criterion of one errorless trial was almost five times faster than the control group receiving no mediation.

Jensen and Rohwer (1965) studied the effects of sentence mediators on paired associate learning for groups of subjects at several age levels. Paired associate learning was markedly facilitated by mediation instructions particularly in the age range from seven to thirteen. The mediators were formulated by each subject and were not repeated after the first study trial. Of further interest is the fact that instructions to use mediators tends to wipe out age differences in speed of learning from about eight years of age and above.

Levin, Davidson, Wolff and Criton (1973) compared induced imagery and sentence strategies in children's paired associate learning. Samples of second and fifth graders were asked to learn word-picture pairs under one of four instructional conditions: control, sentence generation, imagery generation or joint imagery-sentence generation. In the control condition, subjects were given regular study-test, paired associate instructions. For the imagery condition, the subject was told to "make up a picture in his head" of the two stimuli in each pair "doing something together." In the sentence condition, the subject was told to make up a one sentence story about the two stimuli in each pair

doing something together, saying it to himself. The imagery plus sentence condition requested the subjects to make up an interesting picture as in the imagery instructions followed by a story about the interaction as in the sentence instructions.

The results of the experiment indicate that in each grade the control group was statistically lower than each of the three strategy groups on paired associate performance. However, no significant differences among the various instructional strategies were detected in either grade.

In an experiment conducted by Taylor, Josberger, and Whitely (1973), elaboration instructions and verbalization were examined as factors facilitating recall in retarded children. These studies attempt to bridge the differential findings regarding the facilitation effects of elaborative strategies with educable mentally retarded. Two types of elaboration instructions were examined--mental images and sentences. The other factor of verbalization was manipulated allowing half the subjects to overtly verbalize their elaborations and the other half prohibited from doing so. The rationale for verbalization is the possibility that requiring children to overtly verbalize their elaborations may additionally provide a verbal elaboration (sentence) describing each image. Hence, if this is the case, their overt verbalization should produce relatively greater effects with imagery elaboration. The analysis of data revealed no significant differences between the four conditions. Also, overt verbalization was not found to significantly facilitate paired associate learning.

The selected research reported above comes from an area that has generated much research. All reported research on the effectiveness

of elaboration strategies indicate that they are quite facilitative in paired associate learning. The use of sentence mediators is as effective as imagery elaboration and Jensen and Rohwer (1963a) indicate that such mediational links improved retardates learning impressively.

Stimulus Recognition in Paired Associate Learning

Bernbach (1967) presents a study that relates the necessity for stimulus learning and recognition in paired associate learning. He says:

> First, an internal representation, or tag of the stimulus is placed in memory, and second, the association of the correct member of the response set is made to that tag . . . if the tag becomes unavailable, there will be no way to reach the association, and it will not be possible for a correct response to be made [except by chance] (p. 514).

The procedure presented subjects with a long, continuous string of consonant trigrams, each of which they had to identify as old or new. In addition to making this recognition response, subjects had to anticipate for each item which of the digits "1", "2", or "3" was assigned as the correct paired associate response.

It was found that if the subject did not recognize a paired associate stimulus as one seen before, the probability of a correct response was at the chance level regardless of how many times previously the subject had given the correct response.

Martin (1967) investigated the same relation between simulus recognition and paired associate learning and obtained the same general findings as Bernbach (1967). He argues that "regardless of the current status of an S-R association, the activation of that association, and hence the occurrence of the response event R, has as a necessary

antecedent recognition of the stimulus event S" (p. 500).

Samuels (1973) examined the effect of visual discrimination training on paired associate learning. Kindergartners were randomly assigned to one of three treatment groups. The experimental group got visual discrimination training forcing attention to certain distinctive features of certain letters. One control group received visual discrimination training on the same letters but attention was not drawn to their distinctive features. The second control group received no visual discrimination training. Analysis of the data provide strong support that training to note the distinctive features of a stimulus during perceptual learning facilitates the hook-up phase in a paired associate task. The experimental group learned significantly faster than either of the control groups. Control group one did not differ on the task from Control group two. The author states "that visual discrimination training that fails to focus attention on the dimensions of differences is little better than no visual training at all" (Samuels, 1973, p. 169).

In a study examining the effects of visual recognition memory, and PAL on reading achievement, Samuels and Anderson (1973) reported results indicating that children with high visual recognition memory scores were superior to those with low scores in a PAL task; that good readers were superior to poor readers in visual recognition memory; and that good readers make fewer errors than poor readers in recognizing previously seen stimuli.

These research articles emphasize the necessity for stimulus learning in order for paired associate learning (and presumably other forms of learning) to be carried out. Bernbach (1967) and Martin (1967) point out that unless one recognized the stimulus, the probability of a

correct response is at the chance level. Samuels (1973) demonstrated effect of drawing attention to the distinctive features of the stimulus as a necessity for paired associate learning. Furthermore, it is argued (Samuels and Anderson, 1973) that the difference between good readers and poor readers originate not at the stimulus-response association stage but at the perceptual learning stage.

The objective of this study was to examine the learning performance of LD and EMR students when certain compensations for their deficits were provided on a PAL task varying on a concreteness-abstractness dimension.

The following hypotheses were advanced:

1. For all treatment conditions and levels of imagery, children with Learning Disabilities (LD) will perform better than the Educable Mentally Retarded (EMR) children.
2. Levels of Imagery (I) will be a significant main effect with more High Imagery (H) word pairs learned than Moderate Imagery (M) word pairs; and more Moderate Imagery (M) word pairs learned than Low Imagery (L) word pairs.
3. Because the LD group is characterized as primarily having perceptual learning and attentional deficits,
   (a) Stimulus Enhancement (SE) treatment groups will perform significantly better than the Control (C) group on PAL.
   (b) SE treatment group will perform as well or slightly above the provided mediators (PM) group on PAL.
   (c) There will be no significant difference in Performance between the PM group and Control (C) group on PAL.

4. Because the EMR group is characterized as having a deficit in mediational ability,
   (a) Provided Mediators (PM) treatment group will perform significantly better than the Control (C) group on PAL.
   (b) Provided Mediators (PM) treatment group will perform significantly better than the Stimulus Enhancement (SE) group on PAL.
   (c) There will be no significant differences in performance between Stimulus Enhancement (SE) group and the Control (C) group on PAL.
5. For the LD and EMR groups, performance on PAL should vary directly with the ability to Recognize Stimuli (RS) or Recognize Mediators (RM).

CHAPTER III

METHOD AND PROCEDURE

Description of Sample

The dample for this study was obtained from several public school systems in Northcentral Oklahoma. Intermediate level (grades 4, 5, and 6) elementary school-aged boys who had been identified by qualified psychological examiners as either having learning disabilities or mental retardation served as subjects. The Oklahoma State Department of Education specified that only children with IQ's that fall within the range of approximately 50 to 75 were eligible for placement in an educable mentally retarded class. For learning disabilities placement, normal or potentially normal intelligence (IQ of 90 or above) must be demonstrated (Bulletin S.E. No. 9). Only those boys so identified and currently enrolled in special classes either full time or part time served as subjects for this study. A total of 108 students, 54 identified as Children with Learning Disabilities and 54 identified as Educable Mentally Retarded, constituted the experimental population. The mean I.Q. scores were 96.04 for the LD group and 70.60 for the EMR group.

Materials and Instruments

All subjects were presented with a 15-item paired associate (PD) list (see Appendix B). The PAL task, as described by Ross (1976) involves

> the presentation of a word or picture together with or immediately followed by a second word or picture. The child is required to learn to associate the two stimuli . . . . This task is quite similar to much of the rote learning found in school and real-life situations. Learning to name letters or to read combinations of letters (C-A-T = "cat"), memorizing multiplication facts (7 x 7 = 49), or even learning to associate names to faces of people can be construed as Paired Associate Learning. Indeed, the facility with which a child is able to learn Paired Associates in a laboratory experiment has been found to be a sensitive measure of learning ability and a good prediction of school achievement" (p. 25).

PA's of three levels of rated imagery according to the Paivio, Yuille and Madigan (1968) norms were randomly ordered and reordered for simultaneous visual and auditory presentation at a five-second rate. A standard study-trial, test-trial format was followed. In this study-test method, all of the S-R pairs are first presented, one pair at a time, followed by the recall or test trial, during which the stimulus terms alone are presented and the learner attempts to provide the correct response to each. Over a series of trials, the study and test phases are alternated, with the order of S-R pairs and stimulus terms varied from trial to trial. For this study three study-test trials were utilized.

