A STUDY OF THE EFFECTS OF COGNITIVE TRAINING ON THE ABILITY OF ADOLESCENT EDUCABLE MENTALLY RETARDED STUDENTS TO LEARN AND RETAIN VOCATIONAL COMPETENCIES

by

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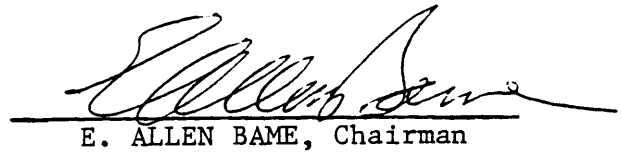

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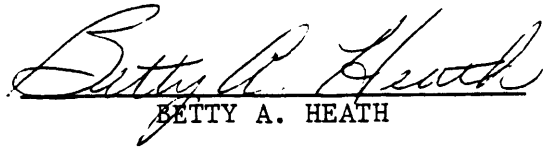

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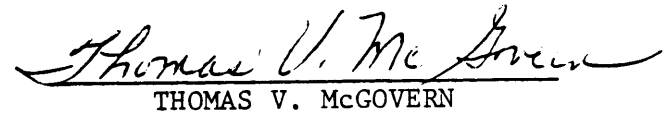

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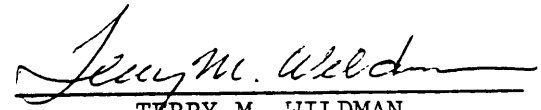

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CHAPTER I

INTRODUCTION

Background of Problem

Never before has so much attention been focused on the handicapped segment of our population. Throughout the seventies, Americans have been made aware of the special needs of the handicapped mainly through the efforts of government, business and the news media. The federal government, through its public policy, mandated the appropriate education of all handicapped children. The Education for All Handicapped Children Act of 1975 (Public Law 94-142) is designed to remove barriers and restrictions that make a free appropriate public education all but impossible for far too many handicapped children. Compatible with this act is the Vocational Education Amendments of 1976 (Public Law 94-482), which provides for the expansion and strengthening of vocational programs for handicapped students. The act requires that 10 percent of the federal funds to states for vocational education be provided to programs for these children.

Among the handicapped children identified in both P. L. 94-142 and P. L. 94-482 to be served in vocational education are those who have been classified for educational purposes as mildly mentally retarded. The label of mildly mentally retarded or educable mentally retarded, designated as EMR, is used by educators to distinguish this level of mental handicapped (I.Q. 50 - 79) from the lower levels of moderate (I.Q. 25 - 49) and severe or profound (I.Q. below 25) (Smith, 1978).

Of approximately 6.1 million retarded persons in the United States, it was estimated by Bluhm (1977) that more than a third of these individuals are under 21 years of age. A vast majority of the mentally retarded (approximately 89 percent) are considered mildly retarded (Smith, 1978). Given appropriate education and training these individuals could become self-supporting as adults and enter the mainstream of the American work force (Bluhm, 1977). Historically, vocational education has sought to provide "appropriate education and training" to anyone who wanted it and who could benefit by it. However, serious problems became apparent when vocational educators realized that differences had to be considered when teaching the mildly retarded. Although these students are similar to their normal classmates physically, they have a serious learning handicap and are generally not as personally and socially mature as students who are not handicapped. The vocational teacher, in order to successfully teach the mildly retarded, must consider these differences and become committed to making the necessary changes in order to maximize learning for these students. Gold (1976), while discussing the importance of commitment in teaching the mentally handicapped, offered the following comments:

> Whether or not you make such a commitment is governed in part by what you expect from retarded people. If you feel that they are not capable of doing much, you probably will not commit much energy, time or resources to train them in marketable skills but, if you realize that a retarded person's performance is directly related to the amount of time, effort, and resources committed, and especially to the specific instructional strategies used, you probably will make a commitment to use the time, effort, and resources needed to help retarded students succeed (Gold, 1976, p. 146).

While there are vocational teachers committed to the task of providing the necessary job training for their mentally handicapped

students, many of these teachers are lacking specific instructional methods for enhancing learning and retention on the part of these students.

The demonstration of learning and retention on the part of its students has become increasingly important in vocational education programs throughout the country as the demands for competency-based education (CBE) become apparent. In competency-based vocational education programs the content of each course is based upon the actual jobs or tasks performed by the worker (Hoerner and Horne, 1980). The ability to perform these jobs or tasks are called competencies. It is expected that within a given course, whether it be in a special or regular vocational education program, the student is expected to learn, retain, and thus demonstrate these same job related competencies in order to complete that course. Hall and Jones (1976) carry this point a step further:

> A key aspect of CBE is that students are held accountable not for the acquisition of a specific competency but for the demonstration of that competency.

Student success is not measured strictly by correct answers to written tests; instead, competency-based instruction includes preset occupational standards with which student performances are compared. Although CBE provides for strict accountability of the learning achieved and demonstrated by each student, it de-emphasizes group instruction and a set time for all students to accomplish the same performance objectives. In other words, CBE as compared to traditional vocational education provides for greater consideration of individual differences.

A competency-based vocational education program can, however, present special problems for a student who is mentally handicapped. Some examples:

- CBE places a greater responsibility on the learner to progress independently of others.

  Problem: Some mentally handicapped students may not be prepared to accept the responsibility for learning (Smith, 1978).

- Once a competency is demonstrated under test conditions the student is assumed to retain that competency.

  Problem: The mentally handicapped student is likely to have poor memory capacities which are due to strategies for encoding information that are different from those used by persons with normal mental abilities. (Riggar and Riggar, 1980).

- CBE programs frequently use self-pacing learning modules as a means for providing instruction.

  Problem: Poor readers may not be able to use modules effectively. Even when allowances are made for poor readers, the retarded person is frequently unable to follow written or oral communications (Riggar and Riggar, 1980).

The vocational educator serving mildly retarded students and faced with the task of teaching occupational competencies as required in a competency-based program, first needs to be aware of the special learning problems of these students. The vocational educator next needs to develop strategies for teaching the mildly retarded student with the aim of achieving improved learning and retention.

Attention also should be given to improving the thinking-memory pro-

cesses of the mentally handicapped - perhaps prior to these students entering vocational education.

Statement of the Problem

The purpose of this study was to examine the effects of remedial cognitive training on the ability of adolescent mildly retarded students to learn and retain occupational competencies and to determine the effects of selected cognitive teaching strategies on learning and retention.

Specifically, this purpose translates into the following research question:

Which of the four groups of mildly mentally retarded adolescent students shows the greatest amount of learning and retention of vocational competencies?

1. Students who have been provided remedial cognitive training and taught by an instructor using selected cognitive teaching strategies.
2. Students who have been provided remedial cognitive training and taught by an instructor using conventional teaching methods.
3. Students who have not been provided remedial cognitive training but taught by an instructor using selected cognitive teaching strategies.
4. Students who have not been provided remedial cognitive training but taught by an instructor using conventional teaching methods.

Significance of Study

It is generally accepted that it takes a significantly longer period of time for a mentally handicapped person to develop entry-level skills than it does for a normal person. For the City of Richmond, Virginia, the dropout rate from vocational education programs for the mentally handicapped has consistently been higher than for non-handicapped persons. Riggar and Riggar (1980) suggest that the difficulty of the mentally handicapped to sustain long-term training is due to many of the characteristic learning problems of these students. Since competency-based vocational education programs theoretically de-emphasize a set time for students to develop needed competencies, the mentally handicapped without specially developed cognitive training is likely to take even longer to develop entry-level skills.

The proposed study is needed to determine if cognitive training and the selected cognitive teaching strategies will together or separately improve learning and retention for the mentally handicapped. To this end the following research hypotheses are formulated:

H_1: EMR subjects cognitively trained to use learning strategies will test higher in knowledge of learning strategies than subjects who have not been cognitively trained.

H_2: EMR subjects cognitively trained to use learning strategies and cognitively taught vocational skill competencies will test higher in their performance of the competencies than subjects not cognitively trained but cognitively or traditionally taught.

H_3: EMR subjects cognitively trained to use learning strategies and traditionally taught vocational skill competencies will test higher

in their performance of the competencies than subjects not cognitively trained but cognitively or traditionally taught.

H_4: EMR subjects cognitively trained to use learning strategies and cognitively taught vocational informational competencies will test higher in their knowledge of the competencies than subjects not cognitively trained but cognitively or traditionally taught.

H_5: EMR subjects cognitively trained to use learning strategies and traditionally taught vocational informational competencies will test higher in their knowledge of the competencies than subjects not cognitively trained but cognitively or traditionally taught.

H_6: EMR subjects cognitively trained to use learning strategies and cognitively taught vocational skill competencies will test higher in recall of tools and procedures than subjects not cognitively trained but cognitively or traditionally taught.

H_7: EMR subjects cognitively trained to use learning strategies and traditionally taught vocational skill competencies will test higher in recall of tools and procedures than subjects taught not cognitively trained but cognitively or traditionally taught.

H_8: EMR subjects cognitively trained to use learning strategies and cognitively taught vocational skill competencies will show greater retention in performance than subjects taught not cognitively trained but cognitively or traditionally taught.

H_9: EMR subjects cognitively trained to use learning strategies and traditionally taught vocational skill competencies will show greater retention in performance than subjects not cognitively trained but cognitively or traditionally taught.

H_{10}: EMR subjects cognitively trained to use learning strategies and cognitively taught vocational informational competencies will show greater retention of knowledge of the competencies than subjects not cognitively trained but cognitively or traditionally taught.

H_{11}: EMR subjects cognitively trained to use learning strategies and traditionally taught vocational informational competencies will show greater retention of knowledge of the competencies than subjects not cognitively trained but cognitively or traditionally taught.

H_{12}: EMR subjects cognitively trained to use learning strategies and cognitively taught vocational skill competencies will show greater retention recall of tools and procedures than subjects not cognitively trained but cognitively or traditionally taught.

H_{13}: EMR subjects cognitively trained to use learning strategies and traditionally taught vocational skill competencies will show greater retention recall of tools and procedures than subjects not cognitively trained but cognitively or traditionally taught.

Assumptions of the Study

The basic assumptions of this study were as follows:

1. That students assigned to the cognitive training session will maintain regular attendance throughout the training periods.
2. That the students involved in the study will not compromise the essential activities that take place during the training sessions.

Limitations of the Study

Generalizations concerning the populations involved pertained only to adolescent EMRs enrolled in vocational education in Richmond City Schools.

Definition of Terms

In order to promote clarity and understanding, the following terms are defined as they relate to this study:

Cognitive Training. The regular application of memory-enhancing techniques to a variety of tasks, so that their use in rehearsal and retrieval becomes increasingly automatic or spontaneous.

Competency. Demonstrated ability (including knowledge, skills, or attitudes) to perform a specific task successfully to meet a specified standard (Hall and Jones, 1976).

Entry-Level Skills. The set of competencies required of a beginning worker in an occupation for immediate productivity upon entering that occupation.

Learning. The ability to retrieve information or perform a skill a short period of time after acquisition.

Mentally Handicapped. A label used to designate individuals whose scores on standardized intelligence tests are between 50 and 79, and who have been identified for educational purposes as mildly mentally retarded or educable mentally retarded (EMR).

Module. A learning unit with stated objectives, a pretest, learning activities to enable students to acquire competencies the pretest has shown to be lacking, and a competency evaluation to measure learning success. (Hall and Jones, 1976).

Retention. The ability to retrieve information or perform a skill any time after acquisition.

Strategies. Plans that are carefully developed in order to achieve a desired effect.

Traditional Teaching. The presentation of instruction to learners by a qualified teacher who has not been specially trained to use rehearsal, organization and elaboration strategies.

Summary and Organization of the Study

The mentally handicapped, having special learning problems, face difficulties in a competency-based vocational education program. This study examines the effects of cognitive training and selected cognitive teaching strategies on the mentally handicapped student's ability to learn and retain occupational competencies.

Chapter I provides an introduction, the problem significance, assumptions, limitations, and definition of the terms unique to this study.

Chapter II presents a review of literature supporting the rationale for the study and supportive data of studies relating to selected variables.

Chapter III contains a detailed explanation of the methodology used in the study, including the treatments, population and sample, the design of the study, controls, data and instrumentation, data collection procedures and the analysis of data.

The findings of the study including the description and statistical analysis of the data are reported in Chapter IV.

Chapter V summarizes the findings, the conclusions drawn from the data, and implications and recommendations for further studies.

CHAPTER II

REVIEW OF RELATED LITERATURE AND RESEARCH

This chapter reviews the pertinent literature including empirical studies regarding short-term memory and the mentally retarded, mnemonic strategy training with mentally retarded children, and cognitive considerations and strategies for learning motor skills. It was evident from the literature search that studies on the cognitive training of mentally retarded students to develop vocational competencies were very limited and, therefore, justified the need for research in this area.

Short-Term Memory and the Mentally Retarded

Before attempting to research any means of training the mentally handicapped to "learn" more efficient means of learning, it seems reasonable to review studies that have examined the learning difficulty of these individuals. Based primarily on the theories of Waugh and Norman (1965) and Atkinson and Shiffrin (1968) and their models of human short-term memory, a considerable amount of research has been focused on the human memory system and the typically poor recall of the mentally retarded. Ellis (1970), as a result of comparative studies of institutionalized mildly retarded and normal subjects, concluded that two processes are involved in the short-term storage of information, and in the retarded subjects one of these

processes is defective. He also concluded that active rehearsal strategies are necessary for one of the storage processes but not for the other. Another, but not so firm conclusion was that the retardate's deficiency is caused by a "failure of the rehearsal mechanism(s)." Ellis' two-process or multi-process interpretation of the memory system based on Waugh and Norman's (1965) theoretical concepts is shown in Figure 2.1.

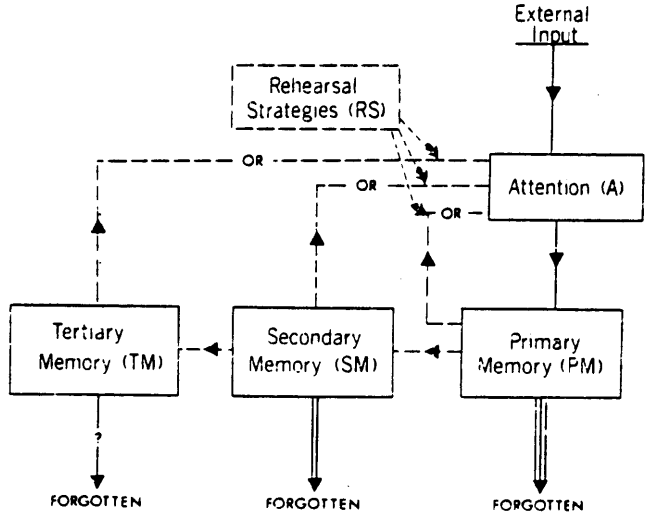

Fig. 2.1. The multi-process memory model (from Ellis, 1970).

The general concept is that stimulants from the environment filter through an attention (A) process and pass into the primary memory (PM). The PM has a capacity of retaining only a few items which can easily decay due to time per se or as a result of interference. New information is constantly replacing the previous in PM. As indicated by the three-line arrow much information is forgotten. In comparison, the two-line arrow of the secondary memory (SM) and one-line arrow of the tertiary memory (TM) respectively show less

information forgotten. Information is transferred from PM to SM and to TM by means of rehearsal strategies (RS) mechanism. The RS (broken lines) with the focus of attention can retrieve information before it is lost from PM, SM, or TM. It is likely that meaningfulness and attention facilitate the flow of information from PM to SM. Information stored in TM may be recalled several days later, months later, or perhaps permanently, which explains the question mark placed beside the forgetting process in TM. If the information does not transfer beyond SM, it is forgotten following a brief interval (Ellis, 1970).

