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Teaching Skill Generalization: Metacognitive and Mnemonic Training of Educable Mentally Retarded Children

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Teaching Skill Generalization: Metacognitive and Mnemonic Training of Educable Mentally Retarded Children

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A Thesis Presented to the Graduate Faculty of the Fort Hays State University in Partial Fulfillment of the Requirements for the Degree of Master of Science

by

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ABSTRACT

Although previous research has shown that EMR children can be trained to use mnemonic techniques, they are unable to spontaneously transfer this training to dissimilar tasks. In the present study, 18 EMR children were divided into two equal groups. The IM group was trained to use a mnemonic/metacognitive strategy for a PA task, and the C group received no training. After training, both groups were tested for their recall of PA (Maintenance), MA (Near Generalization), and FR (Far Generalization) items immediately after training (Immediate Test) and two weeks later (Delayed Test). The IM group recalled significantly more and studied longer for the Maintenance and Near Generalization tasks, but neither group performed differently on the Far Generalization task. Neither group's performance or study times changed significantly between the Immediate and Delayed tests. The IM group used the trained strategy for Maintenance and Near Generalization tasks, but they tended to discard the use of the strategy for the Far Generalization task. However, it was noted that two IM Ss demonstrated Far Generalization and used the strategy for all tasks. The implications of this study for educational applications and future research considerations were discussed.
INTRODUCTION

There has been considerable effort extended in the investigation of the nature, extent and causes of the poor performance of the mentally retarded on memory tasks. Although the mentally retarded have been successfully trained to use mnemonic strategies, they are unable to spontaneously transfer this training to dissimilar tasks. Researchers have recently begun to train the mentally retarded metacognitive skills in conjunction with mnemonic skills with positive results. The nature of memory, mnemonics, mnemonic training, skill maintenance, skill generalization and metamnemonic training as they relate to the mentally retarded will be discussed in the following sections.

The Memory of the Mentally Retarded

According to Goulet (1968), there are two basic types of mental retardation research. One form of research strategy is designed to identify the existence or nature of the learning deficit in the mentally retarded by comparing them to a non-retarded population. Variables such as maturation or intelligence are typically matched. Inherent problems due to the nature of this design include the difficulties of insuring that the task measures the same psychological process for both groups and the problems of measurement of differing abilities. The second major research design uses a retarded population with the objective of comprehending their behavior independent of a nonretarded reference group. Designs may investigate comparable mentally retarded groups performing under different experimental
conditions or they may use identical experimental conditions while manipulating retarded groups differing in MA, CA, or IQ. Most researchers agree that the memory of the mentally retarded is not structurally deficient, but that a deficit in memory production is present (Borkowski and Wanschura, 1974; Brown, 1974; Brown, Campione, Bray and Wilcox, 1973; Butterfield, Wambold, and Belmont, 1973; Campione and Brown, 1977; Hagen and Stanovich, 1977; MacMillan, 1970; Turnbull, 1974; Turnure, Buium, and Thurlow, 1976). A critical distinction between production and structural deficits is evident in the responsivity of these types of deficits to training. Structural deficits, by their nature, are not amenable to training, whereas production deficits are responsive to training. Therefore, if a response to training procedures can be shown, a production (rather than structural) deficit can be shown to have been in effect. However, the effectiveness of the training procedure as well as the quality of the experimental design are also influential variables (e.g., if training does not result in improved performance; Campione et al., 1977).

Several studies support the production deficit hypothesis by demonstrating marked improvements in memory performance as the result of training (Campione et al., 1977; Turnbull, 1974). Although there is much empirical support for the operation of production deficits, there has been no clear evidence of structural deficits in retardate memory.

Nature of the Deficit

There is general agreement that retarded individuals do not perform as well as normals on memory tasks and that this is due to production
deficiencies. This had led to considerable research efforts to determine the exact nature of the shortcomings of the memory of the mentally retarded. The focus of research has been diffuse; many aspects of the memory processes have been investigated. Some researchers feel that the mentally retarded utilize inefficient acquisition strategies. Baumeister (1971) compared retarded individuals with normals and found that normals utilized active acquisition strategies in the areas of strategy selection (determined by the meaningfulness of the task materials, the amount of information to be learned, the choice of coding techniques, and the rate of information presented), code selection, form of information reduction, and response to feedback. The retarded subjects (Ss), however, adopted an inefficient passive acquisition strategy.

Butterfield et al., (1973) compared active and passive learning in both retarded and non-retarded Ss. They found that non-retarded adults adapt their use of active and passive learning strategies according to recall requirements. Retarded Ss and young children were found to persist in an acquisition strategy despite changing recall requirements. The persistent use of passive learning despite its ineffectiveness in many memory situations was characteristic of young children and the mentally retarded. Non-retarded adults were found to better utilize their active learning. There were differences noted in the length of rehearsal, rapidity of access to active memory stores, and recall accuracy. Retarded Ss tended not to rehearse, had low recall accuracy for the first items on the lists and gained access to their active memory stores less rapidly than non-retarded Ss.
Spitz (1973) demonstrated that retarded Ss have difficulty in utilizing and recognizing information-reducing variables in task materials. Their inability at input to spontaneously select, scan and organize information resulted in inefficient memory. Spitz reasoned that information stored in an organized manner is more likely to be retrieved successfully.

Other researchers feel that a rehearsal deficit is in effect (Brown, 1974; Brown et al., 1973; Butterfield et al., 1973; Ellis, 1970a; Hagen et al., 1977). The mildly retarded tend to not spontaneously rehearse (Butterfield et al., 1973; Hagen et al., 1977), but when they do it is improperly sequenced, and it is not coordinated with retrieval or acquisition processes (Butterfield et al., 1973). Similarly, although retarded individuals appear to possess the necessary structures for memory, it has been proposed that they tend not to use simple memory strategies in a spontaneous manner (Brown, 1974; Butterfield et al., 1973; Campione and Brown, 1978). Additionally, the developmentally young tend not to use mediational strategies spontaneously (Jensen and Rohwer, 1963b). Butterfield et al., (1973) found that although retarded adolescents can competently utilize all of the processes necessary for accurate recall, they cannot perform accurately unless they are trained in appropriate sequencing of the processes. They hypothesized that there is a transitiutional failure of executive control in effect. That is, while Ss may know a strategy, they may not always know when to employ it.

In support of this hypothesis, Brown (1974) found that retarded Ss' spontaneous use of strategic memory devices is deficient; that
they possess limited plans and strategies; and that the intent to use such strategies may be developmentally related. The notion of developmental lag was first introduced by Zigler (1969). Zigler felt that although retarded Ss have a normal sequence of development, it proceeds at a slower rate. Support for this has come from studies showing that retarded and nonretarded children of equal MA use the same cognitive strategies, or fail to use the same cognitive strategies, contrary to the ideas of specific cognitive defects (Hagen and Huntsman, 1971; Hagen et al., 1974).

Baumeister (1971) agreed with the developmental versus pathological condition hypothesis underlying the impaired memory performance of the mentally retarded. He urged the use of developmental terms when discussing mental retardation and claimed that verbal learning is of greatest relevance to the understanding of developmental retardation because the ability to acquire verbal associations is considered to be a major determinant of intelligent behavior. The developmental lag hypothesis has also received support from studies demonstrating that younger children are less efficient in using effective retrieval strategies than older children (Kobasigawa, 1977).