Paired associate materials consisted of five high-image pairs, five moderate-image pairs, and five low-image pairs selected from the highest, lowest, and most moderately rated imagery according to the Paivio, Yuille, and Madigan (1968) norms. The five PA's selected at each level

fall within the 40 highest, 40 lowest, and 40 most moderately rated imagery (I) categories according to Paivio et al. norms. The mean imagery value of the 925 nouns rated by Paivio's subjects is 4.95 on a 7-point scale; where 1 and 7 respectively represent the low and high imagery values. The standard deviation for this list is 1.93. The 40 words lowest in imagery value do not exceed 2.77 in rated I, and this falls more than one SD below the mean. The 40 high imagery words have a rating greater than 6.70 or .89 SD's above the mean. The range for the 40 words of moderate imagery value is 4.80 to 5.13 and represent those words clustering closest to the mean I value. For the words comprising the PAL list for this study, the mean imagery values for low, moderate and high are 2.61, 5.04 and 6.78, respectively. The 15 paired associates were randomly formed. The total 30 words were preselected on the basis of "familiarity" or recognition ratings by fourth grade teachers and students (pilot study). After the word pairs were formed, the same fourth grade students were asked to "make up a simple sentence using both words" of the S-R bond. These sentences were then used as the sentence mediator in the mediation training condition. Obvious associations between words have been avoided (e.g. BABY-GIRL).

The three treatment levels utilized include a Stimulus Enhancement (SE) condition where the stimulus terms were highlighted by color, block letters and double underlines; Provided Mediators (PM) condition where subjects receive word pairs in a sentence context with the stimulus and response word underlined; Controls (C) received none of the above aids. For all treatment conditions the visual presentation, via slide projections, was accompanied with aural input with a synchronized tape

recorder.

A test booklet (see Appendix D) for each child was used so that each subject could indicate his responses in a response recognition fashion. He needed only to indicate his response by choosing (placing a check mark) one of four choices. The test booklet also contained either the stimulus or mediation recognition test dependent upon the treatment condition to which that subject was assigned.

Procedure

For the learning disabled group, 54 subjects were randomly assigned to one of the three treatment groups. Similarly the educable mentally retarded subjects were randomly assigned to one of the three treatment groups yielding a total of six groups with 18 subjects in each. All subjects were tested in small groups of 3-5 in isolated rooms within each school building. All testing was conducted by the same experimenter. A slide projector and tape recorder were used for visual and auditory presentation of paired associate items. The mixed-list paired associate was presented to each group of subjects at a five-second study-test trial rate. Subjects were carefully instructed to "Remember the words that go together" (see Appendix A for complete transcript of instructions). Following the instructions, a study-test trial example consisting of three pairs was administered, in order to insure familarity with the required procedure.

During test trials, stimulus items were presented in neutral form, that is without stimulus enhancement nor in the context of a sentence, and subjects had 10 seconds to respond by making a check mark next to the correct response word in the test booklet. A total of three study

and test trials constituted the PAL paradigm. Items were randomly rearranged from study trial to study trial to avoid serial effects. On test trials, stimulus terms were also rearranged from test trial to test trial to again avoid serial learning.

Following the three study-test trials, subjects were given either a stimulus recognition or mediator recognition task. The subjects were asked to indicate by check marks those stimuli, or mediators, which ever the case may be, that they remember from the study trials. Again, practice examples were given to insure familiarity with the required procedures. Distractors for the Stimulus Recognition test were selected from the Thorndike and Lorge (1944) teacher's word book. Distractors for the Mediator Recognition test were developed by the experimenter.

Statistics

A 2 x 3 x 3 repeated measures analysis of variance design was the statistical method employed to analyze the data collected, and to test hypotheses 1 through 4 as listed above, with appropriate post-hoc procedures to determine the nature of any significant main effects or interaction. The first factor represented two levels of special education categories--Learning Disabilities (LD) and Educable Mentally Retarded (EMR); the second represented the levels of word imagery--High (H), Moderate (M) and Low (L); and the third represented the three levels of treatment--Stimulus Enhancement (SE), Provided Mediators (PM) and Control (C). The dependent variable for this portion of the analysis is the number of correct measures summed across three test trials. All hypotheses were tested for significance at the .05 level of probability.

Hypothesis 5 was tested by examining the percentage of correct paired associate learning when the stimulus terms or sentence mediator is correctly recognized. The learning trend across trials of those correctly identified items was graphed and examined as well. In addition, interactions with imagery level was also examined.

CHAPTER IV

ANALYSIS OF RESULTS

The results of this experiment were analyzed by means of a 2 x 3 x 3 split plot analysis of variance design (Kirk, 1968). The between-subjects independent variables consisted of group (Learning Disabilities (LD) and Educable Mentally Retarded (EMR) and compensation conditions (stimulus enhancement (SE), provided mediators (PM) and control (C). The within-subjects independent variable was imagery (high (H), moderate (M), and low (L)). The dependent variable was the number of correct responses on the paired associate learning task summed across three test trials. The summary of this analysis of variance and the cell means are presented in Table I and Table II, respectively. The results will be discussed in terms of the hypotheses they test. Each hypothesis was tested for significance at the .05 level of probability.

Hypothesis 1: For all treatment conditions and levels of imagery, children with Learning Disabilities (LD) will perform better than the Educable Mentally Retarded (EMR) children. This hypothesis predicted a main effect for group with Learning Disabilities children scoring higher on the PAL task than Educable Mentally Retarded children. As Table I indicates, this main effect was found. ($F = 34.48$, $df = 1/102$, $p < .01$). Table II shows the means were in the predicted direction. Learning Disabled children scored significantly higher ($\bar{x} = 32.76$) than Educable Mentally Retarded children ($\bar{x} = 24.94$) thereby supporting the

first hypothesis.

TABLE I

SUMMARY OF THE ANALYSIS OF VARIANCE ON PAIRED ASSOCIATE LEARNING SCORES

Source	Degrees of Freedom	Mean Square	F
Group	1	549.64	34.48**
Compensation	2	317.27	19.90**
Group x Compensation	2	14.98	.94
Error (between)	102	15.94	
Imagery	2	263.30	90.79**
Imagery x Group	2	24.84	8.56**
Imagery x Compensation	4	9.75	3.36*
Imagery x Compensation x Group	4	2.42	.83
Error (within)	204	2.90	

* $p < .05$

** $p < .01$

TABLE II

PAIRED ASSOCIATE LEARNING MEANS FOR VARIOUS TREATMENT CONDITIONS

		Imagery Levels		
		High	Moderate	Low
LD	Stimulus Enhancement	11.78	10.67	9.61
	Provided Mediators	13.17	12.89	11.22
	Control	10.94	9.72	8.28
EMR	Stimulus Enhancement	10.11	6.61	5.67
	Provided Mediators	11.83	11.06	9.06
	Control	9.44	6.33	4.72

Hypothesis 2: Levels of Imagery (I) will be a significant main effect with more High Imagery (H) word pairs learned than Moderate Imagery (M) word pairs; and more Moderate Imagery (M) word pairs learned than Low Imagery (L) word pairs. This hypothesis predicted a main effect for Imagery levels which, as Table I indicates was found ($F = 90.79$, $df = 2/204$, $p < .01$). As Table III indicates, the PAL means of the imagery levels did conform significantly to the order predicted by Hypothesis 2. Also obtained were significant Imagery by Group and Imagery by Compensation interactions. An examination of the data indicates that the order predicted by this hypothesis was obtained, but the LD group displayed less variability in their scores across all

levels of imagery than the EMR group. Furthermore, groups receiving Provided Mediators performed better at all levels of imagery but this was not the case for the Stimulus Enhancement or Control groups.

TABLE III

NEWMAN-KEULS COMPARISON OF PAIRED ASSOCIATE LEARNING MEANS FOR IMAGERY LEVELS

	Imagery Levels		
	High	Moderate	Low
Paired Associate Learning Means	11.21_a	9.55_b	8.09_c

Note: Means having different letter subscripts differ significantly from each other at the .05 level of significance. That is, for all pair-wise comparisons, if the subscripts of the respective means are different, then they differ significantly from each other.

Hypothesis 3: Because the LD group is characterized as primarily having perceptual learning and attentional deficits: (a) Stimulus Enhancement (SE) treatment groups will perform significantly better than the Control (C) group on PAL; (b) SE treatment group will perform as well or slightly above the Provided Mediators (PM) group on PAL; and (c) There will be no significant difference in performance between the PM group and Control (C) group on PAL. This hypothesis predicts a group by compensation interaction, which as Table I indicates, was

not found ($\underline{F}$ = .94, $\underline{df}$ = 2/104, $\underline{p} > .05$). A Newman-Keuls post hoc comparison test was employed nonetheless, in order to explore the data in order to determine the reason for failing to obtain a significant interaction. An examination of Table IV indicates that for hypothesis 3a, no significant differences were observed between Learning Disabilities children who received Stimulus Enhancement (LD-SE) ($\bar{x}$ = 10.69) and Learning Disabilities children who received no compensation (LD-C) ($\bar{x}$ = 9.65), and, thus, this hypothesis was rejected. For hypothesis 3b, which predicted no significant differences between Learning Disabilities children who received Stimulus Enhancement (LD-SE) and Learning Disabilities children who received Provided Mediators (LD-PM), Table IV indicates that LD-SE ($\bar{x}$ = 10.69) and LD-PM ($\bar{x}$ = 12.42) do not differ significantly, thereby supporting hypothesis 3b. However, the direction anticipated, (i.e., LD-SE slightly above LD-PM) proved to be contrary to the obtained results. For hypothesis 3c, which predicted no significant differences between the Learning Disabilities children who received Provided Mediators (LD-PM) and Learning Disabilitiy children who received no compensation (LD-C), an examination of Table IV indicates that LD-PM ($\bar{x}$ = 12.42) and LD-C ($\bar{x}$ = 9.65) do not differ significantly, thereby supporting hypothesis 3c.