In Ellis' conceptual scheme, TM is synonymous with long-term memory (LTM). PM and SM are together roughly equivalent to short-term memory (STM) as discussed in other contexts.

Melton (1963) provided some principal contentions regarding the difference between the two memory mechanisms, which were:

1. STM involves "activity" or recently experienced memory traces, while LTM involves "structural" or established memory traces in the central nervous system.
2. STM involves autonomous decay of memory traces, while LTM involves irreversible, nondecaying traces.
3. STM has a fixed capacity that is subject to overload and consequent loss of elements stored in it for nonassociative reasons, while LTM is, in effect, infinitely expansible, with failure of retrieval attributable mainly to incompleteness of the cue to retrieve or to interference from previously or subsequently learned associations (Melton, 1963, p. 5).

Earlier, Hebb (1949) suggested that the rapid decay of traces in STM in contrast to the permanence of the memory traces established through repetitive learning (LTM) is the most accepted differentiation. Broadbent (1958) and Brown (1958) gave support to the concept that time is a critical factor in the decay of memory traces. They reasoned, however, that decay can be postponed by rehearsal -- recirculating through the short-term store. The decay of a trace begins, according to Broadbent, whenever rehearsal is prevented by distraction or overloading of the short-term store.

Prior to his 1970 position, Ellis' (1963) stimulus trace theory received close experimental attention. At that time, Ellis hypothesized that the mentally retarded should perform more poorly than normals on a number of tasks due to a diminished, or more rapidly fading, stimulus trace. At this point, Ellis was among others (Lewin, 1935; Spitz, 1963) who adopted the theory that structural differences accounted for the poor short-term memory performance of the mentally retarded. Structural features have been described as invariant components of the memory system, not so different from the hardware of a computer (Campione and Brown, 1977). Campione and Brown (1977) suggested that poor performances of short-term memory tasks by retarded persons, such as an enhanced rate of spontaneous decay of information which could not be overcome by training, would reflect a structural difference between retarded and nonretarded persons. However, Campione and Brown further postulated that the difference in the performance of the two groups actually rests with the use of control processes. They defined control processes as "optional strategies that an individual brings to bear on memory

tasks." Control deficiencies are described as trainable, while structural features are not.

Butterfield, Wambold, and Belmont (1973), while convinced that the short-term recall of mentally retarded people could result from a breakdown in any of their STM processes, confined their list of possible causes to three:

1. They could learn imperfectly what they were expected to recall.
2. They could retain poorly what they had learned.
3. They could retrieve incompletely what they had learned and retained (Butterfield, Wambold, and Belmont, 1973, p. 654).

Past studies, however, convinced these researchers further that the STM deficiency of retarded persons must derive from inadequacies in how they acquire or store material or in how they retrieve information from their memory store (Butterfield, Wambold, and Belmont, 1973; Butterfield and Belmont, 1971; Belmont and Butterfield, 1971a).

Belmont and Butterfield (1971b) conducted tests to determine how learning strategies affect accuracy and how peculiarities of strategy might account for the mentally retardeds' memory deficiencies. They defined learning strategy as "the pattern of pauses generated by the subject as he paced himself through serial lists of letters." It was noted that normally intelligent subjects paused increasingly the deeper they went into the list while the retarded subjects did not. The conclusions reached were that the normals' active strategies contributed to their high primacy. In a second test, the procedures were reversed. The normal subjects were not allowed to rehearse

and the retarded subjects were forced to rehearse. The results revealed enhanced primacy for the retardeds, and greatly decreased primacy for the normals.

A procedure for the direct observation of rehearsal was employed by Kellas, Ashcroft, and Johnson (1973) in order to assess the degree of spontaneous and instructed rehearsal activity in experiments using retarded and normal subjects. While noting that the pause time measure procedure used by Belmont and Butterfield (1971b) provided precise measurement of the distribution of study time, the authors concluded that it provided no direct observation of the actual amount of rehearsal which occurred during input processing. The technique employed by Kellas and others required the subjects to rehearse overtly, which allowed quantitative measurement of the amount and distribution of the rehearsal of each item. Through a precise measure of the deviation of stimulant exposure for each list item for each subject, a comparison is made between overt rehearsal and covert control groups. The study which involved 40 EMR subjects demonstrated that mentally retarded individuals can successfully process information for retrieval from the STM when they have employed an active rehearsal strategy during input.

Campione and Brown (1977) reasoned that rehearsal training should produce little or no improvement if causes for poor performances by mentally retarded were structural. They summarized their theory in these words:

> While early theories emphasized structural differences, the research findings have not been confirmatory. We know of no structural differences that have been demonstrated clearly, and . . . there is abundant evidence for control deficiencies. In fact, various types of training components

> have been included in much of the recent research, and the emphasis has been on an individual's activity as he is trying to memorize a set of items (Campione and Brown, 1977, p. 372).

Mnemonic Strategy Training With Mentally Retarded Children

Much has been written during the past decade regarding research in mnemonic strategy training with mentally retarded persons. The thrust of recent studies in this area has been basically concerned with what Belmont and Butterfield (1977) term the "instructional approach." The overall direction in this approach is toward discovering and developing training methods that are proved effective for improving memory skills in the mentally retarded. Due mainly to the success of laboratory techniques, Wambold and Hayden (1975), Winschel and Lawrence (1975), and Winschel and Ensher (1977) were among those who saw the need for special education to translate these processes into classroom methods. Wambold and Hayden stated:

> A straightforward translation of these efforts that maintains the rigor of scientific study additionally offers special educators a chance to replicate the lab findings and develop advancing knowledge in these areas. Much work does indeed lie ahead; let us begin (Wambold and Hayden, 1975, p. 132).

Winschel and Lawrence (1975) suggested six strategies which they felt should be assiduously pursued in the classroom due to their success in influencing memory and because they appear to be deficient in retarded children. The list of strategies are:

1. The ability to label objects or to generate names for unconventional or unnamed stimuli.
2. The ability to group stimuli by temporal units, as when one organizes nine contiguous digits into three chunks of

three digits each.

3. The ability to recode or cluster materials as when randomly presented words are organized into rational categories for recall.
4. The ability to observe automatically more than one dimension of a relevant stimulus.
5. The ability to transfer information from one sensory process to another, as when the stimulus is presented visually but must be reproduced verbally.
6. The ability to understand or reproduce sentences employing linguistic patterns of varying complexity (Winchel and Lawrence, 1975, p. 397).

Campione and Brown (1977) identified three types of tasks that involve mnemonic strategies and which have been utilized in the majority of research. The tasks named were rehearsal, organization, and elaboration. According to the authors, rehearsal strategies are best used if the amount of material to be learned is somewhat small, and where the material is to be reproduced in an exact order (e.g. a telephone or social security number). Organizational strategies as defined by Pellegrins and Ingram (1979) refer to "processes whereby the organism attempts systematically to store and retrieve the information presented so as to maximize performance." Campione and Brown (1977) stressed the importance of using organizational strategies when there is some inherent order to the information to be remembered or wherein systematic order can be associated by the subject. Campione and Brown (1977) reported that elaborative strategies are especially applicable in a situation wherein there are associations

between unrelated items to be learned, and wherein there is time to form meaningful context in which to integrate the items.

Rehearsal Strategies

The failure of retarded adolescents to spontaneously rehearse as a learning strategy has been consistently documented (Ellis, 1970; Belmont and Butterfield, 1970a; Belmont and Butterfield, 1970b; Butterfield and Belmont, 1971; Butterfield and Wambold, 1973; Brown, Campione, and Murphy, 1974; Reichard, Cody, and Barkowski, 1975; Campione and Brown, 1977).

In a study designed to assess the durability of rehearsal strategies, Reichard et al. (1975) provided clustering and/or cumulative-rehearsal instructions to retarded adolescents with IQs ranging from 30 to 70. Four instructional conditions (cumulative clustering, cumulative rehearsal, clustering, and a no cumulative-strategy control group) were presented to the subjects. In the cumulative clustering group the subjects were trained to rehearse cumulative items within three different categories (one category at a time) by means of a "shadowing" technique. Using this technique, the subjects were required to repeat aloud whatever the experimenter said in the process of studying pictures of familiar objects in each category.

In the cumulative-rehearsal instruction group the subjects were instructed to rehearse aloud, shadowing the experimenter by repeating the names of pictures exposed by a slide projector. The procedure involved naming the current picture, rehearsing all of the

previously presented pictures plus the current one three times in a series.

In the clustering-instruction group, the subjects were told the name of the category both before and after the presentation of three pictures. A shadow rehearsal was used which consisted of the subjects repeating the name of each picture once as it was shown.

The subjects in the control group were only required to rehearse overtly; they could do so in any manner they desired. Six training trials were conducted for each of the four groups and the subjects were instructed to continue rehearsing aloud using the same technique as before. This procedure allowed the experimenters to assess each group for immediate transfer of memory strategies. Short- and long-term transfers were also assessed over a one day and two week period respectively.

The results were tabulated with regards to the four groups and subjects having high or low mental age-intelligence quotient (MA-IQ). These results showed that 100 percent of the high MA-IQ (MA around 7.0 and IQ as low as 48) cumulative-rehearsal subjects demonstrated both immediate and short-term transfer of their strategy to new lists. Studies conducted by Butterfield, Wambold, and Belmont (1973), and Kellas, Ashcroft, and Johnson (1973) had previously shown that retarded persons could be taught the cumulative-rehearsal strategy. However, after two weeks and a new serial list, 83 percent of the cumulative rehearsal subject in the high MA-IQ group continued to utilize this learning strategy. The results also revealed that 83 percent of the high MA-IQ cumulative-clustering subjects showed

immediate transfer, and short-term transfer was demonstrated by 67 percent of this group. Long-term transfer was not attained by the subjects in the cumulative-clustering group. Strategy-transfer, apparently, did not occur with the subjects in the cluster and control groups, nor was such transfer observed and recorded with subjects in any of the instructional groups in the low MA-IQ level (generally below a MA of 6.0 and IQ of 44). The authors suggest, as a result of the outcome of their study, that persons with intelligence quotients as low as 48 and mental ages of 7.0 can successfully learn, retain, and transfer cognitive strategies such as cumulative rehearsal and cumulative clustering.

Turnbull (1974) hypothesized that rehearsal strategies of retarded persons could be further strengthened by providing significant length to a training period which utilized proven methodologies. Her study was designed to measure the effects of intensive training in overt cumulative rehearsal on the performance of retarded subjects on serial order tasks. Twenty EMRs with a mean chronological age of 11.8 years and a mean IQ of 67 were divided into two treatment groups. The subjects were given a pretest, 14 training sessions, and a post-test on a 7-position serial memory task. During the training session, the experimental group was given instructions in cumulative overt labeling and was assisted in practicing this technique. The stimuli were 63 pairs of cards containing pictures of common objects and the subjects were called upon to look at a picture and name the card aloud. Upon seeing the second card, the individual was to call out the name of that card and go back and repeat the name of the first card. This

process continued up to seven cards turned face down, and the participants were told to remember the position of each card. The subjects were next shown a picture and asked to turn up one of the cards that contained a picture of the matching object.

The control group was given no instructions on rehearsal strategy. Four weeks after the training sessions, a post-test was given. Although no instructions were given to rehearse, all experimental subjects spontaneously engaged in cumulative overt labeling and outperformed the control subjects significantly.

Although the prevailing research consistently supports the theory that retarded adolescents do not spontaneously rehearse efficiently in the majority of situations, Campione and Brown (1977) cautioned their readers that it would be erroneous to conclude that they "never" rehearsed. In view of data that show the exception for highly selected retarded individuals, the authors stressed that retarded adolescents are much less likely to employ an efficient rehearsal strategy than their counterparts who are not retarded.

Organizational Strategies

It was first proposed by Miller (1956) that short-term memory is limited by a capacity of seven plus or minus two. In order to enhance the memory process, Miller saw that the limitation should be expressed in the memory system in terms of meaningful chunks instead of individual items. Bransford (1979) suggests that the use of "familiar words" is an example of meaningful chunks of information. He further points out that pausing helps the individual to chunk items, such as telephone numbers which are usually provided in two

units. Chunking, often referred to as grouping, is reported by Winschel and Lawrence (1975) to be a short-term memory strategy that should be taught in special education classrooms. They stated:

> It appears that retarded children do not incidentally acquire grouping skills as do normal children and, in consequence, it is another dimension of their intellectual behavior that requires an intensive program of remediation and instruction (Winschel and Lawrence, 1975, p. 400).

Spontaneous organization of input stimulus material (strategies that include grouping, sorting, clustering, and labeling) has been found to be poor in retarded persons (Spitz, 1966). Accordingly, when information is stored in an unorganized manner retrieval is more difficult. Burger, Holmes, Blackman, and Zetlin (1978) examined the ability of EMRs and nonretarded children to learn and retain a sorting and retrieval strategy designed to be applicable to recall and clustering. Subjects from each of the two groups were given a baseline sorting task and, based on the results, assigned to subgroups representing experimental, practice, and control. Taken from photographs of common objects, the experimenters used six different sets of cards. Each set contained sixteen pictures representing four superordinates, with four pictures for each superordinate. The experimental group was given three training sessions consisting of identifying the appropriate superordinate groupings of the pictures and remembering the number of pictures that belong to each grouping. During testing, when the subjects were unable to recall all the pictures, cues were provided by supplying the superordinate names one at a time. The subjects were taught to count the number of pictures missing and to try to recall the missing items. The subjects were consequently taught to use the training procedure of remembering the

superordinate groupings and the number of pictures in a particular group. Following the training sessions, a criterion 1 measure was obtained for both the experimental and practice groups. Three weeks later, a criterion 2 measure was administered. The two criterion measures were taken from sorting and recalling performances in a single trial. The practice group was presented with the same stimuli as the experimental group, however, with no training. The control group received only the baseline and criterion measures. The results indicated that the subjects in the experimental group outperformed those in the other groups on measures of short- and long-term recall, clustering, and sorting.

The findings of a study by Riegel and Taylor (1974) suggest that retarded children do not generally discover associative relationships between items spontaneously; however, those who can be trained to organize input at a conceptual level can cluster and, consequently, recall more during output. Glidden (1976) stressed that the relationship between organization and recall involving the retarded population may not be strong unless intensive strategy training is employed.

Elaboration Strategies

Cognitive strategies involving the use of elaboration suggest that the learners attempt to add meaning to information to be learned through the use of a symbolic construction (Weinstein, 1978). Campione and Brown (1977) recognized similarity between the concepts of organization and elaboration in that with both the goal is to either use the meaning inherent in the material or to develop or determine meaning in order to facilitate recall.

Generally, Dansereau (1978) sees elaboration as a mnemonic technique in which incoming material is embellished by creatively interrelating the items to be learned or by relating the new material to peg words or images that were previously learned. He gives the following examples:

> First letter - in order to remember the order of 12 cranial nerves (olfactory, optic, oculomotor, trochlear, etc.) many of us have learned the phrase "On old Olympus, towering top, a fat agile German vaults and hops." The first letter of each word is also the first letter of each of the major cranial nerves.
>
> Peg word - a person first learns a rhymed peg word list such as "one-bun, two-shoe, three-tree," and then learns to associate imaginatively each of these words with the members of a list to be learned. For example, in learning the items on a grocery list (e.g. steaks and potatoes) the student might first image bun and steak together as a sandwich, then potato and shoe as an Idaho potato in tennis shoes, etc. When asked to recall the second item on the list he locates the second peg word, shoe and then recalls the image of the potato in tennis shoes.
>
> Method of loci - a learner mentally places items in distinct locations along a very familiar route (e.g. the route from the person's front door to the back bedroom). In order to recall the information, the student imagines traveling back through the route, picking up the items as they occur (Dansereau, 1978, pp. 5-6).