**Summary.** Research has provided evidence that has led to the rejection of the structural deficit hypothesis of memory in the mentally retarded. Retardate memory is seen as being impaired due to a production deficit. Retarded Ss were seen to rely upon passive rather than active learning systems, to have difficulty using information-reducing techniques, and to have a rehearsal deficit. The retarded tend not to use available memory techniques in a spontaneous or properly sequenced manner; it was suggested that their memory deficit is developmental in nature.
Mnemonics: A Brief Overview

There has been considerable interest in the use of mnemonic techniques in order to improve the memory performance in both retarded and nonretarded individuals. Hintzman (1978) defined mnemonics as "the process of learning through indirect associations." Mnemonic techniques include mental imagery, metrical mnemonics (rhymes, organization, spatial location), method of loci, attention to critical items, orthography, and a number of variations of these techniques (Spear, 1978). Mnemonic systems can reduce long, unrelated materials into manageable units by providing rules and methods to shorten the sequence to be learned as well as creating meaningfulness where there was none previously. According to Spear (1978), mnemonic systems function within the basic principles of efficient memorization: (1) because of the limited capacity of short term memory, small basic units of input material enhance memorization; (2) internal organization such as categories or chunks are needed due to difficulties in learning ordered relationships; (3) because well-incorporated associations aid memory search during retrieval, established relationships between already learned information and the material to be learned must exist (external organization); and, (4) depth of processing, e.g., the greater the extent of necessary treatment of the information to be remembered the harder it is to recall. Mnemonics appear to fulfill these basic requirements.

Weinstein (1978) stated that mnemonic skills can be used to re-code, transform, or encode presented material either by reducing the content ... or by elaborating the content, as in making a sentence
or integrated mental picture out of a noun pair. Therefore, there is a common conceptual base underlying research in mnemonics, elaboration, encoding, and mediation." Research has shown that learning efficiency can be increased through mnemonic training in a variety of populations (Weinstein, 1978). Some examples include: beginning readers (Ehri and Wilce, 1979); learning disabled children (Torgeson and Houck, 1980); advantaged and disadvantaged children (Pishkin and Rasmussen, 1977), normal fourth and fifth graders (Reese, 1977); institutionalized and non-institutionalized Ss (Jensen and Rohwer, 1963a; MacMillan, 1970; Milgram, 1967); and undergraduates (Krebs, Snowman, and Smith, 1978). Variables such as the degree of bizarre interaction (Crowder, 1976; Emmerich and Ackerman, 1979; Wollen, Weber and Lowry, 1972) and attempting to make the method of loci function like natural memory (Bellezza, Reddy, Goverdhan, 1978) have also been manipulated.

Theoretical Approaches to Mnemonics

While most researchers are able to agree that mnemonic techniques are effective memory aids, there are many different arguments proposing contrasting theoretical bases of mnemonics. The major theoretical points of view will be presented in a non-judgemental manner.

Historically, mnemonic training has been assumed to function because perception, thought and imagination have been assumed to be continuous experience modalities rather than separate components of functioning (Weinstein, 1978).

The Gestaltists theorized that, in the case of visual imagery, the visual image of interacting objects facilitates the formation of
a Gestalt. Other theorists explain the facilitative effect of visual imagery in terms of similarity effects. They propose that visual images are rarely confused because they are distinct from one another and therefore memory is facilitated because of this property of visual images (Hintzman, 1978).

The most attention has been given to the dual coding theory (Paivio, 1969; 1971; 1976). Paivio proposed that there are three levels of information processing: representational, referential, and associative. In the representational level of information processing, nonverbal stimuli activate imagery and linguistic stimuli activate verbal representation. The activation of established interrelationships between verbal representations and imagery gives rise to the referential level. This initiates a process whereby exchanges of verbal representation and imagery occur at an implicit level rather than in the form of overt responses.

Associations of verbal and imagery representations are activated at the associative level. Verbal stimuli elicit verbal responses and imaginal representations are evoked by nonverbal perceptual images through interconnections in an associative chain or an imaginal system, respectively. Essentially, two types of memory codes (verbal and visual) are involved. The verbal component is controlled by the left hemisphere and the visual component resides in the right hemisphere. The combination of two different memory codes leads to better recall because both hemispheres are involved. The use of mnemonics elicits the associative level of information processing.

Although some researchers agree that associative learning is involved in mnemonic techniques, their agreement with the dual coding
theory ends there. Hintzman (1978) theorized that associative learning is facilitated because the Ss form unitary and interacting representations. Swenson (1980) stated that mnemonic techniques deliberately associate new material with existing concepts. Associative techniques facilitate better retention and meaning is seen as a mediating factor which promotes fast learning.

In direct contrast with the dual coding theory, Anderson and Bower (1973) argued that there is a single semantic memory system that represents both verbal and visual material in an abstract code that is modality-free. However, Eysenck (1977) theorized that like the dual coding theory, information is processed imaginally and verbally. However, unlike Paivio, Eysenck theorized that this information is then placed into a central conceptual processing system. The products of this system are then consciously expressed in images and words.

Other theorists have placed more weight on memory encoding rather than storage. Olton (1969) hypothesized that although mnemonics influence the rate of the original learning, they do not substantially effect retention. However, Kail and Siegel (1977) theorized that the differences in initial encoding that are associated with the form of modality of the information presentation is not maintained in temporally consequent codes. While initial verbal or visual codes are stored in their particular formats, separate long term memory codes are relatively unaffected by the literal features of the initial perceptual code. Although the initial encoding may be primarily determined by the mode of presentation, it is usually only one of many attributes characterizing mnemonic coding.
Summary. Mnemonic training has been shown to be an effective memory aid for different populations. Mnemonic training has been hypothesized to work because it reduces and organizes the material to be learned, provides two access routes to memory storage which increases the probability of successful retrieval, and heightens the associative level of information processing.

Mnemonic Research Using Retarded Subjects

A considerable number of research efforts have explored the effectiveness of training the mentally retarded in mnemonic techniques. Most studies have demonstrated that mnemonic training does facilitate their memory performance (Borkowski and Kamfonik, 1972; Borkowski et al., 1974; Campione et al., 1977, 1978; Gordon and Baumeister, 1971; Jensen et al., 1963a; MacMillan, 1970; Milgram, 1967; Ross and Ross, 1973, 1978; Taylor, Josberger and Knowlton, 1972; Turnbull, 1974; Wanschura and Borkowski, 1974; Whitely and Taylor, 1973).

The mildly retarded are defined as those individuals whose IQ scores fall within the 50-75 range. They are also classified as the Educable Mentally Retarded (EMR) and the Educable Mentally Handicapped (EMH). For the purpose of brevity and to prevent confusion, the term EMR shall be used to describe the mildly retarded. EMRs have been found to be able to use verbal mediators (MacMillan, 1970), mediational chains (Borkowski et al., 1972), to benefit from instructions to mediate (Gordon et al., 1971), to generate elaborations (Taylor et al., 1972; Whitely et al., 1973), to be capable of long term benefits from mnemonic training (Ross et al., 1973, 1978), and to be easily trained (Campione et al., 1978).
When trained, EMRs can generate verbal elaborations or visual images (Campione et al., 1977; Taylor et al., 1972). Although self-generated mediators have been found superior to experimenter-provided mediators in normal populations (Bower, 1972; Danner and Taylor, 1973; MacMillan, 1970; Schwartz, 1971), this does not appear to apply to retarded populations. Although it has been shown that retardates can effectively utilize experimenter-provided mediators (Jensen et al., 1963; MacMillan, 1970; Milgram, 1967; Turnure et al., 1971), the quality of EMR-produced mediators is poorer (Buckhalt et al., 1976; Campione et al., 1977), and EMRs may fail to produce (Borkowski et al., 1974) or use mediators (MacMillan, 1970). Because it is crucial that the mediators contain meaningful relationships between the items to be learned (Turnure and Thurlow, 1975), the poor quality of EMR generated mediators lessens their effective use in memory tasks. Even when immediate performance has been facilitated by explicit and intensive training in the self-generation of mediators, long term benefits have not been seen (Borkowski et al., 1974). Most studies have shown that experimenter-provided mediators facilitate superior performance on memory tasks for EMR children (MacMillan, 1970, 1972; Wanschura et al., 1974).