TABLE IV

NEWMAN-KEULS COMPARISON OF PAIRED ASSOCIATE LEARNING MEANS FOR THE GROUP COMPENSATION TREATMENT CONDITIONS

	Group Compensation Conditions					
	LD-SE	LD-PM	LD-C	EMR-SE	EMR-PM	EMR-C
Paired Associate Learning Means	10.69_{ab}	12.42_{a}	9.65_{abc}	7.46_{bc}	10.65_{ab}	6.83_{c}

Note: Means having different letter subscripts differ significantly from each other at the .05 level of significance.

Hypothesis 4: Because the EMR group is characterized as having a deficit in mediational ability: (a) Provided Mediators (PM) treatment group will perform significantly better than the Control (C) group on PAL; (b) PM treatment group will perform significantly better than the Stimulus Enhancement (SE) group on PAL; and (c) There will be no significant differences in performance between SE group and C group on PAL. This hypothesis predicts a group by compensation interaction which, as Table I indicates, was not found ($F = .94$, $df = 2/104$, $p > .05$). A Newman-Keuls post hoc comparison test was employed nonetheless, in order to explore the data in order to determine the reason for failing to obtain a significant interaction. An examination of Table IV indicates that for hypothesis 4a, which predicted that Educable Mentally Retarded children who received Provided

Mediators (EMR-PM) would perform significantly better than the Educable Mentally Retarded children who received no compensation (EMR-C), significant differences were obtained with EMR-PM group ($\bar{x}$ = 10.65) performing better than the EMR-C group ($\bar{x}$ = 6.83), thereby supporting the contention of hypothesis 4a. Hypothesis 4b predicted that the Educable Mentally Retarded children receiving Provided Mediators (EMR-PM) would perform significantly better than the Educable Mentally Retarded children receiving Stimulus Enhancement (EMR-SE) and an examination of Table IV indicates that EMR-PM group ($\bar{x}$ = 10.65) does not differ sufficiently from EMR-SE group ($\bar{x}$ = 7.46) to be considered significant, although the predicted tendency was observed. For hypothesis 4c, which predicted no significant differences between the Educable Mentally Retarded children who received Stimulus Enhancement (EMR-SE) and Educable Mentally Retarded children who received no compensation (EMR-C), an examination of Table IV indicates that EMR-SE ($\bar{x}$ = 7.46) and EMR-C ($\bar{x}$ = 6.83) do not differ significantly, thereby supporting hypothesis 4c.

A significant main effect was obtained for compensation conditions as can be seen in Table I ($\underline{F}$ = 19.90, $\underline{df}$ = 2/102, $\underline{p} < .01$). For this study, this fact is significant to the extent that it interacts with the other independent variables, rather than in isolation. In analyzing this factor, Table V indicates that significant comparisons across the levels of Stimulus Enhancement (SE), Provided Mediators (PM) and no compensation (C) with PM identified as significantly contributing to higher PAL performance.

TABLE V

NEWMAN-KEULS COMPARISON OF PAIRED ASSOCIATE LEARNING MEANS FOR COMPENSATION CONDITIONS

	Compensation Conditions		
	Stimulus Enhancement	Provided Mediators	Control
Paired Associate Learning Means	9.07_b	11.54_a	8.24_b

Note: Means having different letter subscripts differ significantly from each other at the .05 level of significance.

Although not predicted, two other interactions were found, one of which was a group by imagery interaction ($\underline{F} = 8.56$, $\underline{df} = 2/204$, $\underline{p} < .01$). An analysis of the simple main effects for this interaction are shown in Table VI. As indicated, there were significant differences in the imagery condition. An analysis of Table VII, as well as an analysis of Figure 1, indicates that for both the LD and EMR groups, no significant differences were obtained on the PAL when the imagery level was High (H). However, significant differences in the performance on the PAL were obtained when Moderate (M) and Low (L) Imagery (I) levels were analyzed with the LD group attaining higher scores. It can also be seen from Table VII and Figure 1 that the mean PAL scores for both LD and EMR groups decreased with a decrease in the imagery level.

TABLE VI

SUMMARY OF THE SIMPLE MAIN EFFECTS ANALYSIS
FOR GROUP BY IMAGERY INTERACTION

Source	df	MS	F
Group Within:			
High	1	60.75	8.38**
Moderate	1	258.23	35.62**
Low	1	280.33	38.67**
Within Groups	102	7.25	
Imagery Within:			
LD	2	70.12	24.18**
EMR	2	218.02	75.18**
Group x Imagery	2	24.84	8.57**
Imagery x Subjects Within Groups	204	2.90	

* $p < .05$

** $p < .01$

The most important implication of these results is that Hypothesis 1, that Learning Disability children will learn to perform better than Educable Mentally Retarded children, is true only for Moderate and Low levels of imagery. Apparently, EMR children can learn the PAL task as well as LD children when the imagery level is high, but not when the task is more abstract.

TABLE VII

NEWMAN-KEULS COMPARISON OF PAIRED ASSOCIATE LEARNING MEANS FOR GROUPS BY IMAGERY INTERACTION

		Groups	
		LD	EMR
Imagery Levels	High	11.96_a	10.46_a
	Moderate	11.09_a	8.00_b
	Low	9.70_a	6.48_b

Note: Means having different letter subscripts differ significantly from each other at the .05 level of significance.

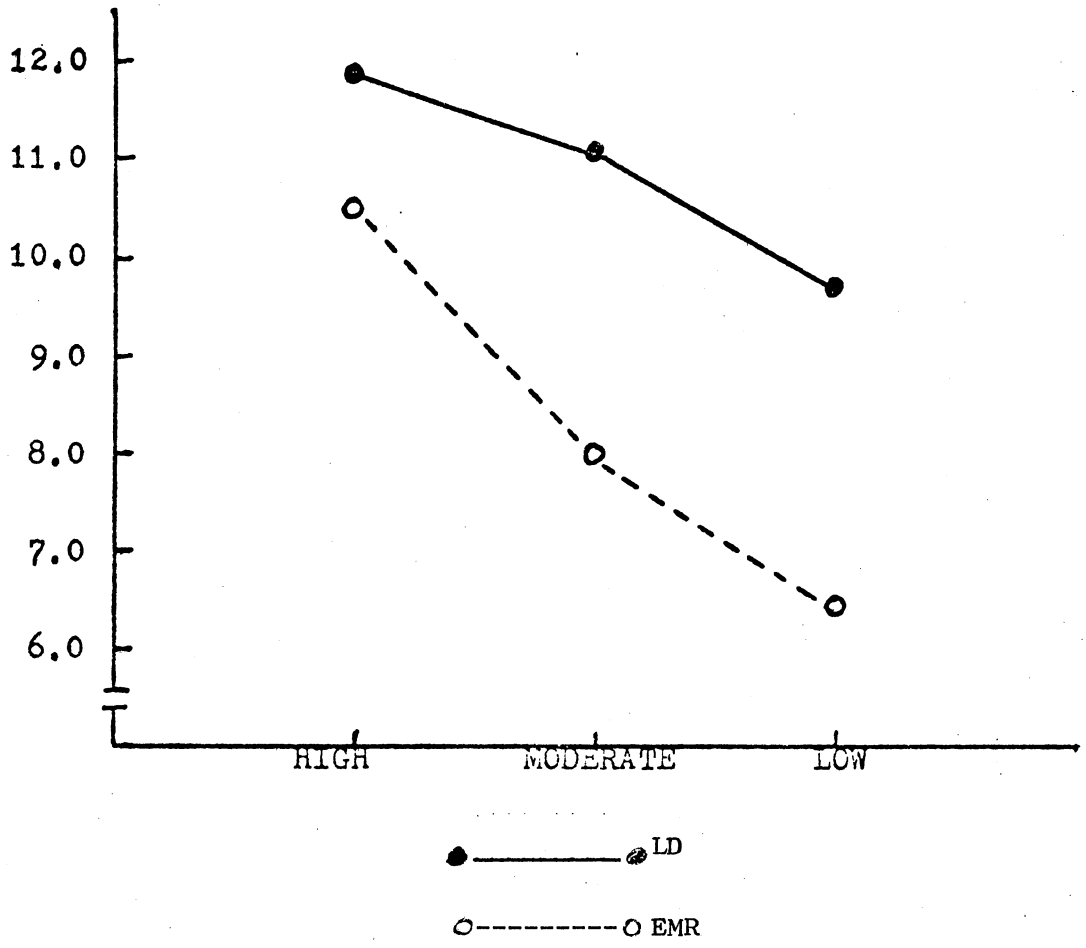

Figure 1. Paired Associate Learning Means as a Function of Group and Imagery Conditions