Elaboration as a strategy requires the learner to create a symbolic construction using previous knowledge, that can be combined with new information to make that information more meaningful (Weinstein, Underwood, Wicker and Cubberly, 1979). As with the other strategy areas discussed, it has been generally concluded that retarded children do not spontaneously employ elaboration strategies (Burkoweski and Kamfonek, 1972; Campione and Brown, 1977; MacMillan, 1970; Ross, 1971; Ross and Ross, 1978; Turnure, Buium, and Thurlow, 1976). Although young children of normal intelligence experience

similar difficulty in the use of verbal mediators (use of language to form associations), the problem usually disappears with age (Flavell and Wellman, 1977; Ross, 1971; Turnure, Nissan, and Thurlow, 1976).

MacMillan (1970), in a study designed to determine the effect of verbal mediation on paired associate learning by EMR children, stressed the difficulty of these children to generate a sentence which included the pair of items to be associated. An example of a stimulus could be the word, "cup," and the corresponding response to be associated with the stimulus may be the word, "glasses." In this particular example and in the experiment, the children in the experimental group and those in the experimental-control group were required in pretraining to repeat a sentence while looking at pictures of both words: "The cup wore glasses." The children in the experimental group were exposed to each of the stimulus and response items in pairs by use of pictures. As each paired objects was shown, the experimenter provided a verbal mediator in the form of a simple sentence: "The boat is full of scissors." The children in the experimental-control group were provided sentences along with stimulus and response items only during pretraining. During the test portion there were no sentences provided. The experimenters wanted to know if these children would generate sentences as effective mediators for recalling the responses. A third group of children, the control group, was not provided with verbal mediators. However, the subjects were taught to rehearse the stimulus-response association.

The results showed that the children in the experimental group outperformed the other groups due to their learned ability to use the verbal mediators that were provided by the experimenters. The

experimental-control subjects did not perform well at generating sentences which were effective mediators. Therefore, the study suggests that EMRs can utilize verbal mediators rather effectively when provided. Barkowski and Wanschura (1974), using experimenter-provided mediational aids, also concluded that EMR individuals can successfully employ elaborative strategies. The work of MacMillan (1970) and Barkowski and Wanschura (1974) strongly support Flavell's (1970) research which concluded that the poor performance of young children in mediation tasks was due to their inability to spontaneously produce effective mediators (production deficiency) rather than an inability to use certain experimenter-provided mediators (mediational deficiency).

Bransford (1979) discusses another form of mnemonic strategy which appears to facilitate learning and remembering. In a discussion of the concept of imagery, Bransford explained Paivio's (1971) dual-code theory, which suggests two memory systems, one to process verbal input and the other, visual. According to Paivio, a word such as "chair" can be stored in both the verbal and visual systems; a word like "serious" would not easily bring about a visual image and would store verbally. The concept of imagery is not soundly based on Paivio's dual-code theory; however, his findings regarding the imagery value of words are considered important (Bransford, 1979).

Following up on the work of Bending and Taylor (1973) in the area of imagery and EMR children, Ross and Ross (1978) compared the effects of long-term training in the use of imagery and rote-repetition strategies by primary grade EMR children. The authors predicted that imagery would facilitate acquisition with greater proficiency

than would rote-repetition. Since Bending and Taylor (1973) demonstrated the effectiveness of imagery-based elaborative sentences for facilitating recognition of associative groupings, Ross and Ross were somewhat certain of the efficacy of imagery in establishing a relationship among items to be remembered. The authors were also certain that rote-repetition, as a rehearsal strategy, would be superior to the control group which received no mnemonic strategy training. The results confirmed the author's prediction as the imagery post-training mean (12.46) was superior to the rote-repetition (9.18) and control (6.09).

An example of the imagery condition, rote-repetition condition and control conditions used by Ross and Ross (1973) in the aforementioned experiment is provided below.

Imagery Condition. A child motivated by tokens to remember three pictures such as car, apple and squirrel, was given only a moment to look at them. The child had been taught to use stories and related table games in the development of imagery strategies. He was told to use a story or game to remember the two or more objects together. The child pretended that he turned on a television set and immediately saw the objects to be remembered. He continued to imagine that he told his friend what was happening in the television scene. He later told his parent how creating a mental picture of objects had helped him to remember. Following each story, were questions, strategy discussions, and a practice game designed to improve the use of imagery. Ross and Ross (1973) provided the following story as one of those used in the imagery training sessions:

> Sandra' class was playing Take a Picture. In this game the teacher gave each child three pictures to look at and remember. She gave Sandra pictures of a cake, a mouse, and a chair, and she gave Anne pictures of a boat, a seagull, and a boy. As soon as the children had looked at their pictures, the teacher took them away. When she held up one of Sandra's pictures, like mouse, then Sandra had to say the other pictures that went with mouse, which were chair and cake. If Sandra could remember the pictures she got a token and some new pictures to remember. The first child to get three tokens won the game.
>
> Sandra tried hard to think of a way to remember that cake, mouse, and chair went together. Then she said to herself, "I think I'll put them all in a picture like on television. I'll pretend I'm turning on the TV and the minute the picture comes on, it will have the cake and the mouse and the chair in it." Sandra pretended to turn on the TV, and there was a picture with a mouse hiding under a chair eating a piece of cake. Sandra thought about the picture. She could imagine how hungry that mouse was! Just then the teacher looked at Sandra and held up a picture of a chair, and quick as anything Sandra said "cake and mouse."
>
> "Good work Sandra!" said her teacher. You didn't have to stop for a minute to think of the pictures that went with chair. Can you tell us how you remembered so quickly?" (Ross and Ross, 1973, p. 463).

The experimenter asked questions following the story that were designed to stimulate discussion regarding the imagery strategy. The opportunity to practice the strategy was provided in a game which followed the questions and discussion.

Rote-Repetition and Control Conditions. The children in the rote-repetition group were taught to remember a series of objects and events using the same general procedure previously described. Different, however, were the stories and games; in this situation, a rhythmic type of rote-repetition was employed. The subjects in the control group participated in story and game activities in order to ensure equal time in experimenter contact. Although no training in mnemonic strategies was utilized, the group also received equal rewards during

sessions, as did the imagery and rote-repetition groups, and equal time to develop familiarity with pictures, objects and games.

As indicated previously, imagery proved superior to rote-repetition as a learning strategy. Bender and Taylor (1973) found imagery to be more effective than a strategy (highlighting) which required the subject to concentrate on the shape and details of the picture rather than an integrated image and story. The strength of imagery may be reasoned in the concept that concrete words may be coded in both imagery and verbal forms, whereas abstract words may be coded only in verbal form (Bower, 1972).

Strategy Maintenance and Generalization

Campione and Brown (1977) suggested that a distinction be made between the terms "maintenance" and "generalization." Although both terms are often used to indicate the transfer of a trained strategy to a situation different from the precise training period, they actually describe different circumstances. Following the suggestions of Campione and Brown, Kramer, Nagle and Engle (1980) offer the following explanation:

> . . . we use strategy maintenance (or retention) to refer only to situations where there is no change in the experimental task used during training and testing and strategy generalization (or transfer) to describe instances that are designed to evaluate the use of a strategy on a task that is clearly different from the one used during training (Kramer, Nagle, and Eagle, 1980, p. 307).

Much of the research so far reported has involved the concept of strategy maintenance. Thus far, we have seen that mentally handicapped adolescents can effectively learn strategies of rehearsal,

organization, and elaboration. The findings have been fairly consistent, even for long-term retention. Brown, Campione, and Murphy (1974) found that eight out of ten moderately retarded adolescents trained to rehearse a task of keeping track of changing variables were able to maintain their rehearsal strategy six months after training had terminated. However, these same researchers stressed the need for new concentration on training strategies which would allow the mentally retarded flexible transfer to new situations.

Investigations conducted later by Brown, Campione, and Murphy (1977) were designed to determine not only long-term maintenance of training but whether generalization to similar tasks was to be found. The subjects consisted of a young group of educable retarded children, MA 6 and an older group having similar IQ but a MA average of 8. The tasks that followed training involved span estimation. That is, the children were called upon to estimate the number of items in a serial each of them could remember. While testing for maintenance and generalization, the training tasks were geared to provide metamnemonic awareness (an awareness of one's own memory limitations). Although all subjects were given two days of training, half of the children received explicit feedback and the remainder did not. The results showed that the older subjects improved under both explicit and implicit feedback conditions. The younger children gained only from explicit feedback. After one year, maintenance of training was demonstrated by the older persons, while the younger children showed improvement only on a test given immediately following training. Generalization to similar span-

estimation tests was not apparent even though, as mentioned previously, maintenance was found for the older subjects.

Brown, Campione, and Barclay (1979) demonstrated mnemonic strategy generalization with a group of EMR subjects CA 13 and MA 8-9. The children were trained to use a recall-readiness strategy (systematically studying material until it is judged to be known well enough to risk a test) to check and monitor their memory. The training task required the children to study a list of familiar pictures until they felt ready to recall them. After one year, this group of children not only showed strategy maintenance but also demonstrated the ability to generalize the strategy to a situation involving gist recall of prose passages.

In the process of training for generalization, Brown et al. (1979) strongly suggested two considerations: (1) as the training activities are developed, determine also the follow-up generalization probes, and (2) the trainees should know in advance that generalization is one of the goals of training. Brown, Campione, and Barclay also stressed the need for developing metacognitive skills which are usually lacking in EMR children, such as checking, planning, asking questions, self-testing, and monitoring ongoing attempts to solve problems. Belmont, Butterfield, and Barkowski (1979) focus on these activities in their study to develop a "model for generalization" for retarded adolescents. These investigators concluded that generalization can be achieved with careful attention to the particulars of a method and ample feedback on how the individual is performing.

Metacognitive Factors

Metacognition or metamemory are terms used interchangeably referring to a person's awareness of his own memory processes (Campione and Brown, 1977) and the specific strategies he used to store and retrieve information in different situations (Yussen and Berman, 1981). Flavell and Wellman (1977) write about the young person developing a "mnemonic self-concept" as taught through experience in using his memory and memory-enhancing strategies. The point to be made here is that with experience a person will gain knowledge about his ability to perform certain mnemonic tasks as compared to other persons. Several investigators have concluded that children improve with age in memory-monitoring skills (Flavell and Wellman, 1977; Cavanaugh and Barkowski, 1979; and Yussen and Berman, 1981).

In a number of studies led by Brown and her associates, a case has been made stressing the value of training retarded children in metacognitive skills and providing more general knowledge concerning strategies and their use, rather than specific routines designed to accomplish specific tasks (Brown and Barclay, 1976; Campione and Brown, 1977; Brown, Campione and Murphy, 1977; Campione and Brown, 1978; Brown, Campione, and Barclay, 1979). Three basic metamemorial abilities were identified by Brown and Barclay (1976) as essential in the intelligent memorizer. These abilities were listed as:

> (a) introspection: he must have knowledge concerning his own memory processes, his capacity, limitations, and his repertoire of strategic skills; (b) memory monitoring: he must be able to monitor his attempts to be strategic so that he can evaluate the ability of a chosen strategy; (3) executive control: he must be able to organize his activities in the most efficient manner by selecting a task-appropriate skill and

> deciding to maintain, modify, or abandon that skill in response to feedback, that is changing task demands on the success or failure of the strategy (Brown and Barclay, 1976, p. 72).

In the Brown and Barclay study (1976), explicit training was provided to two groups of educable retarded children (MA 6 and MA 8). The task involved the children studying a list of pictures until they felt they could recall the list in order (a recall readiness task involving estimating the degree of learning while performing the task). Only the older children (MA 8) were able to maintain their trained strategy and monitor the effectiveness of their own intervention sufficiently to predict recall readiness reliably.

Kendall, Barkowski, and Cavanaugh (1980) concluded the following from the research of others regarding EMR children: (1) strategy maintenance is a prerequisite for strategy generalization (Barkowski and Cavanaugh, 1979); (2) strategy training on a number of different tasks that require similar strategies may enhance generalization (Brown, 1978); (3) metamemory may be the process that develops when strategy training is broad based and directs generalization (Brown, 1978).

The Kendall, Barkowski and Cavanaugh (1980) study involved the use of an interrogative strategy in which children were trained to aid their learning of a paired-associated (PA) list. The answers to the following questions were sought in the study:

(1) Will the children learn to use the self interrogation strategy as an aid to PA learning?

(2) Will the strategy be maintained and generalized?

(3) What is the relationship between strategy use and recall performance on the maintenance and generalization tests?

(4) Is metamemory assessment useful for predicting strategy training, maintenance, and generalization?

(5) Does feedback concerning the value of the strategy facilitate generalization and post-test metamemory (Kendall, Barkowski, and Cavanaugh, 1980, p. 257)?

The researchers (Kendall, Barkowski and Cavanaugh) believed that if the subjects were given extended training followed by feedback, they would be more likely to use the interrogative strategy on the generalization test. The study proved that many EMR children can be taught to use, maintain, and generalize an interrogative learning strategy. Metacognition was seen as important and, in some instances, necessary for strategy transfer.

Kramer, Nagle, and Engle (1980), in their review of recent research on the training of mentally retarded people to use mnemonic strategies, have concluded that the most productive instructional approach for promoting strategy generalization is to concentrate on developing metacognitive skills such as estimation, comparison, and decision making. Brown, Campione, and Barclay (1979) also concentrated on general metacognitive activities and included such routines as checking, monitoring, and reality testing. Under the heading of self-regulation, Brown, Campione, and Barclay have begun to teach the child, although at a very simple level, to self-interrogate or ask himself a routine set of questions when faced with a particular class of problems. An example of the questions the child might ask himself via self-interrogation is provided.

1. Stop and think.
2. Do I know what to do (i.e. understand the instruction, both explicit and implicit)?
3. Is there anything more I need to know before I can begin?
4. Is there anything I already know that will help me (i.e. is this problem in any way like one I have done before) (Brown, Campione, and Barclay, 1979, p. 510)?

Cognitive Considerations and Strategies for Learning Motor Skills

A number of researchers are convinced that the learning of motor skills requires in various degrees the utilization of cognitive processes (Adams, 1971; Laabs, 1973; Marteniuk, 1973; Roy and Diewert, 1975; Kelso, 1977; Singer, 1978; Singer and Gerson, 1979).

Adams (1971) provided an example of how humans covertly guide their motor behavior in the early stages of learning with verbal responses: "I'll make a shorter movement next time." According to Adams, the individual monitors the correctness of his motor movement. He states that initially motor sequences are under the conscious attention of verbal control. As the motor behavior becomes habitual, conscious attention diminishes and as practice and movement become automatic, consciousness drops out.

Laabs (1973) and Marteniuk (1973) have been among the researchers concerned with determining the various cues upon which movement reproduction is based and which might be stored in short-term memory. In theory, information such as rate, time, and direction of the movement is needed by the person in order to reproduce the movement (Marteniuk, 1973). In a study of the storage and retention characteristics of two other movement cues, location and distance,

Marteniuk found that both cues had access to the central processing capacity in that forgetting did not occur until rehearsal was blocked by the introduction of a secondary task.