Support for the existence of a developmental trend has been given by the finding that self-generated mediators are better than experimenter-provided mediators only after nonretarded children are in the sixth grade. Young nonretarded children benefit more from experimenter-provided mediators (Danner et al., 1973). This finding agrees with the developmental nature of mental retardation.
Most researchers agree that, unlike nonretarded Ss, visual imagery and verbal elaboration are apparently equally facilitative in improving EMR memory (Borkowski et al., 1974; Taylor et al., 1972; Wanschura et al., 1974). Groups that use mixed mediators (visual imagery and verbal elaboration combined) performed slightly better than groups using verbal imagery or verbal elaboration alone (Wanschura et al., 1974).

The quality of mnemonic training for EMR populations has been emphasized by many researchers. Variables such as training intervals (Wanschura et al., 1974), additional practice (Thurlow, 1973), and overt verbalization (Whitely et al., 1973) have been explored. Intensive and special training (Butterfield et al., 1973; Ross and Ross, 1978; Turnbull, 1974), as well as explicit feedback (Brown, Campione and Murphy, 1977) have been found to aid EMRs' use of mnemonics.

Further support for the presence of a developmental trend has come from Brown et al., (1977) who found an interaction between cognitive maturity and the effect of explicit feedback. They determined that young EMRs need explicit feedback prior to showing training effects, but that older EMRs will improve regardless of the nature of the feedback. They hypothesized that because younger EMRs are dependent on external intervention to stress crucial aspects of information, they need explicit prompts, training, and feedback in order to improve their performance. Similarly, Rohwer and Ammon (1971) found that training elaboration skills is more productive for older than for younger Ss.

Researchers agree that EMRs are capable of learning through observation (Achenback and Zigler, 1968), and that this observational learning holds for mnemonic training (Ross, 1970a and b; Ross et al.,
Observational learning of EMRs may be enhanced through psychological attachment to the model (Ross, 1970a) and by attention-directing variables (Ross, 1970b). EMRs who received direct training did as well as EMRs who observed models from mediators (Ross et al., 1973).

Other researchers have found that noninstitutionalized retarded individuals acquire learning sets faster than those who are institutionalized (Kaufman, 1963), that high similarity of intralist concepts will hinder the PA learning of normal adults but not of retarded adults (Wallace and Underwood, 1964), and that retarded individuals perform better with concrete rather than abstract mediators (Griffith, Spitz and Lipman, 1959). Goulet (1968) suggests the use of highly familiar pictures as stimulus items because they have been seen more often.

Because of the language deficit associated with retardation, introspective reports have been found inadequate in determining the types of acquisition strategies used. Baumeister (1971) found that the use of subject-paced tasks provides objective and direct monitoring. Subject-paced tasks provide subject presentation rates and interitem intervals as well as providing latency records of these events. As the S goes through the PA list, the acquisition strategies (which may be directly related to the systemic latency functions) may be revealed.

**Visual Imagery Versus Verbal Elaboration**

There is considerable empirical support for the promise that visual imagery is superior to verbal elaboration for a normal population (Crowder, 1976; Nelson, Metzler, and Reed, 1974; Paivio, 1976; Rohwer, 1970; Snodgrass, Volvovitz, and Walfish, 1972). Rohwer (1979) found that pictures evoke imagery more readily than words and were
more easily learned. Nelson et al. (1974) confirmed the superiority of visual imagery and found that the amount of detail in the stimulus was not a critical factor.

Paivio (1976) explained that the better performance of visual imagery is due to a combination of dual coding and image superiority which causes an additional effect on memory. However, Crowder (1976) argued that visual imagery is superior because he felt that the storage capacity for visual imagery is greater than for words. Additionally, recognition of pictures is based on multiple criteria because of their greater inherent detail.

Although other researchers have not been able to obtain qualitative differences between verbal elaboration and visual imagery (Anderson et al., 1973; Bower and Winzenz, 1970; Chase and Clark, 1972; Wysenck, 1977), it is generally agreed that visual imagery tends to foster greater facilitation of memory than verbal elaboration.

However, a developmental trend in this superiority of visual imagery has been found. Bruner, Olver, and Greenfield (1966) hypothesized that a sequential emergence of representational modes can be seen in children. Motor representations occur first, followed by imaginal and lastly symbolic (which is primarily verbal in nature). In contrast, Reese (1977) found that verbal elaborations are more facilitative in paired-associate learning for younger children, but that visual imagery is as equally facilitative as verbal elaborations in older children.

Rohwer (1970) also noted a developmental trend. He found that the ability to benefit from imagery develops later than verbal elabora-
tions and that the probability that imagery can be elicited in young children is lower than that probability for older children. He hypothesized that the storage capacity for imagery is dependent on the simultaneous incorporation of an appropriate verbal representation of the same stimulus. This ability to simultaneously store verbal and imaginal information is thought to be more probable for older than for younger children.

Paris and Lindauer (1977) found developmental trends in elaboration. During childhood, a gradual spontaneity in creating elaborators is seen in conjunction with increased age. As children age, they begin to rely less on retrieval cues and a better understanding of complex relationships between the items to be learned can be seen. As children age they develop greater expertise in creating semantic and interacting relationships between the items, thereby promoting the creation of elaborations.

There are several explanations regarding the facilitative effect of visual imagery upon memory. In describing the association theory, Reese (1977) talks in terms of compound images. By uniting, interconnecting, or associating the material to be remembered, compound images provide an efficient means of organization, which presumably facilitates recall. Research has shown that associations between pairs of visual forms are greatly facilitated by storing the material in united form (Asch, Ceraso and Heimer, 1960; Epstein, Rock and Zuckerman, 1960). It has also been shown that recall is superior for two objects being pictured imaginally as interacting rather than acting independently (Crowder, 1976; Morris and Stevens, 1974). An interacting image can be readily formed (Bower, 1970).
Morris et al., (1974) argued that imagery per se does not improve recall, but that it does provide an opportunity for the association of unrelated units. Brown (1976) concurred and stated that imagery is effective because several concepts can simultaneously be related together in the image (i.e., chunking).

According to Baddeley (1976), there are several essential principles of visual imagery: (1) both the cues and the stimulus items must be visualized; (2) the cues must either be easily subject-generated or provided by the experimenter during recall; (3) the images must be united and interactive; (4) more than one item may be associated with a particular cue only if elaborated into an unitary image; and (5) performance may be impaired by semantic similarity in the cues.

In a review of the literature, Reese (1977) concluded that there has been no empirically decisive evidence of the relative effectiveness of experimenter-provided versus self-generated images. However, he found that the research generally indicates that instructions to generate images are generally less effective than experimenter-provided images in the facilitation of memory.

Many researchers have attempted to delineate qualitative aspects of differing forms of input in order to determine the optimal type of mediator. Most researchers agree that concrete words, particularly nouns, are easier to learn than abstract words (Lambert and Paivio, 1976; Lutz and Scheirer, 1974; Paivio, 1971; Paivio and Csapo, 1973; Rohwer, 1970; Wimer and Lambert, 1959). Rohwer (1970) determined that concrete noun pairs in PA tasks are easier to learn. In summarizing the reasons why concrete words are more easily recalled, Spear (1978)
found that they are more easily organized and united into images, are 
less susceptible to interference, encourage faster initial encoding, 
and create less confusion in encoding because concrete words have 
less inherent variability in meaning.

Other researchers have explored the types of connectives used to 
unite noun pairs. When Ss are asked to use imagery in learning a noun 
pair, Paivio (1971) found that a verb is automatically introduced in 
order to connect the two nouns in a meaningful combination. Rohwer 
(1970) found evidence that visual imagery is best elicited with 
sentences utilizing verb connectives.