The second interaction was found between imagery levels and compensation conditions ($\underline{F} = 3.36$, $\underline{df} = 4/204$, $\underline{p} < .05$). An analysis of the simple main effects for this interaction are shown in Table VIII. As indicated, there were significant differences at all levels of imagery. An analysis of Table IX as well as an analysis of Figure 2 indicates that Stimulus Enhancement (SE) and Control (C) conditions yielded no significant differences in PAL for all levels of imagery. However, Provided Mediators (PM) condition displayed a significantly higher performance when compared to SE and C compensation conditions for Moderate and Low levels of imagery. For High imagery PM contributed significantly higher PAL performance than the C condition, but not when compared to groups receiving SE. It can also be seen from Table IX and Figure 2 that the mean PAL scores for all compensation conditions decreased directly with a decrease in the imagery level. It appears that providing a mediational link improved significantly the PAL performance when the task is of a less than concrete nature. The practice of highlighting or enhancing a task contributes only slightly, but not significantly to the overall level of performance on the PAL task.

TABLE VIII

SUMMARY OF THE SIMPLE MAIN EFFECTS ANALYSIS
FOR IMAGERY BY COMPENSATION CONDITION

Source	df	MS	F
Compensation Within			
High	2	49.79	6.87**
Moderate	2	162.26	22.38**
Low	2	124.73	17.20**
Within	102		
Imagery Within:			
Stimulus Enhancement	2	103.45	35.68**
Provided Mediators	2	55.29	19.06**
Control	2	124.06	42.78**
Imagery x Compensation	4	9.75	3.37*
Imagery x Subjects within Groups	204		

* $p < .05$

** $p < .01$

TABLE IX

NEWMAN-KEULS COMPARISON OF PAIRED ASSOCIATE LEARNING MEANS FOR IMAGERY BY COMPENSATION INTERACTION

		Compensation Conditions		
		SE	PM	C
Imagery Levels	High	10.94_{ab}	12.50_{a}	10.19_{b}
	Moderate	8.64_{b}	11.97_{a}	8.03_{b}
	Low	7.64_{b}	10.14_{a}	6.50_{b}

Note: Means having different letter subscripts differ significantly from each other at the .05 level of significance.

Hypothesis 5: For the LD and EMR groups, performance should vary directly with the ability to Recognize Stimuli (RS) or Recognize Mediators (RM). This hypothesis predicts that as the number of stimuli or mediators a child recognizes increases, so would the overall performance on the PAL task. A child who is able to recognize more stimuli or mediators should perform better than a child who recognizes a lesser amount. An analysis of Figure 3 indicates that such a trend was obtained. This figure further indicates the strength of providing mediational links, especially for the EMR group. According to the graphic representation, when an Educable Mentally Retarded child

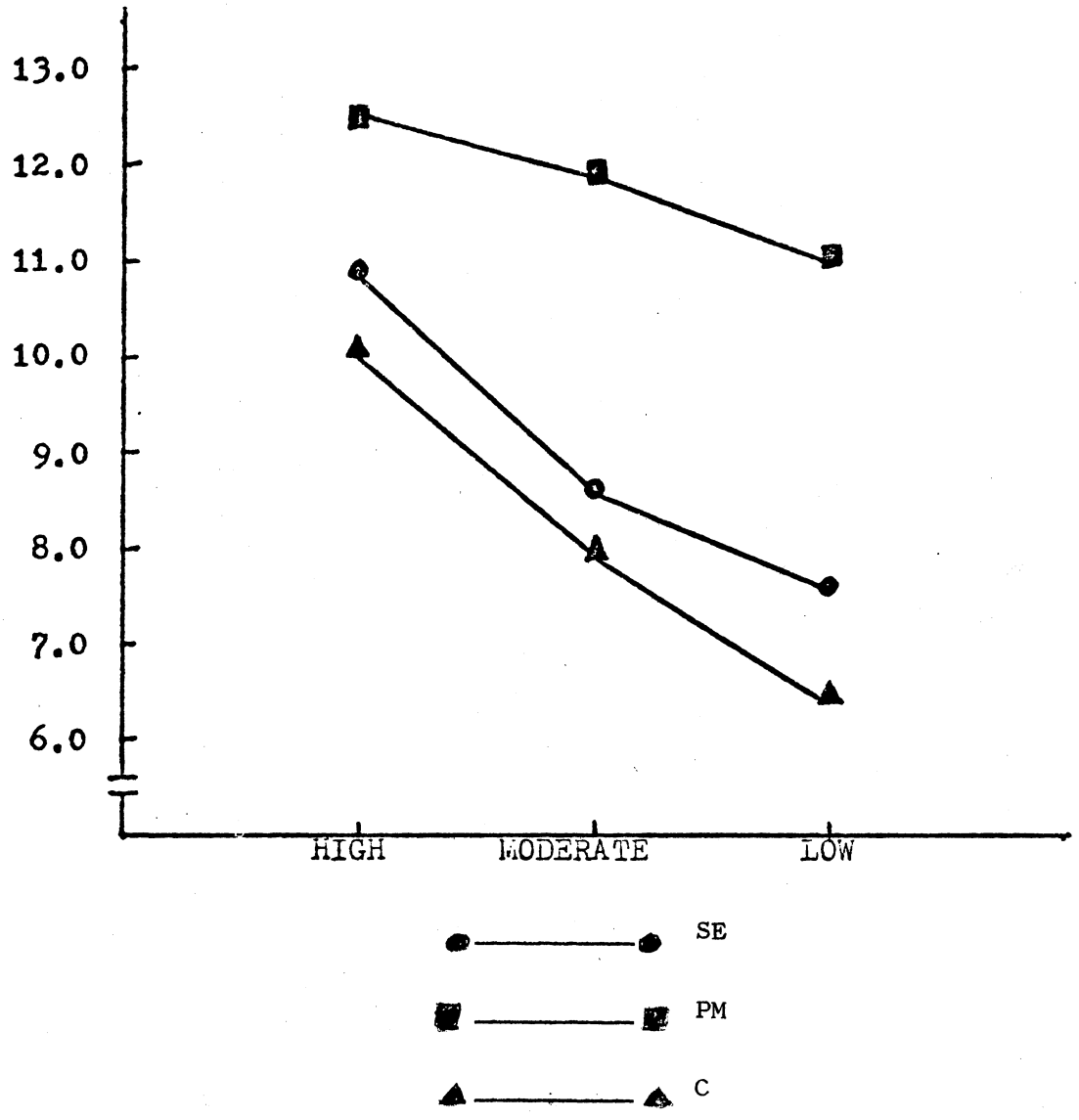

Figure 2. Paired Associate Learning Means as a Function of Imagery and Compensation Conditions