Singer (1978) contends that many of the strategies related to the learning of cognitive materials are similar to those used to develop motor skills. He discusses two categories of motor tasks requiring different learner strategies. The two categories are self-paced and externally-paced activities. Tasks which allow the learner to initiate when ready and to progress at his own rate of speed, such as typing a letter or assembling or disassembling a carburetor, are generally considered to be self-paced activities. Singer sees an externally-paced activity as one which requires a person to respond instantaneously to unexpected situational demands, such as driving an automobile or playing tennis. For the self-paced activity, the individual has time to preview the situation and pace himself. In practicing self-paced activities, the main focus is on response consistency. The emphasis in practice with an externally-paced activity is on familiarity with a large selection of situations and cues, with response adaptability of greater concern (Singer, 1978). According to Singer, some activities contain both self-paced and externally-paced characteristics, and such considerations should be reflected in the training techniques employed. Adams (1971) pointed out that some psychomotor activities are open-loop and others are closed-loop. In explanation, he stated that an open-loop system has no feedback or mechanism for error regulation, while a closed-loop system has feedback, error detection, and error

correction as key elements. An example of an open-loop motor activity is one in which there is no time to use feedback to correct and make adjustments during performance, such as playing a composition on the piano. The results of the performance are obtained at the end of the activity (Singer, 1978). The same author gives an example of a closed-loop task such as driving a car while continuously making adjustments for effective performance. The trainee, according to Singer, needs to make use of the proper strategies for feedback usage to master closed-loop skills. He must "learn to become less consciously aware of the situation, for open-loop skills. He must be able to develop, store, and retrieve the motor programs as needed."

The selection of a particular learning strategy should be partially determined by the particular situation confronting the learner (Bruner et al., 1956). As discussed with verbal learning, Singer and Gerson (1979) reasoned that it would be educationally sound to instruct learners initially in the use of learning strategies for the acquisition of a skill. When the learner understands the nature of and the reasons for the use of certain strategies for learning to perform a skill, he or she, ideally, should be able to self-generate or generalize the use of these strategies to other environments (Singer and Gerson, 1979). To that end, Singer and Gerson recommended that strategies be categorized according to their facility in aiding the learning of a class or skill. Utilizing this concept, strategies should be grouped according to the ways that they can be applied to tasks with similar characteristics. Singer visualized the learner selecting among alternative strategies of

proven value as they relate to his or her own personal capabilities. He also saw as a logical step the packaging of modules that include strategies which would be applied to the learning of skills. The development and utilization of instructional modules is currently viewed as an important component of some competency-based vocational education programs. Meanwhile, some vocational education programs have documented successful applications of cognitive strategies in the teaching of technical concepts and information.

Kwasnaski (1981), using the relatively simple electrical circuit theory, has developed an analogy strategy explaining the concept of heat flow. According to Kwasnaski, current flow, measured with an ammeter or figured mathematically, "can be translated directly into heat flow in BTU/sq. ft./h to analyze the heating/insulating requirements of various structures." In the classroom, graphs and drawings may be used to illustrate the relationship. Kwasnaski stressed the value of using the electrical circuit theory, and its study for a vocational education class concerned with energy conservation.

Souder (1981) offered an analogy in his electronics classroom using water flow to explain Ohm's law: "The greater the pressure, the greater the volume of water that will flow, just as more electrons flow with a higher voltage." The comparison is extended to include another analogy, "the larger the pipe, the greater the water flow; the heavier the conductor, the greater the current." Souder uses these and other analogies, comparing water flow and current flow, in

order to help students to better understand relatively difficult concepts.

A teaching strategy involving the use of color, shape, position and size as cues enabled 25 EMR students to learn to assemble a small engine in half the time it took the 25 students of equivalent mental age in the control group (Spewock, 1981). Working with four industrial arts and special needs teachers, Spewock, a vocational teacher educator, worked as part of a team to develop the following cues:

1. Position cue - A compartmentalized box measured 2" x 24" x 45" to serve as an organizer for the engine components. The size of each compartment was designed to house a particular engine component with smaller components, such as ignition points grouped together.
2. Number cue - The compartments were each provided a different number to help students recall the correct sequence for replacing the components to the block.
3. Color cue - A painted stripe of matching color was applied to the surfaces of parts designed to be joined in assembly. Wherein the position and number cues aided the sequence of assembly, the color cues were provided to help the students locate where the components fit on the engine block.

Although Spewock does not explain how the size and shape cues were used to help EMR students learn to assemble the engine parts, Winschel and Lawrence (1975) stressed the importance of teachers

verbalizing such dimensions as color, size, shape, composition and use "until such ability becomes an automatic and spontaneous reaction in the child."

The instructor demonstrated the assembly and disassembly procedure to the students and the purpose of the cues. Following the demonstration, the students practiced the activity working alone. As each student gained confidence and proficiency in following the cues, the cues were diminished one by one.

Spewock reported that the students using the cue needed about ten trials to go from all cues to no cues in assembling the engine, while some students in the control group could not complete the exercise. Accordingly, it was further reported that a major problem for students in the control group was remembering the assembly sequence as they worked without the aid of cues.

SUMMARY

The human memory system contains a short-term memory and a long-term memory. In order for information to be retained, it must be actively involved in some form of rehearsal strategy while it is in the short-term store. Information properly rehearsed in the STM normally passes into the LTM to be retrieved when needed. Studies have shown that the mentally retarded do not spontaneously apply efficient rehearsal strategies as do normal individuals; therefore, much of the information which passes into the STM is lost to decay. The prevalent research does not support the theory that the mentally retarded's memory deficiency is caused by structural differences.

However, sufficient evidence apparently supports the theory of control deficiencies in the mentally retarded which can be overcome, in part, through strategy training.

The development of memory enhancing strategies for the mentally retarded from theory to the laboratory has been rapid. Slow, however, has been the implementation of experimentally proven mnemonic strategies in the classroom. Cognitive strategies involving rehearsal, organization, and elaboration have been consistently documented to be experimentally effective in teaching adolescent educable mentally retarded persons how to learn. Although EMRs could readily maintain strategies learned, strategy generalization was often difficult to achieve. However, a recall-readiness strategy yielded both strategy maintenance and strategy generation one year after acquisition. Studies show that teaching mentally retarded children metacognitive skills and providing them with general knowledge concerning strategies and their use will improve their ability to generalize strategies to other tasks. Some valuable metacognitive skills are estimating, comparing, decision making, checking, monitoring, and reality testing.

Cognitive processes are involved in the learning of motor skills as well as verbal. Often the sequences of motor movements are under the conscious attention of verbal control. The training techniques to be employed should require the consideration as to whether the psychomotor activity is self-paced, externally-paced, or contains some characteristics of both. Some motor activity are open-loop and others are closed-loop. An open-loop motor activity does not provide

for error regulation, whereas the closed-loop system readily allows for feedback and corrective responses. Hence, the learner's skill could be greatly enhanced by employing efficient strategies. Strategies should be grouped and classified according to how they may be applied. Modules may be developed utilizing strategies that may be applied toward the learning of certain skills. Instructional strategies, such as analogies and cues should be readily employed by teachers in the classroom setting.

CHAPTER III

METHODOLOGY

This study was conducted to determine the effects of cognitive training on the ability of educable mentally retarded adolescents to learn and retain vocational competencies, and to determine the effects of selected cognitive teaching strategies on learning and retention. The investigation also sought to determine if cognitive teaching and/or cognitive training affected the learning and retention of skill and information competencies equally or if there are significant differences.

Participants

Forty subjects were randomly selected from approximately 90 tenth grade EMR students who entered vocational education training for the first time at the beginning of the 1982-83 school term. The students are members of Richmond Public Schools, Richmond, Virginia and have all been diagnosed by special education specialists as educable mentally retarded. All of these students were enrolled in the Richmond Career Education Center (RCEC), a school designed to provide vocational skills and training for the disadvantaged and handicapped.

Three criteria were established for the selection of subjects. First, the participants had to be members of the tenth grade EMR population having chronological ages ranging from 16 to 19 years. Second, each subject and the subject's parent or guardian had to willingly agree and give permission for the child to be a participant in the experiment.

Third, all the subjects had to be 1982 enrollees for the first time in a vocational education program at RCEC. The total I.Q. range of the 40 subjects was 61 to 70 as determined by the Wechsler Adult Intelligence Scale. The group consisted of 24 males and 16 females. Of these numbers, two of the males and two of the females were white and the remainder of the sample group was black. This group of 40 students was further assigned to four subgroups of 10 persons each.

The cognitive training sessions were designed and conducted by Joseph Cooper. Mr. William Burton, Jr. and Mrs. Gloria Johnson, teachers of auto servicing (10 years) and food services (11 years) respectively, provided the instructional presentations. Both teachers hold the bachelor degree and together represent over 21 years of experience as vocational educators.

Experimental and Control Groups

The three experimental groups and one control group were subjected to the following treatments:

Group I (E_1) - The students were actively involved in eight 1½ hour sessions of cognitive training over a four week period. After completing the training sessions, the students were exposed to four classroom lessons: two involving informational presentations and two manipulative. The four lessons were conducted by two vocational instructors using selected cognitive teaching strategies.

Group II (E_2) - The students in this group experienced the same cognitive training sessions as those in Group I. After the training has been completed the students were exposed to four classroom lessons: two involving informational presen-

tations and two involving manipulative. The four lessons were conducted by the two vocational instructors using traditional teaching methods.

Group III (E_3) - The students did not experience cognitive training. These students were exposed to four classroom lessons: two informational presentations and two manipulative. The four lessons were conducted by the two vocational instructors using selected cognitive teaching strategies.

Group IV (C) - The students in this group did not experience cognitive training. However, along with the subjects in Group II, these students were exposed to the four classroom lessons: taught by two instructors using traditional teaching methods.

Figure 3.1 illustrates the treatments assigned to each of the four groups. Briefly, the students in Group I were exposed to cognitive training and cognitive teaching. The Group II students also experienced cognitive training; however, they were subjected to traditional teaching methods. The students in Group III were exposed to cognitive teaching and those in Group IV traditional teaching methods. The students in both Group III and Group IV did not undergo cognitive training.

The Treatments

Cognitive Training Sessions. The 20 subjects randomly assigned to Groups I and II experienced four consecutive weeks of cognitive training consisting of two 1½ hour sessions each week. Approximately 40 minutes into each training session, a 10 minute break was provided. The eight training sessions covered the following topics and

COGNITIVE TEACHING	TRADITIONAL TEACHING	
GROUP I (E_1)	GROUP II (E_2)	COGNITIVE TRAINING
GROUP III (E_3)	GROUP IV (C)	NO COGNITIVE TRAINING

Figure 3.1 Illustration of Treatments Applied to the Four Groups

activities (See Appendix D for detailed description of the training sessions).

Session 1: Introduction of the training program, grouping and imagery concepts. Initiation of metacognitive activities.

Session 2: Review and practice of grouping and imagery strategies. Introduce and practice an overt cumulative rehearsal strategy. Involve group in self-testing and checking (metacognitive) activities.

Session 3: Introduce and practice reflectivity through listening skills, visual discrimination and verbalization strategies.

Session 4: Continue to practice reflectivity, visual discrimination and verbalization. Make use of metacognitive activities.

Session 5: Review reflectivity, grouping, imagery, cumulative rehearsal, visual discrimination and verbalization strategies. Encourage the use of metacognitive activities.

Session 6: Review and practice all learning strategies covered. Emphasize the use of metacognitive skills.

Session 7: Review and test for generalization and metacognitive skills.

Session 8: Stress generalization and metacognitive skills. Review importance of pausing and selecting the learning strategy that is most appropriate for the task to be performed.

Traditional versus Cognitive Teaching. The teachers involved in the study each used individual teaching styles while presenting a lesson consisting of technical information and a lesson geared to skill performance. Therefore, four competencies were "taught" to the students in Group II and Group IV by teachers using conventional or traditional teaching styles. The same vocational competencies were "taught" to the students in Group I and Group III. However, for these students the teachers made use of cognitive considerations in their presentations and student applications. These cognitive considerations from this point subsequently will be termed "cognitive teaching." Cognitive teaching, as opposed to traditional teaching, involves the use of special cues and techniques by the teacher similar to the concepts covered in the cognitive training sessions.

The vocational teachers were taught the concepts involved in cognitive teaching only after they had completed their work (using traditional teaching) with Groups II and IV. The reason for this short delay was to prevent contamination of traditional teaching with some aspects of cognitive teaching while these teachers were working with Group II and IV.

The four vocational competencies taken from the vocational training areas of auto servicing and food services are coded for identification purposes and listed below:

AI - Identification of Basic Tools in Auto Servicing

AS - Removing and Replacing Automobile Wheel

FI - Understanding Basic Cooking Terms

FS - Measuring Dry Ingredients

Testing Procedures

The testing schedule for the forty subjects consisted of two pretests and three posttests (see figure 3.2). $Pretest_s$ and $pretest_c$ were designed to establish a baseline of prior knowledge and ability.

To determine prior knowledge and awareness of certain cognitive learning strategies, $pretest_s$ was administered individually to each of the participants by the researcher.

$Pretest_c$, which consisted of six different components, was administered by the teachers. Two of the components were designed to test knowledge of the competencies AI and FI. Two additional parts were provided to determine skill performance of competencies AS and FS. The final two components were designed to test knowledge or recall without clues of skill procedures and tools needed to perform competencies AS and FS.

Following the pretests, students in groups I and II participated in the eight remedial cognitive training sessions as described previously in this chapter.

$Posttest_s$ was administered individually to each of the 40 participants over a two day period following the completion of the cognitive training sessions. Again, this test was administered by the researcher.