Summary. Mnemonic training has been demonstrated to facilitate 
the memory of retarded individuals. The mentally retarded have been 
found to benefit the greatest from experimenter-provided mediators, 
and both visual imagery and verbal elaboration are equally effective.
The use of explicit feedback, highly familiar stimuli and subject-paced 
task presentation were also recommended. Retarded Ss may also be taught 
mnemonics through observational learning techniques. Mnemonic training 
and retardation were discussed from a developmental point of view.

Additionally, evidence was presented supporting the superiority 
of visual imagery over verbal elaborations. The developmental aspects 
of this finding were discussed, as were various formats of stimuli 
presentation. Experimenter-provided images were found to be generally 
superior to self-generated images. Concrete nouns and verb connectives 
were found to be best for eliciting imagery and recall.
Maintenance and Generalization of Strategies in Retarded Populations

The success of any training program must be determined by two factors: maintenance and generalization (Brown, 1974; Campione et al., 1977). Maintenance is the durable use of a strategy learned earlier on a similar task. The new task demands are identical to the previous task demands and the only difference is in the material that is to be learned (Campione et al., 1977).

Generalization occurs as a response to changes in the task demand as well as in the material that is to be learned (Campione et al., 1977). Although maintenance is essential for generalization, maintenance does not guarantee generalization (Burger, Blackman, and Tan, 1980).

EMRs have been found to maintain mnemonic strategies (Belmont, Butterfield, and Borkowski, 1978; Bower, 1972; Brown et al., 1974; Campione et al., 1977; MacMillan, 1970; Milgram, 1967; Rohwer, 1966; Ross et al., 1973). Following intensive training, EMRs can maintain mnemonic skills for specific tasks for a reasonable period of time (Brown et al., 1974; Campione et al., 1977; 1978), but there has been very little evidence showing generalization (Campione et al., 1977).

In order to determine the presence of generalization, a problem solving situation must exist in which it is known that the S can do the basic information processing, yet needs to create at least one new critical process or may rearrange a known process. Additionally, the S must be able to recognize the existence of a problem, must be able to manage the problem for appropriate solution, and the S must
be motivated to solve it. In this manner, generalization or transfer of training is being investigated (Belmont, Butterfield, and Ferretti, Note 1). The extent of transfer can be determined by manipulating the degree of difference in the task demands and the stimulus items and then comparing this with the original training and later transfer tasks (Campione et al., 1977).

Several studies have failed to demonstrate transfer of mnemonic learning in EMRs to new situations (Campione et al., 1977, 1978; Jensen, 1971; Jensen et al., 1963b; Kramer, Note 2; Milgram, 1967, 1968; Turnure and Thurlow, 1973). However, according to Burger et al., (1980), these results were caused by training and the effects of generalization task demands that were very unlike the original demands.

Transfer of training has been fostered in EMRs when several variables were manipulated. These variables include: the length and nature of test trials and the degree of task difficulty (Borkowski et al., 1972); continually changing the task demands during training (Farb and Throne, 1978); training twice (Belmont et al., 1978); sufficient and consistent training (Ross, 1971; Ross et al., 1973; Turnure et al., 1973; Wanschura et al., 1974); and the active production of mediators combined with an emphasis on their value (Wanschura et al., 1975).

In order to foster generalization, Belmont et al., (1978) recommend that the experimenter attend to the details of the training, provide explicit feedback to the subject, and most importantly, compare and contrast the methods for coping with similar tasks.

Wanschura et al., (1975) investigated the previous studies that demonstrated successful transfer. These studies incorporated several
variables. Transfer is typically seen with mild retardation (mean IQ approximately 70), and when transfer was achieved, it was generally not extensive. They also found that considerable training of strategy acquisition is a necessary prerequisite for transfer.

Belmont et al. (Note 1) indicated that in order to achieve transfer, the following general skills must be taught: goal setting, strategy planning, self-monitoring and problem identification, as well as the task-specific skills. Motivation to do the task and solve problems is also necessary.

Campione et al. (1977) suggest that six skills are needed for transfer; (1) estimating the capacity of the memory; (2) determining what the task demands; (3) choosing a plan of action; (4) monitoring plan execution; (5) monitoring effectiveness of the performance level of the plan; and (6) comparing the given performance level to other possible plan results.

According to the differentiation hypothesis (Appel, Cooper, McCarrell, Sims-Knight, Yussen, and Flavell, 1972), the developmentally young do not know that when they are asked to memorize a set of items for future recall means implicitly that they should do something to the information to be memorized. Early in development, they tend to treat this as a request to merely perceive the items. As a result, young children need to learn to differentiate between a now-oriented perceptual task from a future-oriented recall task.

Summary. Although EMRs have demonstrated their ability to successfully maintain mnemonic strategies, there has been very little evidence showing that they are able to transfer this training to dis-
similar tasks. Recommendations to foster generalization were discussed and included: intensive training, explicit feedback, and the teaching of other skills other than solely depending upon teaching task-specific skills.

**Metacognition**

As discussed, EMRs are able to learn and maintain mnemonic techniques, but are unable to consistently demonstrate transfer. Although they do not lack the necessary memory processes (Brown et al., 1973; Butterfield et al., 1973; Turnure et al., 1976), they do lack the ability to coordinate and gain spontaneous access to them (Butterfield et al., 1973). If it is assumed that their poor performance is partially attributed to their failure to utilize appropriate basic strategies, they therefore need to be taught these strategies (Campione et al., 1978). Rather than emphasizing the training of task-specific skills, it has been suggested that transfer skills be trained directly.

The mentally retarded child is deficient in metaknowledge, which is information about one's own cognitive functions and processes (Belmont et al., Note 1; Brown, 1975; Flavell, 1979; Flavell and Wellman, 1977). EMR children typically fail to realize that the task is difficult and needs mnemonic activities (Campione et al., 1977). They lack metacognitive skills such as checking, planning and asking questions (Brown, 1974), and they do relatively little monitoring (Brown, 1978; Campione et al., 1977; Flavell, 1979) or estimating regarding their own performance (Campione et al., 1977).

In a review of the literature, Belmont et al., (Note 1) found that direct training of metacognitive skills can aid EMRs to transfer
mnemonic skills. Campione et al., (1978) trained EMRs to use mnemonics that had inherent self-testing routines. This training was quite durable, with effects being seen one year later. Brown and Barclay (1976) showed that explicit mnemonic training and training EMRs to correctly predict recall readiness helped to improve their performance. They felt the need to initially train some mnemonic skills before attempting to train Ss to monitor and control strategic behavior. They felt that there are three essential metamemorial abilities: introspection, memory monitoring and control.

Campione et al., (1978) found that the monitoring process that is necessary for estimation of recall readiness can be taught and is generalizable to differing task demands. Unlike the Brown et al., (1976) study, Brown et al., (1977) recommended a focus on direct training of metamnemonic behavior rather than executive control and strategy monitoring.

Campione et al., (1978) determined the critical types of cognitive activities for intervention. These activities should be widely applicable across situations, be easily understood by the child to be workable and reasonable, and be applicable to real-life situations. The metacognitive behavior incorporating checking, monitoring and reality testing was emphasized.

Other researchers have contributed knowledge about metacognitive training. Metacognitive training has been successfully used with groups of children who are: hyperactive (Douglas, Parry, Marton and Garson, 1976; Palkes, Stewart and Freedman, 1972); aggressive (Camp, Blom, Herbert and Van Doorninck, 1977); learning disabled
children be taught to define the problem, attend to the problem, direct their response, reinforce themselves, evaluate performance, and correct errors.

Like mnemonic and retardation, metamemory may be developmental in nature. In a review of the literature, Ramayya and Mulcahy (1978) determined that the development of metamemory in normal and retarded individuals follows the same pattern. In analyzing the literature, they found that children become more accurate and realistic in determining their memorial capacity with increasing age. As children grow older, they become increasingly able to introspect and monitor their memory performance.