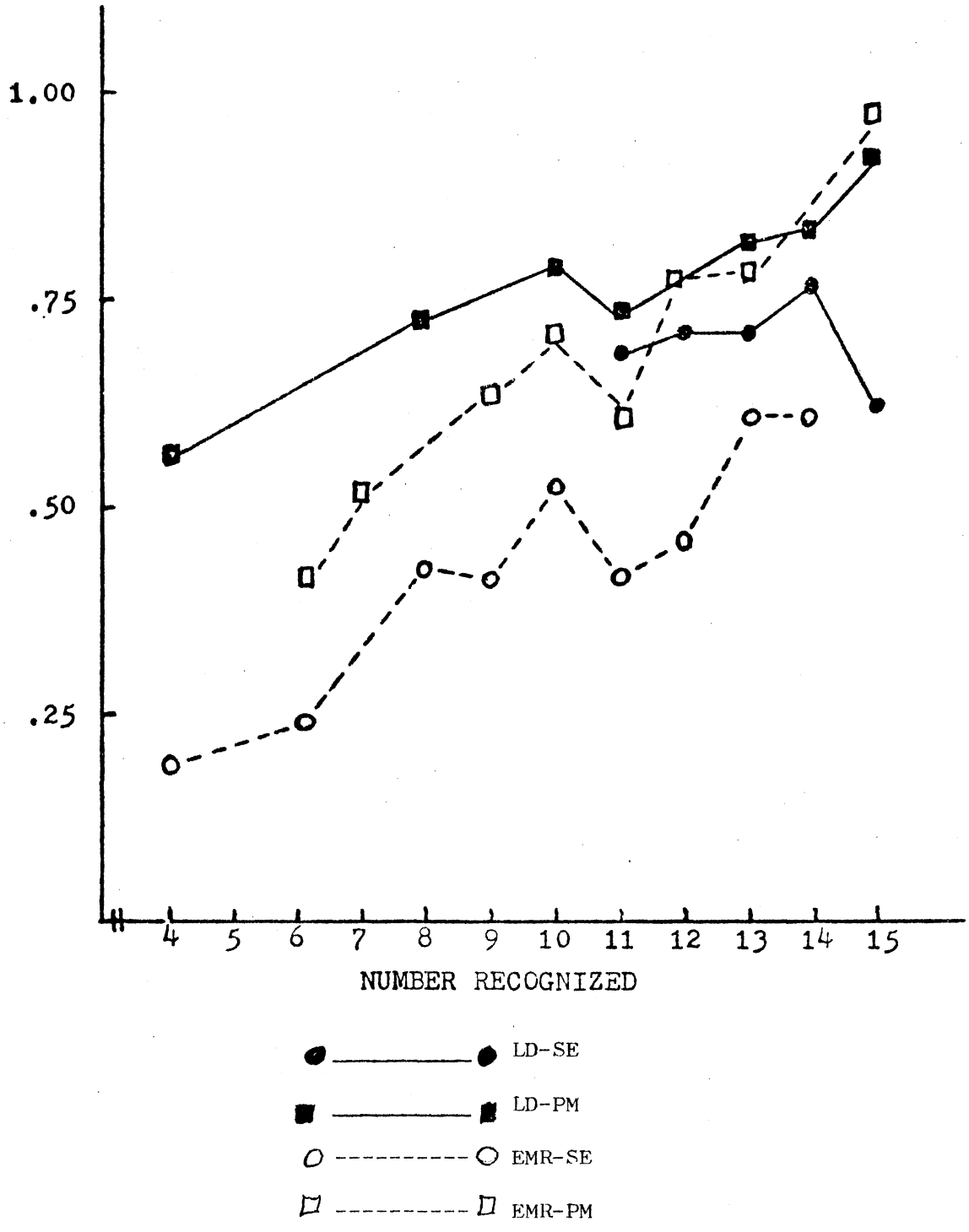

Figure 3. Per Cent Correct of Paired Associate Learning as a Function of Total Recognition Scores and Group Treatment Conditions

recognizes the mediators that were provided, he is then able to function as well as the child who is diagnosed as Learning Disabled on this particular PAL task.

CHAPTER V

DISCUSSION AND IMPLICATIONS

The major purpose of this investigation was to examine the effects of compensating conditions on a learning task for two types of special education categories. Furthermore, the attribute of concreteness-abstractness of the learning task was examined as to its influential nature. The theoretical position of Paivio (1970, 1971) and the empirical findings of Jensen and Rohwer (1963a, 1963b, 1965) Ross and Ross (1973), Bernach (1967) and Martin (1967), among others, were used to develop the hypotheses of concern. The present chapter presents a discussion of the findings, educational implications of the findings, and suggested directions for future research.

It was predicted in this study that Learning Disabled children would perform significantly better on a PAL task than Educable Mentally Retarded children. Furthermore, the imagery level characteristics of the PAL task would suggest that more word pairs rated as high in imagery would be learned than moderate-rated word pairs and more moderate work pairs learned than word pairs rated low in imagery. As indicated in Chapter IV, these predictions were borne out. Also, at all levels of imagery, the LD group displayed higher levels of performance than the EMR group . However, regardless of the compensation conditions, significant differences were not obtained between the LD and EMR groups when the PAL task was of a high level of imagery. It appears that for words

possessing a high degree of concreteness, these EMR children, who display a 26 I.Q. points deficiency, are able to utilize the same strategies in PAL so as to be as efficient as the LD child. For the more abstract type of PAL task, less success was observed. Hence, one can then deduce that the strategies needed to learn PA's that are moderate or low in imagery are not necessarily similar or identical to those employed when the PA's are of a concrete nature.

However, an examination of Table IX and Figure 2 indicate that if a strategy is provided, such as providing a mediational link, PAL is higher at all levels of imagery than if minimal (Stimulus Enhancement) or no (Control) assistance is given. This result supports the findings of Jensen and Rohwer (1963a) who observed that children receiving verbal remediation required one-fifth the number of trials to learn PA's to a criterion of one errorless trial, than children who received no verbal mediation assistance.

An extremely significant finding was obtained with respect to the EMR group's performance on PAL when compared to the LD group. Educable Mentally Retarded children have been shown to possess associational deficits in their thought processes (Berkson and Cantor, 1960; Borkowski and Johnson, 1968; and Penny, Seim, and Peters, 1968). However, when this associational deficit is compensated by providing mediational links, the EMR group does not differ significantly from the LD group regardless of the compensations they receive. Thus, the failure to obtain a significant interaction involving the intelligence group and compensation conditions indicates that there is no evidence in this experiment for a relationship between I.Q. and degree of facilitation associated with mediation. Furthermore, EMR children receiving

the mediational links utilized these associations as well as Learning Disabled children who are of same chronological ages, not just normal mental age equivalents as was found by Borkowski and Johnson (1968).

The practice of enhancing stimulus characteristics did not prove to significantly improve PAL performance for the LD population, refuting this study's predictions. Apparently, attention to distinctive features of stimuli is not a sufficient condition to increase PAL performance for the LD group. However, as Clements (1966), Gibson (1969), and Ross (1976) point out, discovery of distinctive features precedes and is perhaps necessary to the formation of adequate memory images. Figure 3 indicates that when an adequate memory image is recognized, it directly facilitates PAL beyond the chance level. As Bernach (1967) and Martin (1967) point out, unless one recognizes the stimulus, the probability of a correct response is at the chance level. As can be seen in this figure, a general trend of a direct relationship between stimulus or mediator recognition and PAL performance was obtained for both the LD and EMR groups. It can further be seen that the EMR group was quite similar to the LD group on PAL performance when recognition scores were similar.

Upon further examination of Figure 3, the LD group receiving Stimulus Enhancement displayed less variability in recognition scores than the LD group receiving mediational intervention. Thus, the effect of highlighting the stimuli resulted in more of the stimuli being recognized at a later time. This would be consistent with the notion that providing compensation for the perceptual and attentional deficit would result in better visual memory skills by contributing to greater PAL performance. And once a LD child can recall the stimulus, he can

then spontaneously generate his own strategies for this learning task.

An examination of Figures 4, 5, and 6, clearly indicate the general performance of a direct relationship between recognition scores and PAL performance when broken down into the various levels of imagery. As a child is able to recognize the stimulus or mediator, which were presented as a compensation for their deficits, it is clear that their learning is greatly facilitated. The strength of providing mediational links for the EMR children is dramatic when compared to the performance of the LD group for all levels of imagery.

It was found that enhancing the stimulus characteristics of the PA's did not significantly improve the learning performance of the Learning Disabled group when compared to groups receiving no compensations at all. It was anticipated that such an impact would be obtained, due to the reported deficits in perceptual and attentional skills for this population. The failure to obtain higher PAL performance under these conditions leads us to explore and examine several aspects. First, perhaps the enhancement of stimuli, such as capitalization of letters, color highlighting, and underlining was not sufficient to draw and hold one's attention as was assumed. Second, perhaps the intensity of the stimulus enhancement prevented the child from attending to the second word in the word pair, which was not enhanced in any manner, thus limiting the effects of their spontaneously generated mediational links. Third, it is quite possible that perceptual and attentional deficits are not the primary sources of difficulty for the Learning Disabled group. It appears from the obtained data that associational processes may also be listed among their weaknesses. And fourth, the problem of selective attention (Hagen and Hale, 1973) may