$Posttest_{c1}$ was given to the subjects in four stages over a 19 day period. Table 3-1 provides a detail review of the four stage teaching and testing schedule used to teach the four competencies and to administer $posttest_{c1}$. During stage I and on day one, groups II and IV were provided traditional teaching of competencies AS and FS. On the fourth day, these students were tested for skill performance and recall of tools and pro-

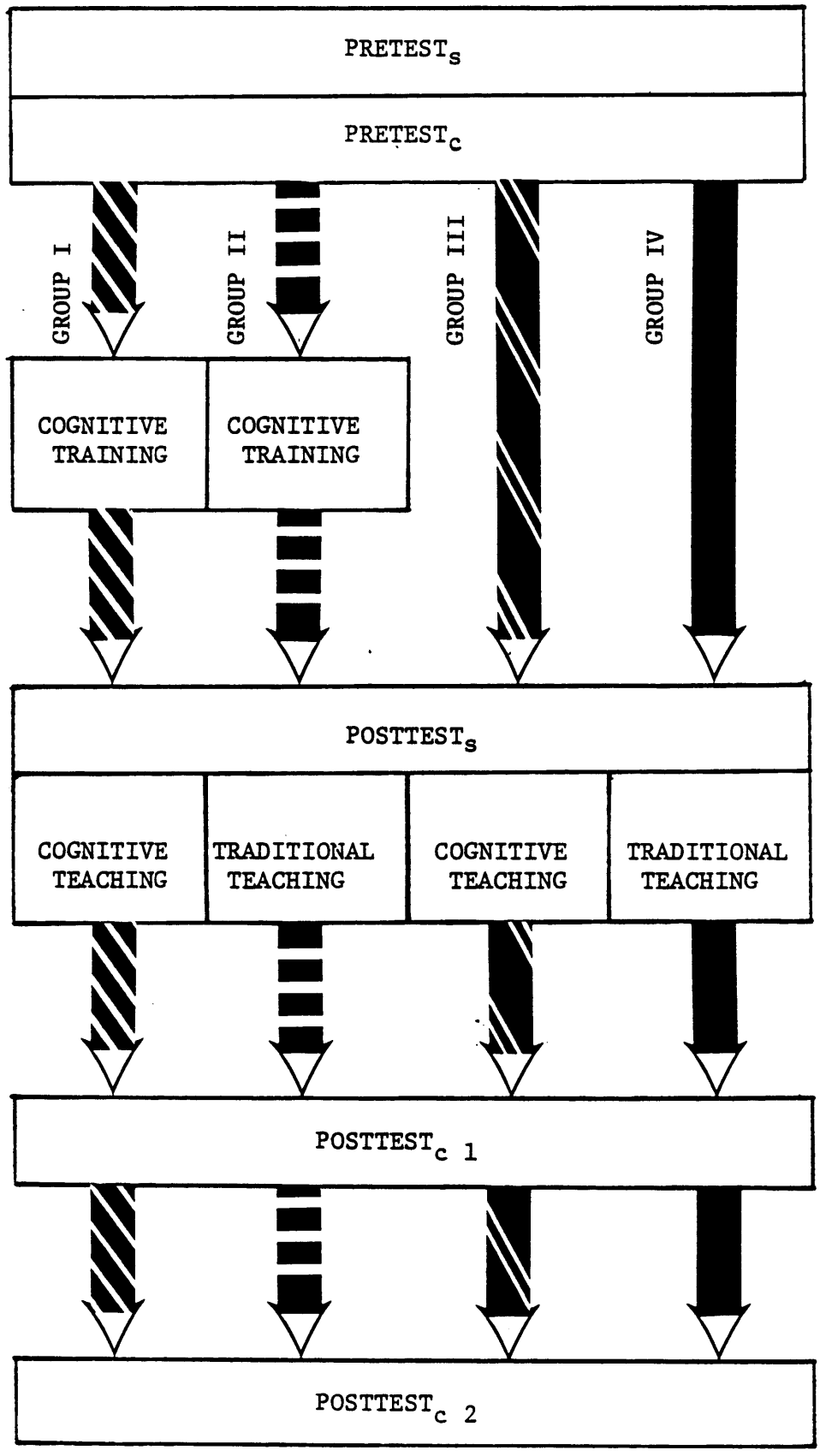

Figure 3.2 Flow of Activities from the Pretests to Posttest$_c$ 2

TABLE 1

TEACHING AND TESTING SCHEDULE FOR POSTTEST C1
(FOUR STAGES)

STAGES		DAY	ACTIVITY	COMPETENCIES	GROUP
I	1	MONDAY	TRADITIONAL TEACHING	AS & FS	II & IV
	2	TUESDAY	NO ACTIVITY	_____	_____
	3	WEDNESDAY	NO ACTIVITY	_____	_____
	4	THURSDAY	TESTING - PERFORMANCE & RECALL	AS & FS	II & IV
II	5	FRIDAY	TRADITIONAL TEACHING	AI & FI	II & IV
	6	SATURDAY	NO ACTIVITY	_____	_____
	7	SUNDAY	NO ACTIVITY	_____	_____
	8	MONDAY	TESTING - INFORMATION	AI & FI	II & IV
	9	TUESDAY	TEACHER INSERVICE ON COGNITIVE CONSIDERATION		
	10	WEDNESDAY	TEACHER PREPARATION		
	11	THURSDAY	TEACHER PREPARATION		
III	12	FRIDAY	COGNITIVE TEACHING	AS & FS	I & III
	13	SATURDAY	NO ACTIVITY	_____	_____
	14	SUNDAY	NO ACTIVITY	_____	_____
	15	MONDAY	TESTING - PERFORMANCE & RECALL	AS & FS	I & III
IV	16	TUESDAY	COGNITIVE TEACHING	AI & FI	I & III
	17	WEDNESDAY	NO ACTIVITY	_____	_____
	18	THURSDAY	NO ACTIVITY	_____	_____
	19	FRIDAY	TESTING - INFORMATION	AI & FI	I & III

cedures. The same individuals received traditional teaching of competencies AI and FI on the fifth day during stage II and were tested on day eight.

Three days, nine through eleven, were used for teacher in-service and preparation for the use of the cognitive considerations to be included in cognitive teaching.

Stage III began on the twelfth day as groups I and III were taught cognitively competencies AS and FS. On day fifteen, these subjects were tested for skill performance and recall of the tools and procedures previously presented during cognitive teaching. On the sixteenth day and during stage IV, competencies AI and FI were cognitively taught to the subjects in groups I and III. The same individuals were tested on the nineteenth and final day.

A four week time duration was provided following each test phase of $posttest_{c1}$ prior to the administration of the corresponding test phases of $posttest_{c2}$. The same test was used for $pretest_{c}$, $posttest_{c1}$ and $posttest_{c2}$. $Pretest_{s}$ and $posttest_{s}$ were also identical.

The six-part test used by the teachers as pretest and posttests were developed by the teachers. For the purpose of providing for greater accuracy in scoring, objective type test items were used in the test for technical information. The test items for this portion included true-false, identification and matching. The test for skill performance first measured the individual's knowledge of tools and the procedures necessary to complete a task, and second measured the individual's ability to perform the task. Checklists were used by the teacher to record accuracy of skill performance. All phases of the six part test were presented in

writing and orally to compensate for reading difficulties and to enhance validity. The test for knowledge of learning strategies was developed and field tested using 20 subjects from the population who were not involved in the study. The results of the field test allowed the researcher to determine acceptable and unacceptable answers. The result of each individual's effort was recorded on a rating form allowing a point value of zero to three for each item.

Analysis of the Data

The 40 subjects were divided into two groups or blocks of 20 subjects each according to the $pretest_c$ scores. A group consisted of scores above the median and the other group below the median. The 20 subjects in each block were then assigned at random to the four treatment groups assuring equal numbers in each group from each of the two blocks.

The equivalence of the four treatment groups was determined from the $pretest_c$ scores using the one-way analysis of variance statistical technique. Prior to data treatment, an alpha level of .05 was established.

The one-way analysis of variance was used to analyze pretest and posttest scores. The data were used to determine the following mean differences with regard to the four groups:

1. Strategy Awareness
2. Skill Learning
3. Information Learning
4. Recall Learning of Tools and Procedures
5. Skill Learning Retention

6. Information Learning Retention

7. Retention Recall of Tools and Procedures

Given F test significance, the Scheffe' post hoc test was used with a significance level of .10.

Hypotheses

The following hypotheses were formulated and stated in the null in order to test the statistical significance of the findings of the study:

HO_1: There is no difference in the mean scores on knowledge of learning strategies among EMR subjects who have been cognitively trained to use learning strategies and those who have not been cognitively trained.

HO_2: There is no difference in the mean scores on performance of skill competencies among EMR subjects who have been cognitively trained to use learning strategies and cognitively taught the competencies and those who have not been cognitively trained but have been cognitively or traditionally taught.

HO_3: There is no difference in the mean scores on performance of skill competencies among EMR subjects who have been cognitively trained to use learning strategies and traditionally taught the competencies and those who have not been cognitively trained but have been cognitively or traditionally taught.

HO_4: There is no difference in the mean scores on knowledge of informational competencies among EMR subjects who have been cognitively trained to use learning strategies and cognitively

taught the competencies and those who have not been cognitively trained but have been cognitively or traditionally taught.

HO_5: There is no difference in the mean scores on knowledge of informational competencies among EMR subjects who have been cognitively trained to use learning strategies and traditionally taught the competencies and those who have not been cognitively trained but have been cognitively or traditionally taught.

HO_6: There is no difference in the mean scores on recall of tools and procedures among EMR subjects who have been cognitively trained to use learning strategies and cognitively taught skill competencies and those who have not been cognitively trained but have been cognitively or traditionally taught.

HO_7: There is no difference in the mean scores on recall of tools and procedures among EMR subjects who have been cognitively trained to use learning strategies and traditionally taught skill competencies and those who have not been cognitively trained but have been cognitively or traditionally taught.

HO_8: There is no difference in the mean scores on retention of skill competencies among EMR subjects who have been cognitively trained to use learning strategies and cognitively taught the competencies and those who have not been cognitively trained but have been cognitively or traditionally taught.

HO_9: There is no difference in the mean scores on retention of skill competencies among EMR subjects who have been cognitively trained to use learning strategies and traditionally taught the competencies and those who have not been cognitively trained but have been cognitively or traditionally taught.

HO_{10}: There is no difference in the mean scores on retention of informational competencies among EMR subjects who have been cognitively trained to use learning strategies and cognitively taught the competencies and those who have not been cognitively trained but have been cognitively or traditionally taught.

HO_{11}: There is no difference in the mean scores on retention of informational competencies among EMR subjects who have been cognitively trained to use learning strategies and traditionally taught the competencies and those who have not been cognitively trained but have been cognitively or traditionally taught.

HO_{12}: There is no difference in the mean scores on retention recall of tools and procedures among EMR subjects who have been cognitively trained to use learning strategies and cognitively taught the competencies and those who have not been cognitively trained but have been cognitively or traditionally taught.

HO_{13}: There is no difference in the mean scores on retention recall of tools and procedures among EMR subjects who have been cognitively trained to use learning strategies and traditionally taught and those who have not been cognitively trained but have been cognitively or traditionally taught.

SUMMARY

The research methodology and procedures used to examine the effects of cognitive training and cognitive teaching on the ability of EMR students to learn and retain vocational competencies were presented in this chapter. The experimental and control groups were reviewed and

the treatments were described. The data collection procedures and data analysis were discussed and the chapter ended with the presentation of 13 null hypotheses. The findings of the study including the description and statistical analysis of data are presented in Chapter IV.

CHAPTER IV

ANALYSIS OF DATA

This chapter reports the statistical analysis and interpretation of research data. Forty EMR students were assigned 10 each to four different treatment groups: cognitive training - cognitive teaching, cognitive training - traditional teaching, no training - cognitive teaching, or no training - traditional teaching. The purpose of the study was to determine the extent to which EMR subjects, after exposure to one of the cognitive training treatment combinations, would test higher in learning and retention than subjects assigned to one of the other two treatments. Pretests and posttests were used to measure knowledge of learning strategies and learning and retention of vocational competencies among the subjects. The specific test categories were strategy awareness, skill learning, information learning, and recall learning of tools and procedures.

The means and standard deviations were computed for the pretest and posttest scores for each group on all of the learning and retention categories (see Table 2). One-way analyses of variance were used to test the hypotheses of interest. Those analyses resulting in significant F ratios were then followed by the Scheffé multiple comparison method.

Pretest$_s$

Strategy Awareness. Pretest$_s$ was administered to the 40 subjects in the four groups in order to determine if the groups were

TABLE 2

Means and Standard Deviations of Pretest and Posttest Scores for all Groups in each Test Category.

TEST CATEGORY	GROUP I $\bar{X}$	I SD	II $\bar{X}$	II SD	III $\bar{X}$	III SD	IV $\bar{X}$	IV SD
$PRETEST_s$								
Strategy Awareness	7.2	4.54	7.0	4.37	6.7	4.57	8.8	3.47
$PRETEST_c$								
Skill Learning	60.6	40.10	61.9	19.44	58.0	32.82	60.7	23.97
Information Learning	66.0	20.85	68.2	24.62	69.4	15.2	71.2	11.89
Recall Learning of Tools and Procedures	15.25	18.22	17.85	14.04	16.7	9.15	16.25	12.39
$POSTTEST_s$								
Strategy Awareness	14.8	3.29	12.0	4.74	8.6	3.41	8.9	5.30
$POSTTEST_{c\ 1}$								
Skill Learning	186.6	6.55	179.9	15.25	170.1	16.58	162.8	27.04
Information Learning	118.4	26.75	126.8	17.79	94.8	28.70	109.2	23.55
Recall Learning of Tools and Procedures	94.65	12.3	92.6	29.10	91.45	20.08	91.8	28.68
$POSTTEST_{c\ 2}$								
Skill Learning	156.1	19.06	146.7	33.58	148.9	19.88	148.1	28.79
Information Learning	103.8	19.03	99.4	22.67	81.78	18.78	93.8	17.14
Recall Learning of Tools and Procedures	70.9	19.13	68.15	24.18	70.0	23.06	63.06	21.88

NOTE: N = 10 for all Groups; Group I = Cognitive Training and Cognitive Teaching; Group II = Cognitive Training and Traditional Teaching; Group III = Cognitive Teaching; Group IV = Traditional Teaching

approximately equal with regard to knowledge of learning strategies prior to treatment. The results of the one-way analysis of variance indicated that the groups were equivalent, F (3,36) = .47, $p > .05$.

Pretest$_c$

As shown in Table 2, Pretest$_c$ consisted of three sub-tests which were administered to subjects in the four groups in order to determine their prior learning of the competencies.

Skill Learning. On skill performance, the four groups mean scores ranged from 58 to 61.9. A one-way analysis of variance showed no significant differences between the groups, F (3,36) = .02, $p > .05$.

Information Learning. The pretest$_c$ revealed little differences between the groups mean score on knowledge of the information competencies. The data yield an F-ratio of .13 which was not significant.

Recall Learning of Tools and Procedures. An analysis of the pretest scores with reference to the students' ability to list tools and procedures needed for the skill competencies indicated also that the groups did not differ significantly F (3,36) = .09, $p > .05$.

Both Pretest$_s$ and Pretest$_c$, with the three testing categories failed to reveal a group mean difference when the scores of these tests were analyzed. This suggests that the groups were comparably matched for their knowledge of the strategies and the competencies prior to treatment.