Summary. The mentally retarded lack the metaknowledge and metacognitive skills necessary for successful transfer of training. It was suggested that rather than teaching task-specific skills and hoping for transfer to occur, direct training of transfer strategies should be attempted in order to increase effectiveness. Various principles of metacognitive training were presented. Metacognition is thought to be developmentally related. Steps thought necessary to metacognitive processing in the developmentally young include: (1) training, checking, monitoring and testing skills; (2) cognitive modeling; (3) overt external guidance; (4) overt self-guidance; and (5) covert self-instruction.
STATEMENT OF THE HYPOTHESIS

The purpose of this study was to determine if the combination of mnemonic and metacognitive training would lead to the transfer of mnemonic techniques in EMR children. The Ss were trained to use a mnemonic strategy on a Paired Associate list and the transfer measures included Multiple Associate and Free Recall lists. The dependent measures included study times and recall accuracy. The treatment group receiving visual imagery and metacognitive training was expected to: (1) exhibit superior memory transfer in comparison to the control group, which received no training. Furthermore, the treatment group was also expected to: (2) utilize a longer study time than the control group, which served as a means of validating the use of the transfer strategy, and to: (3) utilize the trained strategy for all tasks, while the control group would not use the strategy spontaneously.
METHOD

Subjects

The Ss were 18 EMR children enrolled in EMR III classes in the Great Bend, Kansas public schools. Their mean IQ was 68, with a range of 52 to 85, while their mean MA was 10, with a range of 8 to 13. Their mean CA was 15, with a range of 13 years, 6 months to 16 years, 2 months.

The parents or guardians of the Ss were contacted initially by phone (See Appendix A), and after securing phone permission, a release form (See Appendix C) was sent in conjunction with cover letter (See Appendix B). Upon receipt of signed release forms, equal numbers of Ss were randomly assigned to one of two conditions: Control (C) or Imagery-Metacognition (IM).

Materials

The stimulus and response items of each Paired Associate (PA) and Multiple Associate (MA) list, and the items of the Free Recall (FR) lists consisted of common and easily identified pictures of concrete nouns. The 100 pictures were selected from the Peabody Picture Vocabulary Test. The Pictures were mounted on 4" by 6" cards. Ss in the IM condition were also exposed to "T.V." cards. These cards illustrated the two items of selected PA trials interacting and were used for training purposes.

Each picture was categorized (e.g., animals, clothing, food, etc.) and the following restrictions were followed in PA and MA list construction:
(1) Pictures from the same category were not used to form a pair or triplet.

(2) Obvious relationships were avoided (e.g., bird/tree).

(3) Pairs and triplets were capable of being joined by a verb connective.

Two 10-item PA lists were used for maintenance measures, two 10-item MA lists and two 20-item FR lists were used to measure near and far generalization, respectively. Two 10-item PA lists were used for training (See Figure 1). Items used in the maintenance measures were not used in transfer measures and items used for training were not used in either maintenance or transfer measures.

In order to prevent confounding by a list effect, all test lists and both groups were divided into half. That is, the IM group was divided into two blocks of 5 Ss each. The C group was also separated into two blocks of 5 Ss each (See Figure 2). The PA test (I) list (Immediate Test-Day 3) was comprised of two blocks of five PAs each. The PA test (D) list (Delayed Test-Day 17) was divided into two blocks of five PAs each. The MA (I) list and the MA (D) list were divided in the identical manner. The FR (I) list was separated into two blocks of ten FR items each and the FR (D) list was likewise divided.

See Figure 2 for clarification.
A stopwatch was used to record study times. An Individual Record Sheet was kept for each S (See Appendix E).

**Procedure**

Training - Days 1 and 2

All Ss were tested individually in a small, relatively quiet room in their school. They were told, "We're going to play a fun game. I'll show you one picture and then you tell me what picture goes with it. The same two pictures always go together. Now I'll show you the first two pictures that go together and then we'll see if you remember."

All Ss were trained with the two PA training lists. The Control group was instructed to verbalize but received no additional training (See Appendix F), and the IM group received special instructions in mnemonics and metacognition. The IM group was taught to visually imagine the PA pairs interacting. They were trained to monitor their study efforts and were taught to verbalize the task requirements and procedures. The guidance was gradually faded although they received guidance throughout training, as necessary (See Appendix G). All Ss were exposed to the training lists in the following manner. For the first five pairs of the first PA training list, the item pair was presented and the exposure time was S-paced. The response item was then removed and the S was asked to name what belongs with the stimulus item. The response card was then exposed after the S responded in order to provide feedback.

After the fifth pair, the S was shown and asked to recall the remaining five pairs of the first PA training list in one block.
The pairs were exposed and then the stimulus card of each pair was separately exposed and the response card was shown immediately after the S responded. The pair was then removed and the next stimulus card was exposed and the procedure repeated.

The second PA training list was presented to all Ss who were then asked to recall the response items after being exposed to the individually presented stimulus items. Figure 3 illustrates the training procedure and the method of training list presentation.

Insert Figure 3 about here

Testing - Days 3 and 17

Maintenance. All Ss were told, "Today we're going to play some fun games. I'll show you all the pictures that go together and then you tell me what pictures belong with each other." The Ss paced the presentation of the items and their study times were recorded by stopwatch. Use of the strategy was assigned a 1, while nonuse was scored 0 for purposes of analysis.

After presentation of the entire PA list, the stimulus card for each pair was separately exposed and each time the S was asked, "What goes with this?" Their responses were recorded on their individual Record Sheet after each response the appropriate response card was exposed to provide feedback.

Near Generalization. All Ss were instructed, "We're going to play some more, but this time I'll show you three pictures that always go together. Then I'll show you one picture and then you tell me what
two pictures come next." The Near Generalization Testing Procedure was identical to the Maintenance Testing Procedure, however a MA list was substituted for the PA list.

Far Generalization. All Ss were told, "Now we're going to play a different game. I'll show you some pictures and when I am through I want you to tell me what they were." One FR list was used and the Ss paced the exposure time of the initial presentation; this was recorded by stopwatch. After presentation of all FR items, the Ss were asked, "What were the pictures?" and their responses were recorded on the Record Sheet.

Maintenance and Generalization items used for each S for Day 3 were not used for Day 17. Figure 4 illustrates the time line of training and testing procedures that were used.

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Insert Figure 4 about here

-----------------------------------------------

Upon completion of testing, data from each Record Sheet was transferred to a Master List (See Appendix H) for data analysis. The data was separated by group assignment and each S was assigned an identifying number, their birthdate.
RESULTS

Subject Characteristics

The characteristics of the Ss were examined to determine if the IM and C group differed. Analysis of variance results indicate the absence of significant differences between the groups as shown in Figure 5. The groups did not differ for the variables of: Chronological Age (CA), Mental Age (MA), IQ, Sex or on the WISC-R subtests of Vocabulary (VOCAB), Information (INFO), Digit Span (DS) and Similarities (SIM).

MANOVA

A MANOVA was utilized in order to examine training, trial and training x trial effects for the dependent variables of memory performance and study time of the PA, MA and FR tasks.

MANOVA F values for each main effect (Training and Trial) will be reported below with the corresponding univariate F values. Finally, interaction effects will be discussed.

Training Effects

Since four of the six measures involved produced significant univariate F's, the MANOVA results are probably due to the small number of subjects involved in the study. MANOVA results indicate that the training variable approached significance ($F(6,11) = 2.34, p < .105$), as indicated by the following measures. The data is summarized in Figure 5.
**Training Effects - Tasks.** The IM group recalled a greater number of correct items on the PA task and recalled a mean of 6.95 correct items, as compared to the C group, which only recalled a mean of 4.06 correct items. The IM group correctly recalled a mean of 4.67 correct MA items, while the C group could only remember a mean of 1.39 correct MA items. However, neither group performed differently from one another on the FR task. The IM group demonstrated a mean recall of 10.39 FR items, while the C group recalled a mean of 9.67 FR items (See Figure 6).