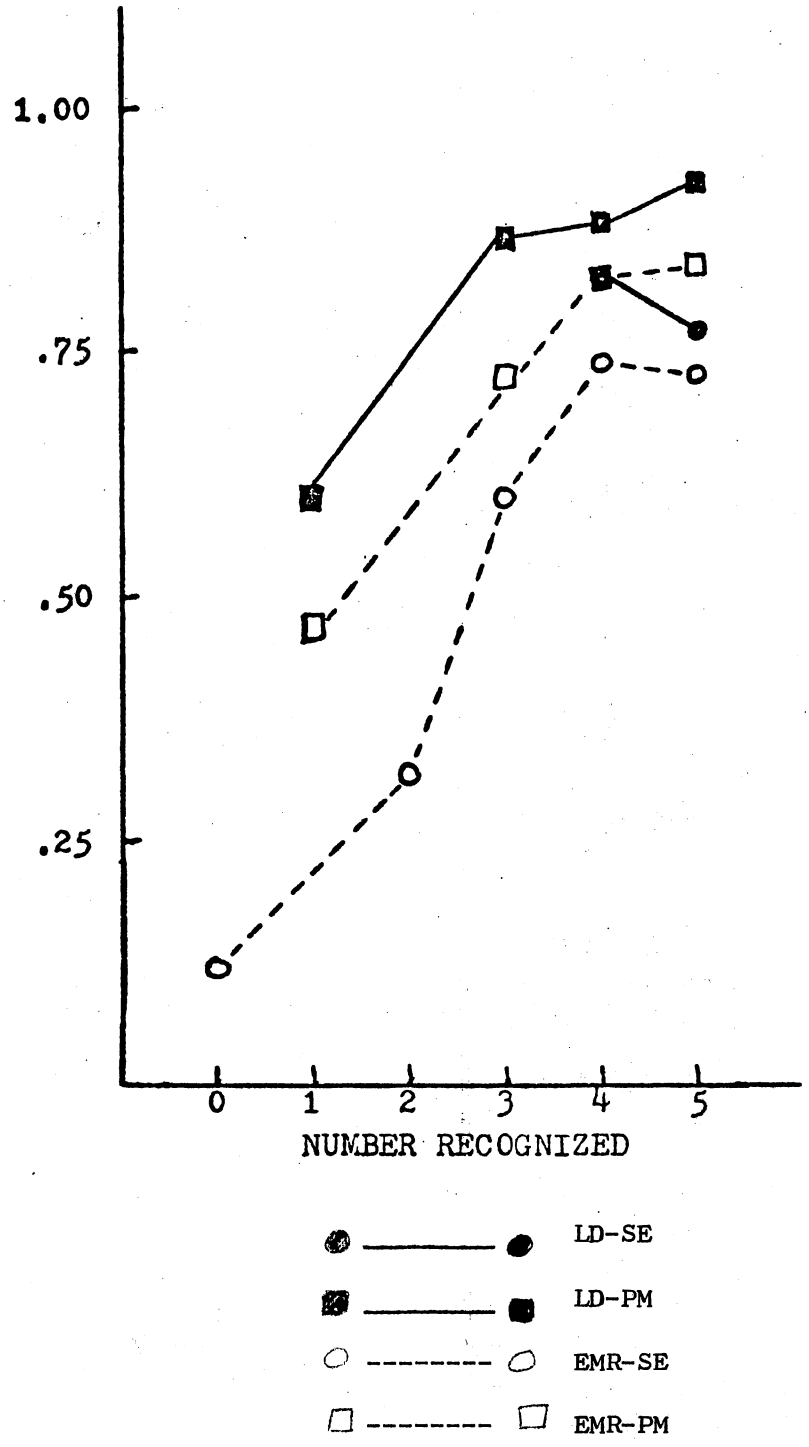

Figure 4. Per Cent Correct of Paired Associate Learning as a Function of Recognition Scores and Group Treatment Conditions for High Imagery Condition

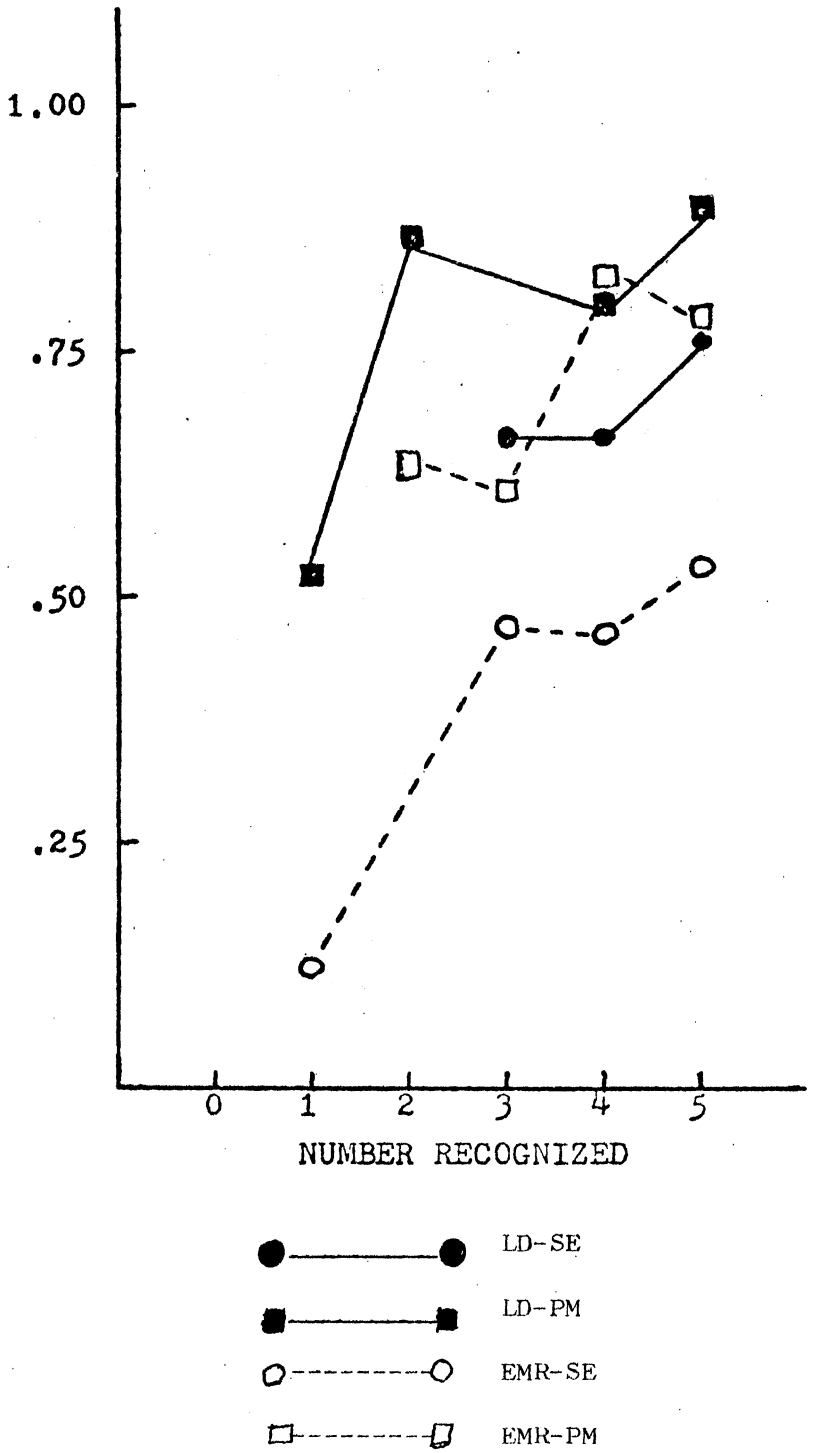

Figure 5. Per Cent Correct of Paired Associate Learning as a Function of Recognition Scores and Group Treatment Conditions for Moderate Imagery Condition