Posttest$_s$

Strategy Awareness. In Figure 4.1, the relative positions of the groups mean scores at pretest and posttest clearly show the elevated

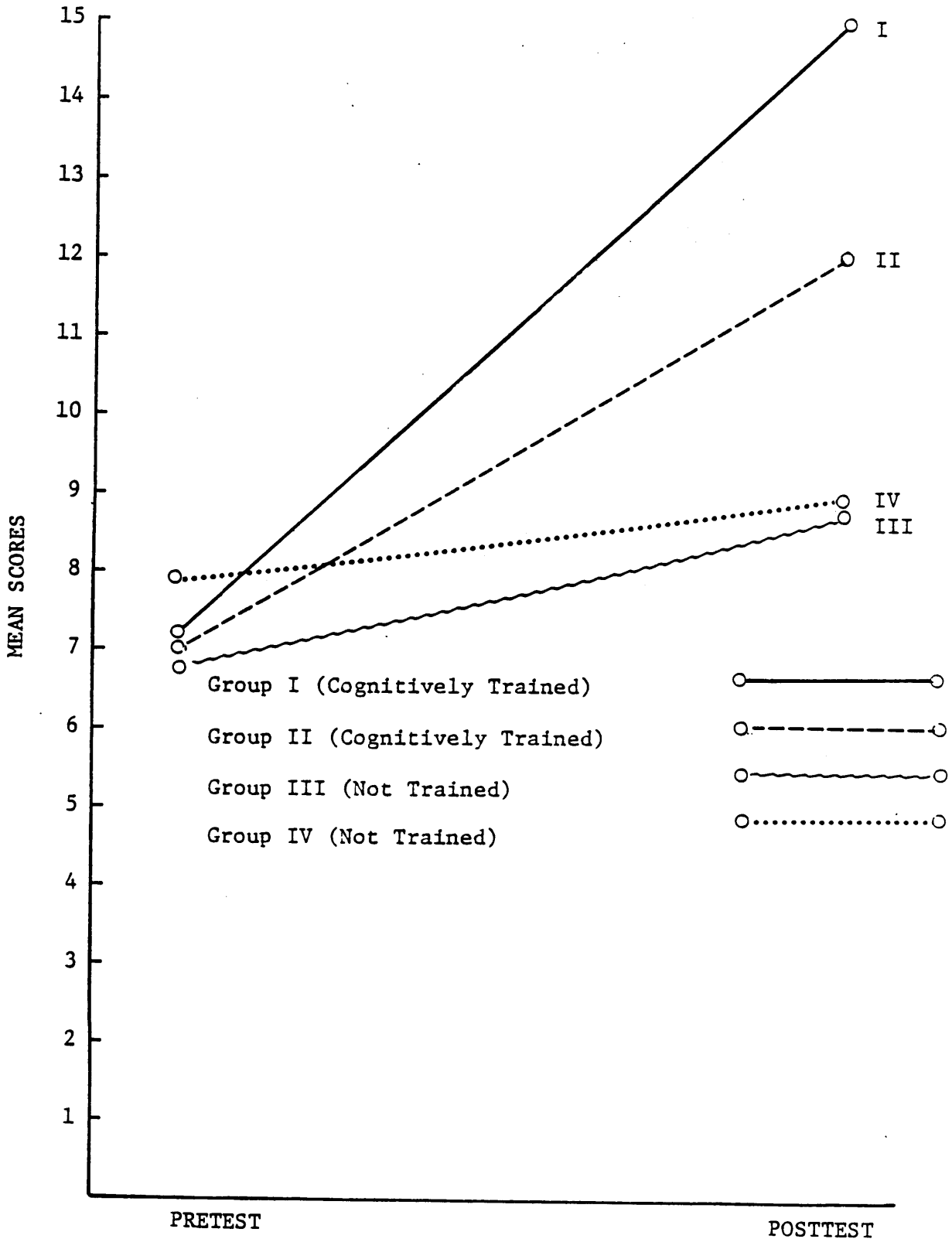

Figure 4.1 Relative Positions of Groups' Mean Scores for Strategy Awareness after $Pretest_s$ and $Posttest_s$.

performance of groups I and II over groups III and IV. Since the subjects in groups I and II were exposed to the cognitive training and the subjects in groups III and IV did not receive treatment, it appears that the training sessions affected positively the experimental groups scores. The analysis of posttest data revealed a significant group mean difference favoring the cognitively trained subjects, F (3,36) = 4.18, $p < .05$. The Scheffé procedure confirms the superior performance of groups I and II compared to groups III and IV, $F = 46.01$, $p < .01$.

Posttest$_{c\ 1}$

Skill Learning. As can be seen in Figure 4.2, a visual comparison of the relative positions of the groups mean scores on skill learning shows large gains by all of the groups from pretest to posttest. A greater difference between the groups mean scores at posttest is also apparent. Although the analysis of the pretest scores showed no significant difference, the application of the one-way analysis of variance on the posttest scores revealed that group performance did differ significantly, F (3,36) = 3.41, $p < .05$. Scheffé test indicated that the mean for group I was significantly higher than that of group IV, $F = 8.84$, $p < .10$. No other group comparisons were significant.

Information Learning. Again, examine Figure 4.2, this time for a comparison of the relative positions of the groups mean scores on information learning. The clustering of mean scores at the pretest is apparent, as is the greater disparity at posttest. It should also be noted that subjects scored much higher on skill learning than they did on information learning.

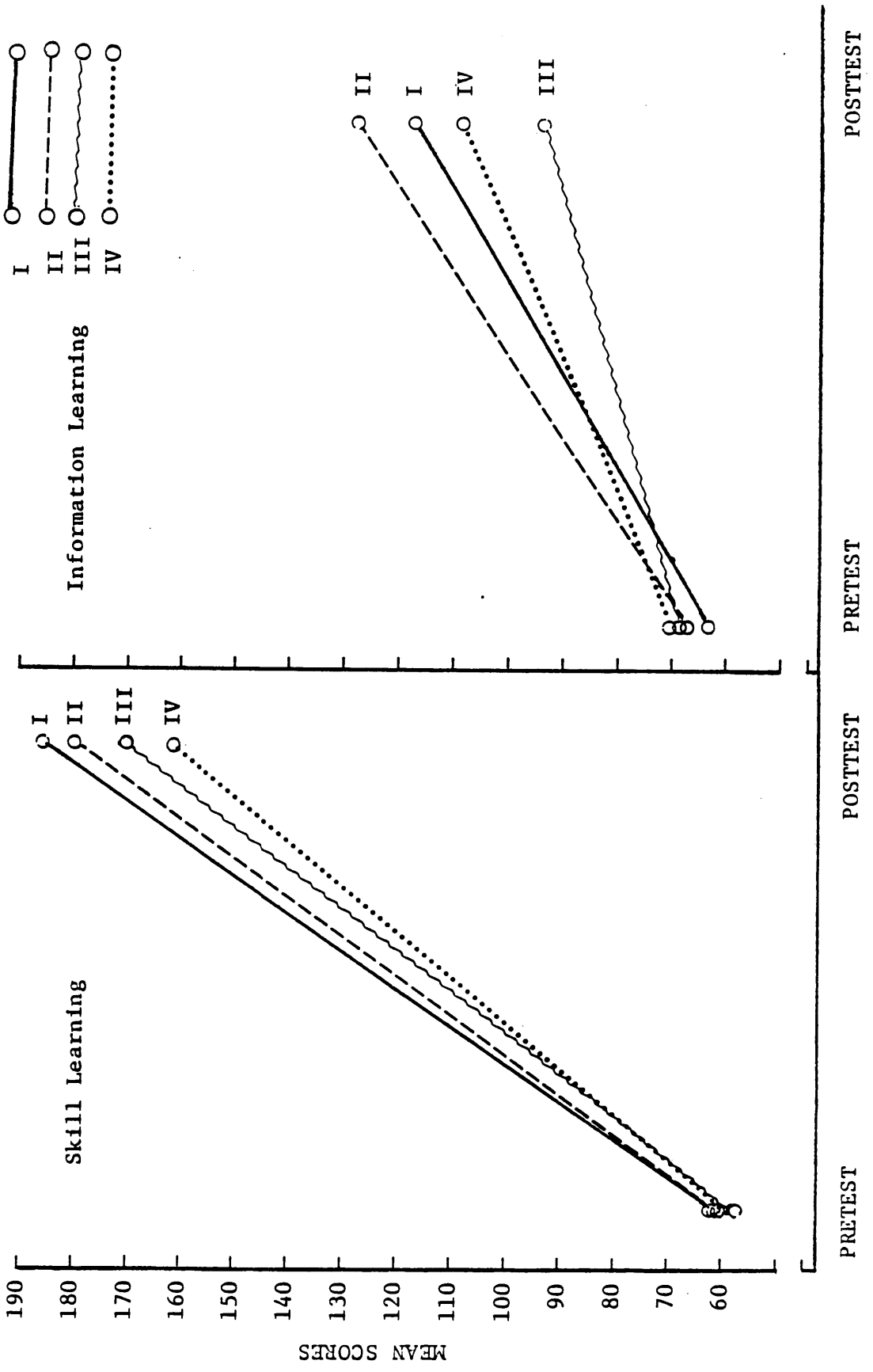

Figure 4.2 Comparison of Relative Positions of the Groups' Mean Scores on Skill Learning and Information Learning after $Pretest_c$ and $Posttest_{c\ 1}$.

The analysis of the posttest scores for information learning showed a significant difference between the group means, F (3,36) = 3.12, $p < .05$. Applying the Scheffé procedure, only groups II (cognitive training - traditional teaching) and III (cognitive teaching) differed to a significant degree, $F = 8.5$, $p < .10$.

Recall Learning of Tools and Procedures. The posttest group mean scores on recall of tools and procedures needed to perform the skill competencies were greatly improved from pretest (refer again to Table 2). However, the one-way analysis of variance for the posttest scores showed essentially no difference across the four groups, F (3,36) = .04, $p > .05$.

Posttest$_{c\ 2}$

The final series of testing for the four groups was for the purpose of comparing the mean scores for differences in retention on skill learning, information learning, and recall of tools and procedures needed to perform the skill competencies.

Skill Learning Retention. Figure 4.3 shows a graphic illustration of learning and retention of the groups as represented by their mean scores from pretest$_c$ to posttest$_{c\ 1}$ to posttest$_{c\ 2}$. Prior to treatment the groups were approximately equal in the students' ability to perform the skill competencies. Immediately following the treatment, all of the groups showed gains. Although differences may be observed between all of the groups, only groups I and IV were significantly different. However, in spite of this difference, the posttest$_{c\ 2}$ scores when analyzed did not show a mean difference, F (3,36) = .26, $p > .05$.

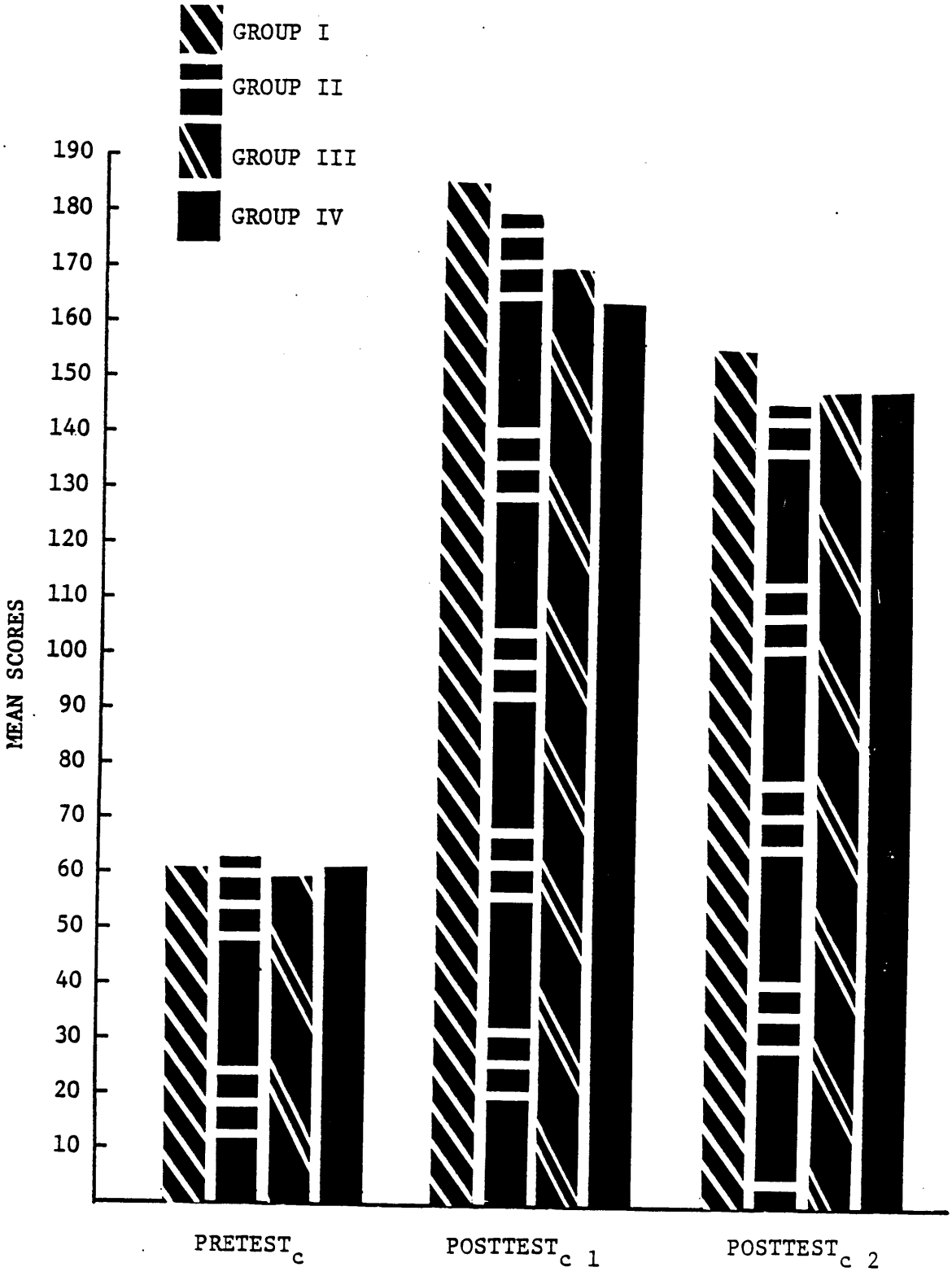

Figure 4.3 Relative Positions of the Groups' Mean Scores on Skill Learning Prior to Treatment, Immediately Following Treatment and Four Weeks Following Treatment.

Information Learning Retention. A graphic presentation of the relative positions of the groups mean scores on information learning for $pretest_c$, $posttest_{c\ 1}$ and $posttest_{c\ 2}$ is given in Figure 4.4. Although the groups showed a difference immediately following treatment ($posttest_{c\ 1}$) at the .05 level, no significant difference was recorded four weeks following treatment, F (3,36) = 2.52, $p > .05$. However, it may be observed that groups I and II showed greater retention as reflected by higher mean scores than groups III and IV.

Retention Recall of Tools and Procedures. The one-way analysis of variance on the $posttest_{c\ 2}$ groups mean scores on recall of tools and procedures showed not significant source of variance, F (3,36) = .12, $p > .05$. A graphic presentation of the four groups mean scores on recall of tools and procedures may be seen in Figure 4.5. It is clear that showed parity in learning and retention.

Analysis of the Hypotheses

Hypothesis One. The null hypothesis is rejected. The group mean scores on knowledge of learning strategies were significantly higher for subjects receiving cognitive training (groups I and II) than for those who had not been cognitively trained (groups III and IV).

Hypothesis Two. The null hypothesis is rejected. The mean score on performance of skill competencies by subjects who received cognitive training and were cognitively taught the competencies (group I) was significantly higher than the mean scores of those who were not cognitively trained but who had been traditionally taught (group IV).