The training effect was significant for the PA ($F (1,16) = 7.2, p < .02, \eta^2 = .312$) and MA ($F (1,16) = 6.91, p < .02, \eta^2 = .302$) tasks. However, the FR task did not exhibit a significant group effect ($F (1,16) = .30, p < .594, \eta^2 = .018$).

**Training Effects - Study Times.** The IM group studied longer than the C group on the PA ($\bar{x} = 170.73$ vs. 84.0) and the MA ($\bar{x} = 206.28$ vs. 101.34) tasks. While the IM group also studied longer on the FR task ($\bar{x} = 109.5$ vs. 75.83), the difference was not as large as in the other tasks, as shown in Figure 7. The training effect for the time spent studying was significant for the PA ($F (1,16) = 6.17, p < .024, \eta^2 = .28$), and the MA ($F (1,16) = 6.9, p < .018, \eta^2 = .301$) tasks. However, the group effect of study times for the FR task was not significant ($F (1,16) = 1.18, p < .294, \eta^2 = .007$).

**Trial Effects (Immediate vs. Delayed Tests)**

MANOVA results indicate that the trials variable was nonsignificant ($F (6,11) = 2.47, p < .092$) across all measures, indicating that there
were no differences in performance or study times between the immediate and delayed tests. Therefore, there was no trial effect across all measures, as reported below.

**Trial Effects - Task Performance.** Trial effects for the PA (\(F (1,16) = 1.04, p < .323, \eta^2 = .006\)), MA (\(F (1,16) = .34, p < .567, \eta^2 = .002\)), and FR (\(F (1,16) = 1.46, p < .245, \eta^2 = .083\)) tasks were found to be nonsignificant. This means that the group's performance did not differ significantly across trials on any task, as shown in Figure 8.

**Trial Effects - Study Times.** There was no difference in the study times for the PA and MA tasks, but the FR task study times were shorter on the delayed test (See Figure 9). This is confirmed by the nonsignificant trial effects found for the time spent studying for the PA (\(F (1,16) = .153, p < .701, \eta^2 = .001\)), and the MA (\(F (1,16) = 1.39, p < .255, \eta^2 = .008\)) tasks. However, the trial effect for the study time for the FR task approached significance (\(F (1,16) = 4.27, p < .055, \eta^2 = .021\)).

**Interactions**

MANOVA results indicate that the training x trial interactions were nonsignificant (\(F (6,11) = 1.17, p < .386\)). Only one univariate interaction was determined to be significant. The time spent studying for the FR recall task was found to have a significant interaction with trials (\(F (1,16) = 6.87, p < .019\)). Examination shows that the mean study time by the IM group decreased over time, while the mean study time for the C group remained relatively constant (See Figure 10). All other training x trial interactions were nonsignificant, as shown in Figure 5.
Use of Strategy

Strategy used by the Ss was determined by their overt verbalization while studying the task items. Because all Ss were required to verbalize their thoughts, it was fairly simple to judge whether they were using the mnemonic – metacognitive strategy. All overt verbalizations that were identical to, paraphrased, or contained the critical components of the trained strategy were regarded as use of the strategy. As Figure 11 demonstrates, the analysis indicated that the Use of Strategy variable was found to be significantly different between the IM and C groups. None of the C group Ss utilized the strategy, while the IM group used the strategy on the PA and MA tasks. The training effect for the Use of Strategy was found to be significant for the PA (F(1, 16) = 16, p < .001, eta² = .5) and MA (F(1, 16) = 16, p < .001, eta² = .5) tasks, but was nonsignificant for the FR task (F(1, 16) = 2.29, p < .150, eta² = .125).

Individual Analysis

As indicated earlier, none of the C group Ss used the strategy (See Figure 12). Of the nine Ss in the IM group, three Ss never used the strategy. Six Ss used the strategy on the PA and MA tasks, and of the six, two Ss used the strategy across all tasks, as shown in Figure 13. Use of Strategy remained constant across trials, i.e., if the strategy was used on the PA and MA tasks on the immediate test, then the strategy was used on the PA and MA tasks on the delayed test, as shown in Figure 14.
Summary

As a result of the homogeneity of the two groups, any differences in performance may be attributed to the training. The training was found to affect performance. The IM group recalled a significantly higher number of PA and MA task items than did the C group. However, training did not appear to affect performance on the FR task, as neither group performed significantly better. The IM group studied the PA and MA items longer than did the C group. However, neither group studied longer for the FR task.

Analysis also demonstrated the lack of influence trials had on performance. The performance of both groups did not differ significantly between the immediate and delayed tests. Although the MANOVA $F$'s for both training and trials had similar probability levels ($p < .10$ vs. $p < .09$), the training was more effective due to the univariate pattern. The trial effect was not as pronounced due to the lack of significant univariable $F$'s, as compared to the training effect, which exhibited four significant univariate $F$'s. The study times for both groups did not differ across trials, although the FR study times for the IM group decreased for the delayed test at a level that approached significance.

The IM group was found to use the strategy, while the C group did not. However, the IM group tended to discard the strategy for the FR task. Three of the nine IM Ss never used the strategy. Of the six remaining Ss, four used the strategy only for the PA and MA tasks, and the last two Ss used the strategy across all tasks.
DISCUSSION

The major finding of this study was that training resulted in better performance on maintenance and near generalization tasks. Analyses of variance demonstrated that the Ss in the two groups did not differ from each other on any variable, which means that the differences in performance may be attributed to the training. The IM group recalled significantly more PA and MA items, but not more FR items. Neither group's performance appeared to change between Immediate and Delayed Testings.

Previous research has shown that trained EMR children can maintain mnemonic strategies (Belmont et al., 1978; Bower, 1972; Brown et al., 1974; Campione et al., 1977; MacMillan, 1970; Milgram, 1967; Rohwer, 1963a; Ross and Ross, 1973), and this study supports that research. Previous studies have also shown that after intensive training, EMRs can maintain mnemonic strategies for a reasonable period of time (Brown et al., 1974; Campione et al., 1977, 1978), as the present study replicates.

The IM group studied longer than the C group for the Maintenance and Near Generalization tasks, but not for the Far Generalization task. Neither group's study times changed from the Immediate to the Delayed testing on the PA and MA tasks. However, the IM group study times decreased from the Immediate to the Delayed testings for the FR task. The C group's study times for the Immediate and Delayed testings for Far Generalization remained constant.
The IM group's use of the strategy was confirmed by individual analysis and the C group did not spontaneously adopt a mnemonic or metacognitive technique, which confirms findings by Butterfield et al., (1973). The IM group used the strategy for the similar task, but discarded the strategy when faced with the dissimilar task. Of note, however is the finding that two of the IM group Ss (22%) utilized the strategy across all tasks and trials. It is of interest to note that the two Ss who did demonstrate evidence of far generalization exhibited divergent characteristics. Examination of the gross discrepancies between the two Ss' IQ, CA, MA, Sex and WISC-R subtest scores provides no clues for the prediction of successful training.

The fact that only two IM Ss exhibited transfer of training to a dissimilar task may be attributed to several factors: appropriateness of the training for fostering Far Generalization; insufficient sample size; or insufficient training. Because two Ss used the strategy and achieved Far Generalization, it may be hypothesized that the training enabled them to perform better. If the Ss had been trained longer, it may have been easier for them to transfer the strategy to the different task demands because they would be more familiar with using the strategy. Additional support comes from Brown et al., (1974) and Campione et al., (1977, 1978) who demonstrated that intensive training is necessary. Previous studies have shown that the direct training of metacognition aids the transfer of mnemonic skills (Belmont, et al., Note 1). The
metacognitive component of the training process may not have been appropriate for the induction of generalization skills. Variables such as the technique, length, appropriateness and intensity of the training will need to be further explored in the future. Because two of the Ss were able to achieve Far Generalization, the components of training used in the study should be closely examined in order to determine those elements which are most conducive for the transfer of learning.