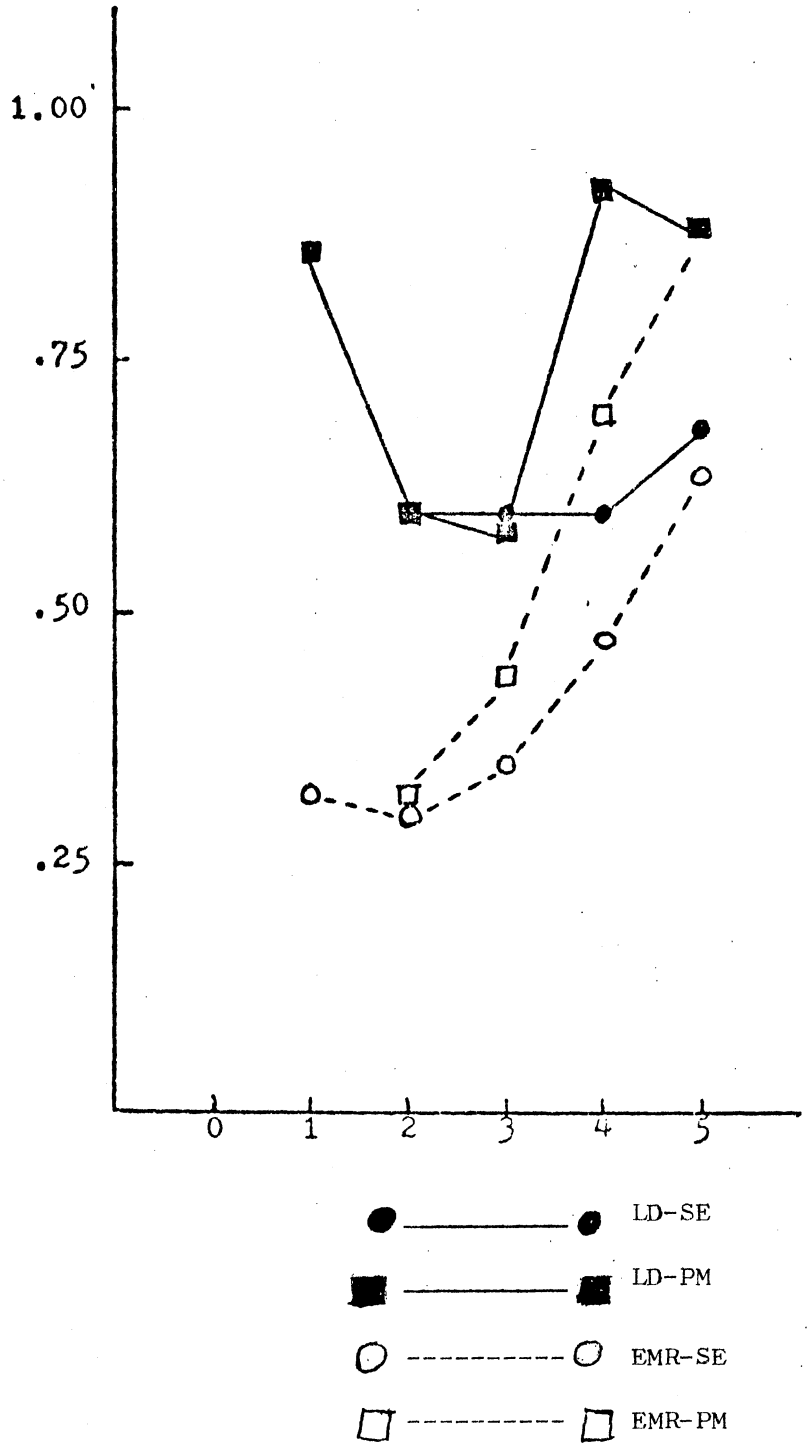

Figure 6. Per Cent Correct of Paired Associate Learning as a Function of Recognition Scores and Group Treatment Conditions for Low Imagery Condition

be interfering. Selective attention refers to the ability to attend selectively to the critical features of a stimulus and to ignore the unessential aspects and is an integral part of the learning process (Hagen and Hale, 1973). It appears that in compensating for attentional and perceptual deficits by enhancing the stimuli, selective attention problems may have arisen. Perhaps a new barrier was constructed in the attempt to overcome another.

It is quite apparent that Educable Mentally Retarded children possess deficits in their associational thought processes. The positive effect that providing mediational links has on their PA learning is apparent and is at a level of performance which is not significantly different from the Learning Disabled children who possess average intellectual capacities. This effect is true not only for the highly concrete type of learning task, but also for more abstract materials.

Educational Implications

The findings discussed in the last section suggest some implications for educational practice. It appears that the imagery level of materials to be learned has the potential for influencing the success of learning. For Educable Mentally Retarded children, material of a concrete nature is learned as readily as children of higher I.Q. scores. With the added assistance of compensating for their mediational deficits, these EMR children can function as well as LD children who are of the same chronological age. Clearly it is educationally sound to either provide mediational links or to train them in developing this strategy. It is possible to train EMR children (or any other child) in the formulation of mediational links. This can be done

through the use of subskill tasks of simple components, for example, one word, several words, a sentence, a sentence containing one specified word, or a sentence containing two specified words as suggested by Ross and Ross (1973).

The importance of recognizing a stimulus as one seen before has been demonstrated by this investigation. It is clear that stimulus recognition learning is a prerequisite to associational learning. Hence, if a classroom teacher can improve visual memory skills, she is then in a better position to teach more complex language activity, beyond rote memory learning. It is apparent from this investigation that both Learning Disabled and Educable Mentally Retarded children recognize either visually or aurally, or both, the words comprising this paired associate task.

The failure of enhancing stimuli to increase PAL performance suggests that such practices may, in fact, compound a problem by over-stimulating the already perceptually confused and attentionally impaired child. The problem of selective attention emerges as one tries to attract and capture a child's attention. It follows, then, that classroom environments, work sheets, assignments, and desks be relatively simple in their appearance so as not to interfere and compete for a child's attention and concentration.

It appears that the Paired Associates Learning task can be useful in testing and predicting learning proficiency. Rohwer (1971) indicates that the PAL task requires the acquisition and production of new information and skills, as well as requiring imaginative conceptual activity. Thus, a child can improve his performance by organizing the materials in terms of self-generated images, sentences, or categories.

In contrast, standardized achievement and intelligence tests require recall and application of knowledge and skills, and the use of formal conceptual activities such as the application of a well-defined set of rules. Rohwer also indicates that the PAL task is less influenced by ethnic and socio-economic status factors than are the standardized measures of achievement and intelligence.

Suggestions for Future Research

The findings of this investigation and their implications indicate areas for further investigation. A set of questions to examine revolve around the teaching of various strategies for learning new materials. Can children be taught how to generate and utilize mediational links on PA learning? Are other strategies such as pictorial elaboration and mnemonic devices as efficient in PA learning? Does this particular strategy influence other areas of learning besides PA learning? How facilitative of long term recall are these strategies? Will children spontaneously generalize this skill in other learning situations, and if so, are they efficient?

Another set of questions center around the use of the PA learning task as a measure of learning proficiency. Would children identified as Normal, Learning Disabled, Slow Learner, Educable Mentally Retarded, and Trainable Mentally Retarded by standardized tests, also be so identified by the PA learning task? If a child demonstrates learning proficiency as measured by PAL performance, would such be the case for academic instruction? Can it replace the standardized intelligence tests as an adequate measure of learning potential and predict school success?

A third set of inquiries relate to the ability to learn materials at various levels of abstraction. What mental activity in learners is required for efficient performance at various levels of imagery? What are the properties of the learning material that easily facilitate acquisition, retention, and retrieval? In what manner should this material be presented?

A further question related to the factor is sex. Females have performed higher than males on PAL tasks suggesting that one or more factors are influential. Do females more readily call upon mediational links, or are other strategies employed during PA learning? Are they more efficient in their use of these strategies?

Another question centers around the developmental trend of learning. Do mediation and other strategies follow a chronological pattern in development? If so, is this pattern of development fixed in sequence and time or can intervention bring about accelerated efficiency?

Given the results obtained in this investigation, is it justifiable to separate Educable Mentally Retarded children from Learning Disabled children if, indeed they can learn as effectively when the correct remediation and training is supplied? As more evidence is gathered concerning these special education categories, perhaps the practice of self-contained rooms for EMR and LD children will be reconsidered.

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APPENDIXES

APPENDIX A

INSTRUCTIONS READ TO SUBJECTS

Paired Associate Task

We are going to play a memory game called Which Word Goes With This Word. You will see on the screen and hear at the same time two words that go together. You will see and hear some words like this:

ALLIGATOR--CIGAR

HORSE--FIRE

HAMMER--OCEAN

You are asked to remember the words that belong together. After you see and hear all of the word pairs, you will see and hear the list again--but this time you will only hear the first word and you are asked to pick the second word from your booklet. Here is an example:

ALLIGATOR--CIGAR

HORSE--FIRE

HAMMER--OCEAM

After you see and hear all the words that go together, you will see and hear only the first word:

ALLIGATOR

Now look at your booklet at the words on line 1 and check the word that you think belongs or goes together with ALLIGATOR. (The same procedure for all the other example items will be used).

Don't be discouraged if you cannot remember any words at first. You will see and hear the words that go together three times. Here is the list:

Stimulus and Mediator Recognition Test

Now I will read some words to you. Some of them are words that you saw and heard in the game. If you think that you saw and heard the words (sentences) while playing the game of Which Word Goes With This Word, then put a check mark next to it. Listen carefully and follow me as I read the words (sentences) in your booklet.

APPENDIX B

PAIRED ASSOCIATE WORD LIST

PA Word List

truth-fact (L)	moment-excuse	baby-garden
kiss-strawberry (H)	leader-season	kiss-strawberry
prayer-robbery (M)	prayer-robbery	car-tree
chance-method (L)	hint-belief	sickness-fun
meeting-death (M)	car-tree	prayer-robbery
pleasure-present (M)	chance-method	star-cat
hint-belief (L)	pleasure-present	truth-fact
leader-season (M)	girl-frog	leader-season
girl-frog (H)	ability-answer	ability-answer
sickness-fun (M)	truth-fact	girl-grog
ability-answer (L)	kiss-strawberry	meeting-death
star-cat (H)	meeting-death	hint-belief
moment-excuse (L)	baby-garden	chance-method
car-tree (H)	sickness-fun	moment-excuse
baby-garden (H)	star-cat	pleasure-present

H - High Imagery

M - Moderate Imagery

L - Low Imagery

APPENDIX C

PAIRED ASSOCIATE SENTENCE MEDIATORS

PA SENTENCE MEDIATORS

The truth is a fact.

She gave a kiss to the strawberry.

A prayer saved him from a robbery.

He took a chance in using that method.

We had a meeting after his death.

It's a pleasure to get a present.

A hint might tell me about your belief.

He is the leader this season.

The girl was holding the frog.

The sickness at home is not fun.

She didn't have the ability to find the answer.

There was a star on the cat.

At that moment he gave his excuse.

The car ran into the tree.

The baby is playing in the garden.

APPENDIX D

PAIRED ASSOCIATE LEARNING TASK TEST BOOKLET

Name _____

Age _____

Group _____

School _____

IQ _____

Example Page

Directions: Put a check mark next to the right answer.