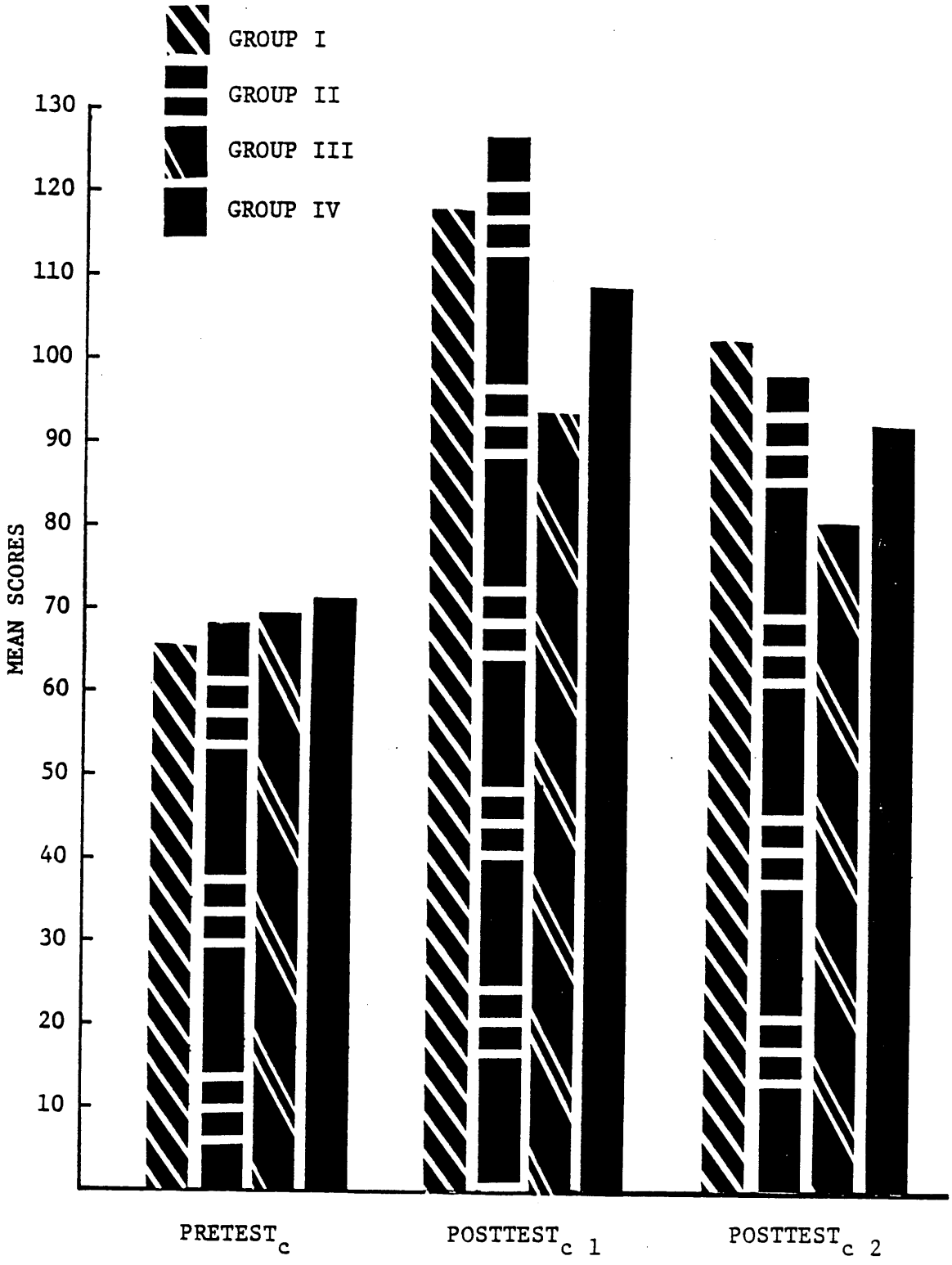

Figure 4.4 Relative Positions of the Groups' Mean Scores on Information Learning Prior to Treatment, Immediately Following Treatment and Four Weeks Following Treatment.

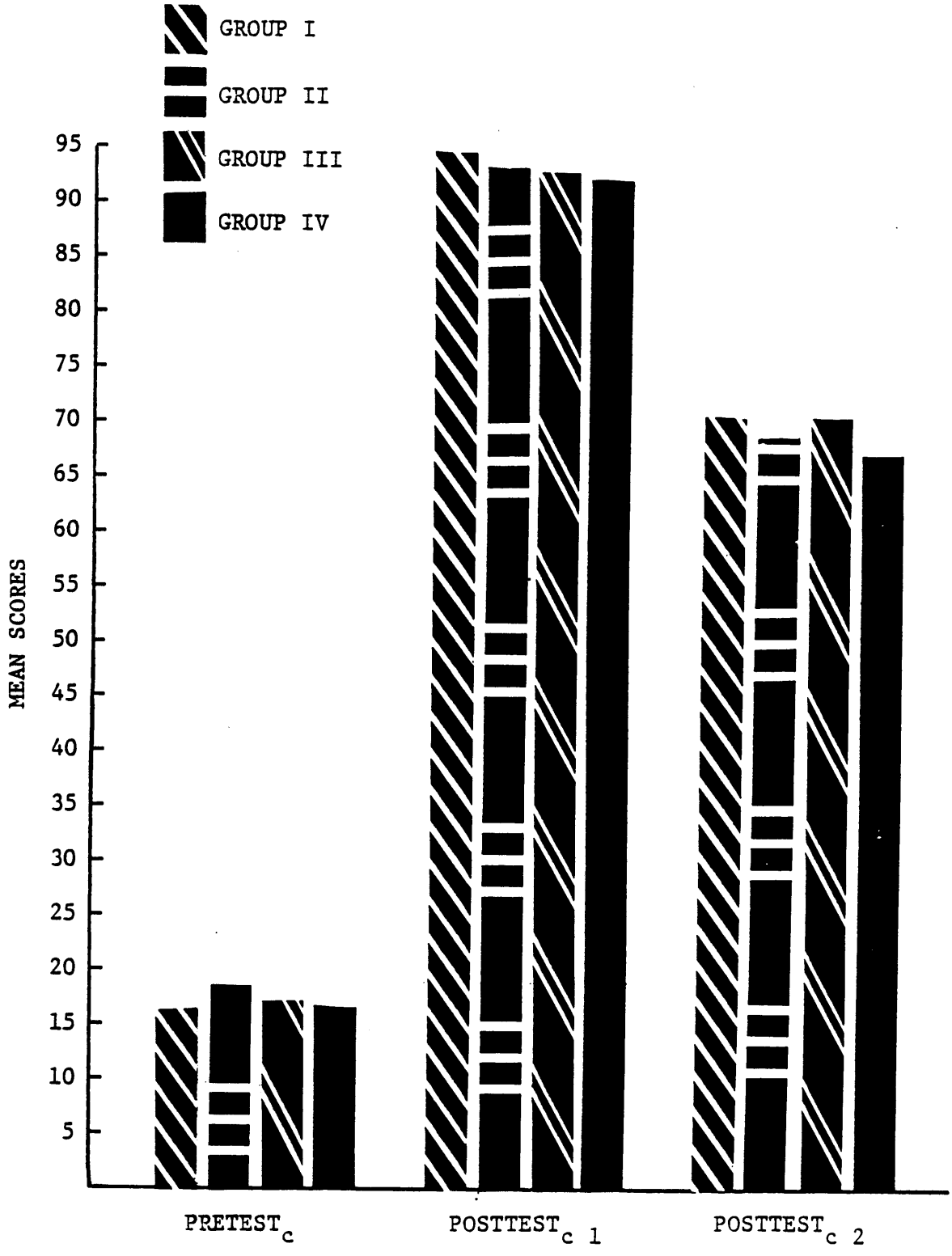

Figure 4.5 Relative Positions of the Groups' Mean Scores on Recall Learning of Tools and Procedures Prior to Treatment, Immediately Following Treatment and Four Weeks Following Treatment.

Hypothesis Three. The null hypothesis could not be rejected. The mean score on performance of skill competencies by subjects who received cognitive training and were traditionally taught the competencies (group II) was not significantly higher than the mean scores of those who were not cognitively trained but who had been cognitively or traditionally taught (groups III and IV).

Hypothesis Four. The null hypothesis could not be rejected. The mean score on knowledge of information competencies by subjects who received cognitive training and were cognitively taught the competencies (group I) was not significantly higher than the mean scores of those who were not cognitively trained but had been cognitively or traditionally taught (groups III and IV).

Hypothesis Five. The null hypothesis is rejected. The mean score on knowledge of information competencies by subjects who received cognitive training and were traditionally taught the competencies (group II) was significantly higher than the mean score of those who were not cognitively trained but who had been cognitively taught (group III).

Hypothesis Six. The null hypothesis could not be rejected. The mean score on recall of tools and procedures by subjects who received cognitive training and were cognitively taught the competencies (group I) was not significantly higher than the mean scores of those who were not cognitively trained but had been cognitively or traditionally taught (groups III and IV).

Hypothesis Seven. The null hypothesis could not be rejected. The mean score on recall of tools and procedures by subjects who received

cognitive training and were traditionally taught the competencies (group II) was not significantly higher than the mean scores of those who were not cognitively trained but had been cognitively or traditionally taught (groups III and IV).

Hypothesis Eight. The null hypothesis could not be rejected. The mean score on retention of skill competencies by subjects who received cognitive training and were cognitively taught the competencies (group I) was not significantly higher than the mean scores of those who were not cognitively trained but had been cognitively or traditionally taught (groups III and IV).

Hypothesis Nine. The null hypothesis could not be rejected. The mean score on retention of skill competencies by subjects who received cognitive training and were traditionally taught the competencies (group II) was not significantly higher than the mean scores of those who were not cognitively trained but had been cognitively or traditionally taught (groups III and IV).

Hypothesis Ten. The null hypothesis could not be rejected. The mean score on retention of information competencies by subjects who received cognitive training and were cognitively taught the competencies (group I) was not significantly higher than the mean scores of those who were not cognitively trained but had been cognitively or traditionally taught (groups III and IV).

Hypothesis Eleven. The null hypothesis could not be rejected. The mean score on retention of information competencies by subjects who received cognitive training and were traditionally taught the

competencies (group II) was not significantly higher than the mean scores of those who were not cognitively trained but had been cognitively or traditionally taught (groups III and IV).

Hypothesis Twelve. The null hypothesis could not be rejected. The mean score on retention recall of tools and procedures by subjects who received cognitive training and were cognitively taught the competencies (group I) was not significantly higher than those who were not cognitively trained but had been cognitively or traditionally taught (groups III and IV).

Hypothesis Thirteen. The null hypothesis could not be rejected. The mean score on retention recall on tools and procedures by subjects who received cognitive training and were traditionally taught the competencies (group II) was not significantly higher than those who were not cognitively trained but had been cognitively or traditionally taught (groups III and IV).

SUMMARY

The major statistical tool applied in this study was the one-way analysis of variance which was supplemented as needed by the Scheffé method for multiple comparison. It was determined that the means of the four groups were equivalent when the pretest scores on strategy awareness, skill learning, information learning, and recall learning of tools and procedures were analyzed. Significant differences, as determined from posttest analyses, were observed with regard to strategy awareness, skill learning, and information learning. This

resulted in a rejection of three null hypotheses (HO_1, HO_2, and HO_5) and a failure to reject of two (HO_3, and HO_4) pertaining to these subjects.

The remaining eight null hypotheses pertaining to recall learning of tools and procedures, skill learning retention, information learning retention, and retention recall of tools and procedures could not be rejected.

CHAPTER V

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

This chapter summarizes the background, purpose, procedure and findings of this investigation. The summary is followed by the basic conclusions, recommendations and implications as determined by the findings.

SUMMARY

Background of the Problem

Educable mentally retarded students entering vocational education programs are, in many instances, expected to learn and retain the same skill and informational competencies as individuals who are not mentally handicapped. This presents a special problem for the retarded student who is likely to have poor memory capacities, due to strategies for encoding information that are different from those used by persons with normal mental abilities.

Evidence supports the theory that many of the learning difficulties of the EMR are due to control deficiencies rather than structural differences which can, in part, be overcome through strategy training. Cognitive training involving rehearsal, organization and elaboration has been found to be effective in teaching EMRs how to learn. Cognitive training that involved metacognitive activities such as estimating,

comparing, decision making, checking, monitoring, and reality testing proved to strengthen the EMR's ability to generalize strategies learned to other tasks.

A review of related literature failed to address the specific question as to whether or not the EMR could be cognitively trained to learn and retain vocational competencies more effectively. It is obvious that such training, if proved effective, could improve the EMR's ability to master the essential competencies needed to compete successfully with non-handicapped trainees.

Purpose of the Study

The purpose of this study was to examine the effects of remedial cognitive training and selected cognitive teaching strategies on the ability of educable mentally retarded students to learn and retain vocational competencies. The study focused on four groups of EMRs in order to determine which of the following groups showed the greatest amount of learning and retention of vocational skill and informational competencies:

1. Students who have been provided remedial cognitive training and taught by an instructor using selected cognitive teaching strategies.
2. Students who have been provided remedial cognitive training and taught by an instructor using traditional teaching methods.
3. Students who have not been provided remedial cognitive training but were taught by an instructor using selected cognitive teaching strategies.

4. Students who have not been provided remedial cognitive training and were taught by an instructor using traditional teaching methods.

Procedure

Ten subjects were randomly assigned to each of four treatment groups. The twenty subjects assigned to groups I and II experienced four consecutive weeks of cognitive training consisting of two 1½ hour sessions each week. The subjects in groups II and IV were taught four vocational competencies by two teachers using traditional teaching methods. Later, the subjects in groups I and III were taught the same competencies by the two teachers using cognitive considerations. The four competencies taught using traditional and cognitive methods were as follows:

Identification of Basic Tools in Auto Servicing

Removing and Replacing an Automobile Wheel

Understanding Basic Cooking Terms

Measuring Dry Ingredients

Two pretests and three posttests were used to measure prior knowledge and ability, and the effects of the various group treatments. From the pretest and posttest scores, eleven applications of the one-way analysis of variance technique were used. These analyses were used to determine the group mean differences with regard to the following categories:

1. Strategy Awareness
2. Skill Learning
3. Information Learning

4. Recall Learning of Tools and Procedures
5. Skill Learning Retention
6. Information Learning Retention
7. Retention Recall of Tools and Procedures

When the analysis of variance led to a significant F test at the .05 level, the Scheffé multiple comparison method was used.

Findings

A parity was found to exist among the group means as it pertains to each of the pretest categories. The post-treatment mean scores on knowledge of learning strategies, skill learning, and information learning showed in each case, a significant difference. Therefore, in each of these situations the Scheffé procedure was applied. Groups I and II combined mean scores were significantly higher on knowledge of learning strategies than the mean scores of groups III and IV. Group I's mean was significantly higher in skill learning than group IV. No other group was significantly higher in skill learning. Only groups II and III differed significantly in information learning.

No significant difference was found in the group mean scores on recall learning of tools and procedures, skill learning retention, or retention recall of tools and procedures.

CONCLUSIONS

The four groups were statistically equivalent prior to treatment not only with regard to the students' knowledge of the competencies

but also in their knowledge of learning strategies. Therefore, any gains on the mean scores of these groups following treatments could be attributed to the treatments. The conclusions expressed in this study were limited to the treatments described therein.

Strategy Awareness

The eight cognitive training sessions were made available only to groups I and II. The data showed quite conclusively that the training sessions enabled the students in groups I and II to gain a superior understanding of the use of learning strategies over the students in groups III and IV.

Skill Learning

The question as to whether or not the students in groups I and II were able to generalize their knowledge of learning strategies to skill learning tasks was answered with mixed results. The students in group I, having been taught the learning strategies and cognitively taught the skill competencies, showed achievement that was significantly greater than the achievement of the students in group IV, the control group. It could, therefore, be concluded that knowledge of cognitive training plus exposure to cognitive teaching improve learning and bring about greater generalization with regard to skill learning than the conventional method of teaching alone. However, the learning strategies plus cognitive teaching (group I) did not prove to be more effective for skill learning than the cognitive training plus traditional teaching (group II).

Although the results were not significant, the students in group I out-performed the students in group III (cognitive teaching) and the group II students out-performed the students assigned to group IV.

Information Learning

The findings for information learning contrasted slightly with the results as determined for skill learning. The major difference was that the mean score of group II proved to be significantly higher than the mean score of group III. Since the treatment for group II was cognitive training plus traditional teaching, and the treatment for group III was cognitive teaching alone, it is concluded that cognitive training plus traditional teaching is significantly more effective than no training and cognitive teaching with regard to information learning of vocational competencies.

Recall Learning of Tools and Procedures

Based on the data recorded in the previous chapter, recall learning, as demonstrated by the group means scores, was not significantly affected by the cognitive training and/or cognitive teaching. The recall learning tasks required the subjects to list without visual or oral cues the necessary tools and procedures to perform two skill activities competently. As indicated in the findings, the subjects in groups I and II failed to generalize their knowledge of learning strategies to these tasks.

Learning Retention

Although some generalization of knowledge and use of learning strategies were observed and recorded in this study, the subjects in groups I and II failed to demonstrate strategy maintenance. Thus, apparent learning gains obtained by these groups on skill and information tasks diminished measurably over the four week period between $posttest_{c\ 1}$, and $posttest_{c\ 2}$. As determined in Chapter IV, there

were no statistical differences between the means of the four groups on either skill learning retention, information learning retention, or retention recall of tools and procedures. It was concluded that the cognitive training and/or cognitive teaching was insufficient to significantly affect learning retention of either of the learning categories.