Because the mentally retarded lack the ability to coordinate and spontaneously attain access to memory abilities (Butterfield et al., 1973), they need to be taught memory strategies (Campione et al., 1978) and the training appeared to help the IM Ss in Maintenance and Near Generalization tasks. However, as Brown (1974) and Campione et al., (1977) have stated, the success of any training program must be evaluated by generalization, as well as maintenance. It is not enough to utilize training techniques that are only applicable for maintenance; Belmont et al., (1979) demonstrated that there is a need to teach the mentally retarded adaptive behaviors as well. There has been a recent focus on the importance of adaptive behavior as it relates to the concept of intelligence; and the training of the retarded can become more efficient if educators are no longer restricted to concentrating on teaching task specific skills while hoping for generalization (Belmont et al., 1978). Rather, the generalization should be treated as the task itself (Belmont et al., 1978), and the child should be provided with a
metacognitive framework that fosters adaptive behavior (Meichenbaum et al., 1979). Therefore, in the attempt to attain this goal, the present study trained task-specific skills (mnemonic imagery) as well as adaptive skills (metacognition), as measured by generalization tasks. This study confirmed the finding by Belmont et al., (Note 1) that the direct training of metacognition aids the transfer of mnemonic skills.

The extent of transfer can be measured by manipulating the degree of difference between the stimulus items and the task demands and by comparisons with the original learning (Campione et al., 1977). Therefore, the finding of a significant effect on the Near Generalization task, while important, is not as critical as a finding of the presence of Far Generalization in the IM group, which is why the achievement of Far Generalization by the two IM Ss is so important.

The educational applicability is clear. If it can be demonstrated that EMRs can be successfully trained to generalize memory strategies, educators will be able to develop more efficient means for teaching this population. Rather than having to teach the prerequisite skills for each task, the focus could be on teaching self-maintenance or metacognitive skills that would incorporate techniques promoting generalization. In this way, only a few essential academic or interpersonal skills would need to be taught and educators would be able to concentrate on training EMRs to adapt these skills to a variety of situations. Be
increasing EMR repertoires of adaptive behaviors and generalization, their level of dependency could therefore be decreased, which would aid in their educational, personal and societal gains. Classroom time could then be utilized in a more efficient manner. The results of the current study should encourage further research that would have direct educational application.
Figure 1

Type of List as Determined by Purpose

<table>
<thead>
<tr>
<th>Number of Lists to be Used</th>
<th>Number of Items Within each List</th>
<th>List Type</th>
<th>Purpose</th>
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<tbody>
<tr>
<td>2</td>
<td>10</td>
<td>PA</td>
<td>Training</td>
</tr>
<tr>
<td>2</td>
<td>10</td>
<td>PA</td>
<td>Maintenance</td>
</tr>
<tr>
<td>2</td>
<td>10</td>
<td>MA</td>
<td>Near Generalization</td>
</tr>
<tr>
<td>2</td>
<td>20</td>
<td>FR</td>
<td>Far Generalization</td>
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</table>
Figure 2

Assignment of Blocked Test Items* and Subjects

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<tr>
<th>Ss**</th>
<th>PA (I)</th>
<th>PA (D)</th>
<th>MA (I)</th>
<th>MA (D)</th>
<th>FR (I)</th>
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<td>A, C</td>
<td>B, D</td>
<td>E, G</td>
<td>F, H</td>
<td>I, K</td>
<td>J, L</td>
</tr>
<tr>
<td>X, Z</td>
<td>B, D</td>
<td>A, C</td>
<td>F, H</td>
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* List Type

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<tr>
<th>Block Name</th>
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<th>FR</th>
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<td>10</td>
</tr>
<tr>
<td>Composition</td>
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<td>E ≠ F ≠ G ≠ H</td>
<td>I ≠ J ≠ K ≠ L</td>
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</tbody>
</table>

**Control Group = W (5 Ss), X (5 Ss) W ≠ X
IM Group = Y (5 Ss), Z (5 Ss) Y ≠ Z
**Figure 3**

Training Procedure

**Days 1 and 2**

<table>
<thead>
<tr>
<th>PA Training List</th>
<th>Trial</th>
<th>Form of Presentation</th>
<th>Recall</th>
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<tr>
<td>1</td>
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<td>Single</td>
<td>After each Trial</td>
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<td>6-10</td>
<td>Massed</td>
<td>After all Trials</td>
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<tr>
<td>2</td>
<td>1-10</td>
<td>Massed</td>
<td>After all Trials</td>
</tr>
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Figure 4

Temporal Order for Training and Testing Procedures by Groups

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<th>Control Group</th>
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<tbody>
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<td></td>
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<td></td>
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<tr>
<td>3 &amp; 17</td>
<td>PA</td>
</tr>
<tr>
<td></td>
<td>MA</td>
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<tr>
<td></td>
<td>FR</td>
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</table>
Figure 5

Summary Table

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**MANOVA**

**Training Effects**

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**Trial Effects**

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**Interaction Effects**

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**Use of Strategy by IM Group**

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| MA       | 0.70 | .414 | 9.67      | 1.0   | 10.23 | 1.72 |
| IQ       | 0.36 | .558 | 66.34     | 6.86  | 68.78 | 10.17|
| SEX      | 0.20 | .661 | 1.56      | 0.53  | 1.45  | 0.53 |
| VOCAB    | 0.44 | .514 | 2.78      | 2.63  | 3.56  | 2.3 |
| INFO     | 0.05 | .822 | 4.23      | 1.99  | 4.45  | 2.1 |
| DS       | 0.99 | .334 | 5.34      | 2.5   | 4.23  | 2.2 |
| SIM      | 0.80 | .384 | 4.0       | 2.4   | 4.89  | 1.8 |
Figure 6

Mean Number of Correctly Recalled Items for PA, MA, and FR Tasks Collapsed Across Trials for Both Groups
Figure 7

Mean Study Times for PA, MA and FR Tasks

Collapsed Across Trials for Both Groups
Figure 8

Mean Number of Correctly Recalled Task Items for IM and Control Groups - Immediate and Delayed Testings
Figure 9

Mean Study Times for Memory Tasks for IM and C Groups - Immediate and Delayed Testings
Figure 10

Mean Study Times for PA, MA and FR Tasks for Both Groups
Figure 11
Strategy Use by IM and CSs on PA, MA and FR Tasks
Figure 12

Use of Strategy by All C Group Ss
Across All Tasks (n=9)
Use of Strategy by Individual IM Ss Across All Tasks (n = 9)

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- **S1**
- **S2**
- **S3**
- **S4**
- **S5**
- **S6**
- **S7**
- **S8**
- **S9**
Figure 14

Use of Strategy by IM Ss

Across Tasks and Trials (n=9)
APPENDIX A

Phone Call to Parents of Ss

"My name is Leslie Paige and I am a graduate student at Fort Hays State University. I am studying children enrolled in special education classes for the mentally retarded as part of my studies. Mr. Karl Anderson, the Director of Special Services has given me permission to contact you. In order to help me learn more about how these children learn, I want to work with your son/daughter, ____________, along with others in his (her) class. It will only take a total of approximately 2½ hours spread out over a 2½ week period. After the study is completed, I hope to be able to share with you what I have learned. With your permission, I will send you a letter explaining the nature of my work, plus a release form that you must sign and return to me if you will allow me to work with your child."
Letter to Parents

February 25, 1981

Dear Parent;

We will soon be conducting a study to determine the effects of different types of instructions on children's memory skills. The purpose of this letter is to ask your permission to allow your child to participate in the study.