A. _____ Fire

_____ Cigar

_____ Ocean

B. _____ Cigar

_____ Ocean

_____ Fire

C. _____ Fire

_____ Cigar

_____ Ocean

Page 1. PART I

Directions: Put a check mark next to the right answer.

1. _____ Present

_____ Fact

_____ Fun

_____ Cat

---

2. _____ Strawberry

_____ Excuse

_____ Belief

_____ Tree

---

3. _____ Frog

_____ Cat

_____ Fact

_____ Robbery

---

4. _____ Strawberry

_____ Tree

_____ Method

_____ Robbery

---

5. _____ Garden

_____ Fact

_____ Present

_____ Death

Page 2.

6. _____ Excuse

_____ Present

_____ Fun

_____ Method

---

7. _____ Season

_____ Belief

_____ Present

_____ Answer

---

8. _____ Frog

_____ Death

_____ Season

_____ Strawberry

---

9. _____ Frog

_____ Tree

_____ Fun

_____ Robbery

---

10. _____ Answer

_____ Belief

_____ Fact

_____ Fun

Page 3.

11. _____ Method

_____ Cat

_____ Season

_____ Answer

---

12. _____ Answer

_____ Strawberry

_____ Cat

_____ Excuse

---

13. _____ Excuse

_____ Garden

_____ Present

_____ Death

---

14. _____ Cat

_____ Fun

_____ Tree

_____ Fact

---

15. _____ Answer

_____ Garden

_____ Roberry

_____ Season

Page 4. PART II

Directions: Put a check mark next to the right answer.

1. _____ Excuse

_____ Garden

_____ Present

_____ Death

---

2. _____ Frog

_____ Death

_____ Season

_____ Strawberry

---

3. _____ Frog

_____ Robbery

_____ Cat

_____ Fact

---

4. _____ Season

_____ Belief

_____ Present

_____ Answer

---

5. _____ Tree

_____ Cat

_____ Fun

_____ Fact

Page 5.

6. _____ Strawberry

_____ Tree

_____ Method

_____ Robbery

---

7. _____ Present

_____ Excuse

_____ Fun

_____ Method

---

8. _____ Season

_____ Death

_____ Frog

_____ Strawberry

---

9. _____ Method

_____ Cat

_____ Answer

_____ Season

---

10. _____ Present

_____ Fact

_____ Cat

_____ Fun

Page 6.

11. _____ Tree

_____ Belief

_____ Strawberry

_____ Excuse

---

12. _____ Death

_____ Fact

_____ Present

_____ Garden

---

13. _____ Answer

_____ Robbery

_____ Garden

_____ Season

---

14. _____ Fact

_____ Fun

_____ Answer

_____ Belief

---

15. _____ Strawberry

_____ Answer

_____ Excuse

_____ Cat

Page 7. PART III

Directions: Put a check mark next to the right answer.

1. _____ Season

_____ Robbery

_____ Garden

_____ Answer

---

2. _____ Excuse

_____ Strawberry

_____ Tree

_____ Belief

---

3. _____ Tree

_____ Cat

_____ Fun

_____ Fact

---

4. _____ Fact

_____ Belief

_____ Answer

_____ Fun

---

5. _____ Frog

_____ Fact

_____ Robbery

_____ Cat

Page 8.

6. _____ Cat

_____ Strawberry

_____ Answer

_____ Excuse

---

7. _____ Present

_____ Fact

_____ Cat

_____ Fun

---

8. _____ Strawberry

_____ Frog

_____ Death

_____ Season

---

9. _____ Method

_____ Season

_____ Answer

_____ Cat

---

10. _____ Tree

_____ Frog

_____ Robbery

_____ Fun

Page 9.

11. _____ Fact

_____ Garden

_____ Present

_____ Death

---

12. _____ Season

_____ Answer

_____ Belief

_____ Present

---

13. _____ Tree

_____ Strawberry

_____ Robbery

_____ Method

---

14. _____ Garden

_____ Excuse

_____ Death

_____ Present

---

15. _____ Present

_____ Fun

_____ Excuse

_____ Method

APPENDIX E

STIMULUS RECOGNITION TEST

Example Page

Directions: Put a check mark next to all the words that you remember seeing on the screen during the first part of the game.

_____ Knife

_____ Horse

_____ Hammer

_____ Hat

_____ Alligator

_____ Bicycle

Directions: Put a check mark next to all the words that you remember seeing on the screen during the first part of the game.

_____	Arm	_____	Girl
_____	Truth	_____	Rabbit
_____	Boy	_____	Fence
_____	Lady	_____	Finger
_____	Head	_____	Sickness
_____	Kiss	_____	Flower
_____	Prayer	_____	Gun
_____	Word	_____	Trip
_____	Number	_____	Ability
_____	Chance	_____	Race
_____	Farmer	_____	Bottle
_____	Grass	_____	Star
_____	Meeting	_____	Pig
_____	Chair	_____	Doctor
_____	Floor	_____	Lemon
_____	Pleasure	_____	Moment
_____	Rock	_____	Car
_____	Hint	_____	Train
_____	Sister	_____	Garbage
_____	Blood	_____	Bacy
_____	Leader	_____	Circus
_____	Bread	_____	Desk
_____	Rope		

APPENDIX F

MEDIATOR RECOGNITION TEST

Example Page

Directions: Put a check mark next to the sentence that belongs with the two words.

ALLIGATOR - CIGAR

_____ The _____ was by the _____.

_____ He threw the _____ in the _____.

_____ The _____ was smoking a _____.

HORSE - FIRE

_____ The _____ was smoking a _____.

_____ He threw the _____ in the _____.

_____ The _____ was by the _____.

HAMMER - OCEAN

_____ The _____ was by the _____.

_____ He threw the _____ in the _____.

_____ The _____ was smoking a _____.

Directions: Put a check mark next to the sentence that belongs with the two words.

TRUTH - FACT

_____ A _____ saved him from a _____.

_____ It's a _____ to get a _____.

_____ The _____ is a _____.

_____ There was a _____ on the _____.

KISS - STRAWBERRY

_____ She gave a _____ to the _____.

_____ The _____ ran into the _____.

_____ The _____ at home is not _____.

_____ She didn't have the _____ to find the _____.

PRAYER - ROBBERY

_____ At that _____ he gave his _____.

_____ It's a _____ to get a _____.

_____ We had a _____ after his _____.

_____ A _____ saved him from a _____

CHANCE - METHOD

_____ A _____ might tell me about your _____.

_____ There was a _____ on the _____.

_____ The _____ was holding a _____.

_____ He took a _____ in using that _____.

MEETING - DEATH

_____ She gave a _____ to the _____.

_____ We had a _____ after his _____.

_____ The _____ at home is not _____.

_____ He is the _____ this _____.

PLEASURE - PRESENT

_____ The _____ ran into the _____.

_____ The _____ is a _____.

_____ It's a _____ to get a _____.

_____ A _____ saved him from a _____.

HINT - BELIEF

_____ A _____ might tell me about your _____.

_____ The _____ at home is not _____.

_____ We had a _____ after his _____.

_____ She gave a _____ to the _____.

LEADER - SEASON

_____ The _____ was holding the _____.

_____ He took a _____ in using that _____.

_____ At that _____ he gave his _____.

_____ He is the _____ this _____.

GIRL - FROG

_____ The _____ ran into the _____.

_____ The _____ was holding the _____.

_____ She didn't have the _____ to find the _____.

_____ A _____ saved him from a _____.

SICKNESS - FUN

_____ The _____ is playing in the _____.

_____ There was a _____ on the _____.

_____ The _____ at home is not _____.

_____ The _____ was holding the _____.

ABILITY - ANSWER

_____ She didn't have the _____ to find the _____.

_____ He took a _____ in using that _____.

_____ He is the _____ this _____.

_____ A _____ might tell me about your _____.

STAR - CAT

_____ The _____ ran into the _____.

_____ There was a _____ on the _____.

_____ At that _____ he gave his _____.

_____ It's a _____ to get a _____.

MOMENT - EXCUSE

_____ At that _____ he gave his _____.

_____ The _____ is a _____.

_____ The _____ was hilding a _____.

_____ She gave a _____ to the _____.

CAR - TREE

_____ We had a _____ after his _____.

_____ A _____ saved him from a _____.

_____ A _____ might tell me about your _____.

_____ The _____ ran into the _____.

BABY - GARDEN

_____ She gave a _____ to the _____.

_____ He is the _____ this _____.

_____ The _____ is playing in the _____.

_____ The _____ at home is not _____.

VITA

William Wah Hing Lee

Candidate for the Degree of

Doctor of Education

Thesis: THE EFFECTS OF STIMULUS ENHANCEMENT AND PROVIDED MEDIATORS ON PAIRED ASSOCIATE LEARNING IN LEARNING DISABLED AND EDUCABLE MENTALLY RETARDED CHILDREN

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