During the study your child will be presented with a series of pictures which s/he will be asked to remember. Before seeing the pictures some of the children will be instructed in the use of memory strategies. We will then determine if the instructions improved performance. The total amount of time required for each child will be approximately 2½ hours, however this will be divided into 4 separate sessions of about 35-40 minutes each. The purpose of the study is to determine the types of instruction which can be used to increase children's learning and memory skills. Your child's performance and IQ test scores will be used in analyzing the data and will be kept strictly confidential.

A release form is enclosed and must be signed by you in order to allow your child to participate. An addressed and stamped envelope is also enclosed for your convenience. This study will be conducted under the supervision of Dr. Jack Kramer (F.H.S.U. number, 800-432-8271) of the F.H.S.U. Psychology Department. The Director of Special Services, Mr. Karl Anderson, and the principal of your child's school have approved this project.

Thank you for permitting your child to contribute to our knowledge about teaching learning and memory skills. If you have any questions regarding this matter, please do not hesitate to contact me at 913-372-4379.

Sincerely,

Leslie Z. Paige
Master's Candidate, F.H.S.U.

Enc.
APPENDIX C

Release Form

I, ___________________________________________ give my permission to allow my son/daughter, ______________________ to participate in a study being conducted by Leslie Paige, a graduate student at Fort Hays State University. I understand that any information pertaining to my child will be kept strictly confidential. I agree to allow my child to work with Leslie Paige for approximately 2½ hours during the school day over a two to three week period. I understand that I may withdraw my child from the study at any time for any reason. I understand that the study will be supervised by Dr. Jack Kramer of the F.H.S.U. Psychology faculty, and that the study has been approved by Mr. Karl Anderson, the Director of Special Services, and by the principal of my child's school. I have been informed that the study will be examining the effect of different types of instructions on children's memory skills and I will received information at a later date that will fully explain the study and the results. I know that by signing this form I do not waive any of my legal rights, nor does it release Fort Hays State University or any of its agents from liability for negligence.

Signed: __________________________  Name __________________________  Date __________________________

Relationship to the Child
APPENDIX D

Individual Record Sheet

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Comments:

IQ = _______  V = _______  MQ = _______  S = _______
CA = _______  DS = _______  SEX = _______
1=M  2=F
APPENDIX E

Training Instructions for the Control Group

Days 1 and 2

The Ss were told, "We're going to play a fun game. I'll show you one picture and then you tell me what picture goes with it. The same two pictures always go together. Now I'll show you the first two pictures that go together and then we'll see if you remember."

The Ss were trained with the two PA training lists in the manner described below. For the first five pairs of the first PA trial list, the item pair for each trial was presented and the S determined the exposure time. Then the response item was removed and the E pointed to the stimulus item and asked, "What goes with this?" The response card was then exposed after the S replied in order to provide feedback.

After the fifth trial, the S was told, "Now I'll show you some more pictures that go together but this time I'll show you all of them and then you'll tell me which ones go together. Wait until I've shown you all of them before you tell me which go together. Think out loud so I can hear you." The remaining five trials of the first PA training list were exposed, again subject-paced. Then the E exposed the stimulus item for trial 6 and asked, "What goes with this?" The S received feedback after each trial by the exposure of the response card. This procedure was follows for trials 6 and 10.
The second PA training list was introduced with, "Let's play some more. I'll show you all the pictures that go together, and then you tell me which go together." The same procedures used for trials 6 through 10 for the first PA training list were used for the second PA training list (See Figure 2).

Day 2

The S's were told, "We're going to play the game again. Remember how to play? I'll show you a picture and then you tell me what picture goes with it. The same two pictures always go together. Now I'll show you the first two pictures that go together and then we'll see if you remember. Remember to think out loud so I can hear you." The entire Day 2 training list was presented, and the identical procedure used for Day 1 was utilized.
APPENDIX F

Training Instructions for the IM Group

Day 1

The Ss were told, "We're going to play a fun game. I'll show you a picture and then you tell me what picture goes with it. The same two pictures always go together. Here's a fun way to help you play the game. Look at both pictures (Expose trial 1 cards). Let's pretend they're on TV and they're doing something to each other, like this (Expose "TV" card). See, here's the (stimulus) and here's the (response) (indicate appropriate cards). Let's pretend they're on TV and Look! (Show "TV" card) the (stimulus) is (verb connective) the (response)! Now, look at the picture (Show "TV" card) and then close your eyes. Think about the picture and see it in your head. Open you eyes. When you want to remember something like these pictures (Expose trial 1 cards), just pretend they're doing something to each other (Expose "TV" card) and see it in your head. Now you try it for these cards." The training persisted through Trial 3, and then the Ss were instructed, "Here's a way that will help you play this game and anytime when you need to remember. You can use this anytime you want to remember something. (Expose PA trial 4). Say to yourself out loud, 'What do I have to do? I have to look at both pictures carefully. Then I pretend that they're on TV in my head. Let's see, the (stimulus) is (verb) the (response)."
This will help me remember so when I see (stimulus) I will think of (stimulus, verb, response). Am I ready for the next pictures? No, I have to think about it some more. I can see the (stimulus, verb, response) in my head. Am I ready for the next pictures? Yes.'"

The E then said, "OK, now you try it," and Trial 5 began. The E directed the S through the 5th trial and then instructed the S, "Now I'll show you some more pictures that always go together, but this time I'll show you all of them and then you'll tell me which go together. Remember to wait until I've shown you all of them before you tell me which go together." As the Ss proceeded through the remaining five trials of the first PA training list, they were reminded to, "Say it aloud so I can hear you." The E prompted the S to use both the imagery/metacognitive strategy and guidance was gradually faded. The S received feedback after naming the response after being exposed to the stimulus and the strategy was repeated. The response card was exposed and the E said (if it was correct), "Say this, 'Good, I'm doing fine' or, (if erroneous), say this, 'That's not right, but it's OK. I can keep on going slowly.'"

The S was then told, "Now I'll show you all the pictures that go together, and when I'm through you tell me which go together." The S was asked to verbalize the strategy before this trial began. The second PA training list was presented and tested as before with E prompts being gradually faded and the S being instructed to vocalize metacognitions. At the end of the session, the S was told, "Remember you can use this anytime you want to remember."
Day 2

The Ss were told, "We're going to play the game again. Remember how to play? I'll show you a picture and then you tell me what picture goes with it. The same two pictures always go together. I'll show you both pictures and then you pretend they are doing something to each other and see it in your head. To help you play the game, and to help you anytime you need to remember, say to yourself out loud, 'What do I have to do? I have to look at both pictures carefully. Then I pretend that they're on TV in my head. Let's see, the (stimulus) is (verb) the (response). This will help me remember so when I see (stimulus) I will think of (stimulus, verb, response). Am I ready for the next pictures? No, I have to think about it some more. I can see the (stimulus, verb, response) in my head. Am I ready for the next pictures? Yes.'"

The E will then say, "OK, now you try it. Now I'll show you all the pictures that go together, and when I'm through you tell me which go together. Remember, you can use this anytime you want to remember." The entire Day 2 training list was presented and tested with E prompts gradually faded and the S instructed to vocalize metacognitions. At the end of the session, the E said, "Remember, you can use this anytime you need to remember."
## APPENDIX G

### MASTER LIST

| SBJ. NO. | CA | MA | IQ | SEX | V | I | DS | S | GRP | PAI | MAI | FRI | PAD | MAD | FRD | PAI | MAI | FRI | PAD | MAD | FRD | SPAI | SMAI | SFRI | SPAD | SMAD | SFRD |
|----------|----|----|----|-----|---|---|----|---|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|

This table contains columns for subject number, various personal identifiers, and the study time strategy.
REFERENCE NOTES


2. Kramer, J. J., Improving the Memory Skills of the Mentally Retarded, Unpublished manuscript.
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Brown, A. L., Campione, J. C., Murphy, M. D. Keeping track of changing variables: long-term retention of a trained rehearsal strategy by retarded adolescents, American Journal of Mental Deficiency. 1974, 78, 446-453.


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