IMPLICATIONS

The results of this study, as well as those of other researchers cited in Chapter II, demonstrate the fact that educable mentally retarded persons can be taught to use learning strategies that will enable them to learn skills as well as information more efficiently. Although the vast majority of the studies pertaining to cognitive training for the mentally retarded deal with informational learning, conclusions can now be made that a system which includes cognitive training plus cognitive teaching can significantly improve skill learning among these students. However, much more work needs to be done. Additional research and greater dissemination of research findings are among the recommendations offered in this study. In their review of research regarding mnemonic strategy training, Kramer, Nagle and Engle (1980) acknowledged the laboratory findings that provide support to retarded individuals learning to use mnemonic strategies and demonstrating <u>retention</u> up to periods of one year. These

researchers, however, suggest caution with respect to generalization. They stated:

> . . . educators should not routinely expect students to generalize classroom-trained strategies to novel tasks; however, future research conducted in classroom settings where individuals can receive intensive and long-term training may prove more fruitful (Kramer, Nagle and Engle, 1980, p. 309).

Since eight cognitive training sessions and a few brief exposures to cognitive teaching improved skill learning among EMR students, it may be reasonable for researcher to direct future studies of this type in the classroom setting and over a longer period of time to improve learning, retention and generalization. The effectiveness of long-term and intensive training is supported by a number of investigators (Glidden, 1976; Campione and Brown, 1977; Ross and Ross, 1978).

The results of this study provide a few answers to important questions. The results also generate additional questions, at least, in the mind of this researcher. For example, what types of mnemonic activities are most effective for strategy maintenance and strategy generalization in skill learning and information learning? What mnemonic activities are most applicable for EMR subjects at various mental age (MA) and IQ levels? What are the most effective mnemonic strategies for teaching vocational education learning tasks that are frequently required of EMR students? How can we effectively train teachers in vocational education to teach "cognitively" and with knowledgable considerations to the recent advances in cognitive learning strategies. These are but a few of the pertinent questions that can only be answered through continued research. In this regard, for a number of years appeals have been made by cognitive researchers

to continue these efforts in the classroom setting (Reichhart, Cody and Borkowski, 1975; Burger and Blackman, 1976; Kramer, Nagle and Engle, 1980). Kestner and Borkowski stated:

> Whatever the reason for the success of the group training procedure, it should lead to a renewed appraisal of the feasibility of small-group, classroom-like setting as a vehicle for strategy training research (Kestner and Borkowski, 1975, p. 494).

The success of classroom oriented research may well depend on the support of special education and vocational personnel who are informed of the advances in mnemonic strategy training with mentally retarded persons. Pilot studies in the school setting could be more easily conducted with the understanding and assistance of those who must work with these students. Then if these research activities are successful, informed teachers could help integrate the findings into curricula for improved educational training programs for mentally retarded students.

RECOMMENDATIONS

The results of this study should be viewed as encouraging. The fact EMR subjects were able to generalize their recently developed understanding of cognitive learning strategies to actual use in skill and information learning provides reason for additional research. The fact that these subjects as a group did not maintain their gains provides even greater reason for additional research. It is hoped that further studies related to this topic will be conducted. With reference to the findings and conclusions of this study, recommendations in several categories are offered.

Basic Research

More attention should be made to determine the effectiveness of various types of learning strategies on skill and information learning, including strategies that may or may not have been discussed in this study. Information readily available on the learning strategies that work best in certain situations or tasks would be valuable to the developers of cognitive training programs.

More attention should be given to the development of curricula for teaching the mentally handicapped how to learn more efficiently with the use of cognitive learning strategies that can be applied particularly in a vocational setting. Learning tasks such as following directions, disassembling and reassembling, learning tools and procedures, and remembering terminology are among the many activities required in vocational education programs that could have curricular implications for cognitive training.

Replication of this study should be considered using the learning strategies suggested in the first recommendation and greatly extending the number of cognitive training sessions. Cognitive teaching, as a system of cueing the student to remember to generalize and to apply the previously learned strategy in this situation, should be intensified and included in this study. Increasing the number of training sessions along with intensifying cognitive teaching may result in improved learning retention.

Teacher Preparation

Colleges and universities offering teacher education programs and courses to teachers that teach the mentally retarded and other

children with special learning needs should provide more opportunities for such teachers to expand their knowledge of and expertise in the teaching of learning strategies to their students.

Special education supervisors and administrators should begin implementing a program of staff development for teachers on the subject of reviewing and understanding research findings on cognitive learning strategy training for the mentally handicapped. Outside of the special education department, other teachers could benefit from knowledge of how cognitive learning strategies can improve students' ability to learn in various subject areas.

Vocational education supervisors and administrators should initiate a program of staff development for special needs vocational education personnel on the subject of developing skills for cognitive teaching in order for them to work more efficiently with students that have been exposed to cognitive learning strategies.

Pilot Studies

Pilot studies in the special education and vocational education classrooms should be planned and conducted by researchers working cooperatively with teachers and other school personnel. The pilot study on mnemonic strategies would not only provide a realistic setting and a familiar environment for students, but would allow for greater dissemination of the finding among the educators associated with it. The successful conclusion of a pilot study could provide the basis for a local program of implementation.

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APPENDICES

APPENDIX A

PERMISSION TO REPRINT SCHEMATIC DRAWING

November 19, 1981
10941 Granada Road
Richmond, Virginia 23235

Publishers, Academic Press, Inc.
111 Fifth Avenue
New York, New York 10003

Gentlemen:

As a doctoral candidate at Virginia Polytechnic Institute and State University, I am presently involved in research on the subject of remedial cognitive training for mentally retarded students in a vocational education setting. In that regard, I am requesting permission to reproduce the following item in my dissertation:

> "Figure 2. The Multi-Process Memory Model" located on page 6 of:
>
> Ellis, Norman R. "Memory Processed in Retardates and Normals." In: Norman R. Ellis, ed. International Review of Research In Mental Retardation. Volume 4, New York: Academic Press, 1970.

With your written permission, I would like to reprint the schematic drawing unaltered as it is presented in the book listed above.

Yours very truly,

Joseph L. Cooper

December 1, 1981

PERMISSION GRANTED, provided that complete credit is given to the source.

Marian McGrath
Rights and Permissions

Please pardon the informality but to speed our reply we have answered on your own letter.

APPENDIX B

PARTICIPATION PERMISSION FORM

Richmond Public Schools

RICHMOND CAREER EDUCATION CENTER
2015 WESTWOOD AVENUE
Richmond, Virginia 23230

January 31, 1983

Dear Parent:

Your son/daughter has been selected to participate in a training program which is designed to improve understanding and learning of vocational concepts and skills. During the eight training sessions to be conducted over a four week period while the students are attending the Career Center, specific learning strategies will be taught. The learning strategies, once learned by the student, could lead to improved understanding and remembering in any subject area.

In order for your son or daughter to participate in this program, it is necessary that you check the appropriate box below indicating your approval and sign your name in the space provided for your signature. If you have any questions, I may be reached at 780-6908 (work) or 272-8396 (home).

Sincerely,

Joseph L. Cooper
Assistant Principal

jg

Yes, I want my son/daughter to participate in the program. ☐

No, I do not want my son/daughter to participate in the program. ☐

Student's Name _____ Date _____

Parent's Signature _____

APPENDIX C

PRETESTS AND POSTTESTS

STRATEGY AWARENESS PRETEST/POSTTEST

DIRECTIONS: The following questions are designed to determine the techniques that you use to remember or learn certain kinds of information. Please answer each question to the best of your ability. There are no correct or incorrect answers. You may read silently as I read aloud to you.

1. What method would you use to remember the following list of words arranged in any order?
   ORANGE APPLE COFFEE PEACH MILK TEA GRAPE JUICE

2. The number, 12026904157 is a long distance telephone number. What method would you use to remember this number?

3. What method would you use to remember the following items that you intend to purchase after school?
   A BASKETBALL, A PAIR OF TENNIS SHOES, SUN GLASSES, AND A NECKTIE

4. Students in driver education class have been taught how to make a left turn. Is it possible to study this procedure without the aid of an automobile? If so, explain how.

5. You are shown a strange looking tool for the first time, what can you do to make it easier for you to recognize that tool when you see it again?

6. You are interviewing for a job and the interviewer has asked a very difficult question, what should you do first?

7. What is a good way to learn something that must be remembered in a definite order?

8. A shopping list consists of the groceries listed below. How would you shop for these items in a supermarket?

STRING BEANS	POTATOES	PAPER BAGS
CORN	CHICKEN	PEAS
LIVER	NAPKINS	ONIONS
PAPER TOWELS	STEAK	LAMB CHOPS

9. A new task has been demonstrated to you by your teacher. The steps were written on the chalkboard. What would you do in order to remember these steps?

10. Some students are slow to give answers when questioned and others are quick. Are there any advantages to either of these characteristics or methods? Which method do you prefer and why?

STRATEGY AWARENESS CHECKLIST

DIRECTIONS: Place an X in the appropriate space to indicate the extent to which the student's answer met or did not meet each criterion. In the event the student does not understand a particular question, the "question rephrased" may be read.

Name _____

Date _____

STUDENT'S RESPONSES MEET THE FOLLOWING CRITERIA:	Not Met (0)	Slightly Met (1)	Almost Met (2)	Met (3)
1. The student would group items under fruit or drink and rehearse. Question Rephrased: You are called upon to remember these words in any order. How would you go about doing this?	___	___	___	___
2. The student would rehearse the numbers in the normal breakdown of 1-202-690-4157. Question Rephrased: How would you go about learning this long distance telephone number?	___	___	___	___
3. The student would use imagery such as a figure having the head of a basketball with sunglasses on. The figure would also wear a necktie and tennis shoes. Question Rephrased: Without writing a list, how would you try to remember these things that you intend to buy after school?	___	___	___	___
4. The student would rehearse the procedure, verbalizing what is supposed to be taking place or visualizing the same. Question Rephrased: Is it possible to study how to make a left turn in an automobile without actually being in or near an automobile?	___	___	___	___
5. The student would look for the important details and study these features. Question Rephrased: Repeat original question.	___	___	___	___
6. The student would take time to think about the possible answers (pause). Question Rephrased: If you are trying to get a job and the person who does the hiring asks you a question and you are not sure of the answer, what should you do first?	___	___	___	___

7. The student would use a rehearsal strategy. ___ ___ ___ ___
   Question Rephrased: How would you try to remember something that must be remembered in a certain order?

8. The student would group items in a manner such as meats, vegetables, and paper goods. ___ ___ ___ ___
   Question Rephrased: How would you go about finding these items in a supermarket?

9. The student would rehearse the steps to the procedure and visualize himself/herself or the teacher performing the activity. In class, the student would practice the procedure - pausing as necessary in order to think through each phase of the activity. ___ ___ ___ ___
   Question Rephrased: Repeat original question.

10. The student would recognize the advantages of answering quickly if one is sure of the answer. However, pausing long enough to think is advantageous when one is not sure. ___ ___ ___ ___
    Question Rephrased: Repeat original question.

AS PRETEST/POSTTEST

Part I

NAME _____ DATE _____

GROUP _____ SCORE _____

TASK/COMPETENCY

Remove and Reinstall a Vehicle Wheel Assembly

DIRECTIONS: In order to perform the task listed on this sheet, you should be knowledgable of the step by step procedure and necessary tools. In the space provided, list the steps in the correct order and the corresponding tools needed to perform these activities.

PROCEDURE	TOOLS NEEDED
1.	1.
2.	2.
3.	3.
4.	4.
5.	5.
6.	6.
7.	7.
8.	8.
9.	9.
10.	10.

INSTRUCTOR CHECKLIST
AS PRE/POST TEST

STUDENT_____ DATE_____

GROUP_____ SCORE_____

TASK/COMPETENCY:

REMOVE AND REINSTALL A VEHICLE WHEEL ASSEMBLY

PERFORMANCE OBJECTIVE:

GIVEN THE NECESSARY TOOLS, A WHEEL MOUNTED ON A VEHICLE, AND AN AUTO LIFT, THE STUDENT WILL REMOVE AND REINSTALL A VEHICLE WHEEL ASSEMBLY IN ACCORDANCE WITH THE AUTO MAINTENANCE MANUAL.

CRITERION-REFERENCES MEASURE:

ON ASSIGNED VEHICLE, REMOVE AND REINSTALL A VEHICLE WHEEL ASSEMBLY IN ACCORDANCE WITH MAINTENCE MANUAL.

ACTIVITY	Correct	Incorrect
OBTAINED CORRECT HANDTOOLS		
REMOVED HUBCAPS		
LOOSENED WHEEL LUGS		
RAISED VEHICLE TO PROPER HEIGHT		
REMOVED WHEEL LUGS		
REMOVED WHEEL FROM VEHICLE		
REINSTALLED VEHICLE WHEEL		
REINSTALLED WHEEL LUGS (HAND TIGHT)		
LOWERED VEHICLE TO GROUND LEVEL		
TIGHTENED WHEEL LUGS		
REINSTALLED HUBCAPS		

FS PRETEST/POSTTEST

Part I

NAME_____ DATE_____

GROUP_____ SCORE_____

TASK/COMPETENCY: Measuring Dry Ingredients

DIRECTIONS: In order to perform the task listed on this sheet, you should be knowledgable of the step by step procedure and necessary tools. In the space provided, list the steps in the correct order and the corresponding tools needed to perform these activities.

PROCEDURE	TOOLS NEEDED
1. _____	1. _____
2. _____	2. _____
3. _____	3. _____
4. _____	4. _____
5. _____	5. _____
6. _____	6. _____
7. _____	7. _____
8. _____	8. _____
9. _____	9. _____
10. _____	10. _____

INSTRUCTOR CHECKLIST
FS PRE/POST TEST

STUDENT_____ DATE_____

GROUP_____ SCORE_____

TASK/COMPETENCY:

MEASURING DRY INGREDIENTS

PERFORMANCE OBJECTIVE:

GIVEN THE NECESSARY TOOLS AND SUPPLIES, THE STUDENT WILL DEMONSTRATE THE CORRECT PROCEDURES FOR MEASURING TWO DRY FOOD INGREDIENTS AS DESCRIBED IN THE FOOD SERVICES TEXTBOOK.

CRITERION-REFERENCES MEASURE:

USING ACCEPTABLE FOOD SERVICES PROCEDURES, MEASURE ONE TABLESPOON OF SALT AND ONE CUP OF ALL PURPOSE FLOUR.

ACTIVITY	Correct	Incorrect
PLACED WAXED PAPER ON THE COUNTER		
POURED SALT INTO TABLESPOON OVER WAXED PAPER		
LEVELED OFF TOP OF TABLESPOON WITH BLADE EDGE OF SPATULA OR KNIFE		
SIFTED FLOUR ON WAXED PAPER		
SPOONED LIGHTLY SIFTED FLOUR INTO DRY MEASURING CUP		
SPOONED FLOUR UNTIL IT HEAPED OVER TOP OF CUP		
REMOVED AIR POCKETS FROM FLOUR WITH SPATULA BLADE		
DREW BLADE EDGE LEVEL ACROSS TOP OF CUP		
PLACED UNUSED FLOUR BACK IN ITS CONTAINER		
PLACED CUP OF FLOUR GENTLY ON COUNTER		

AI PRETEST/POSTTEST

NAME_____ DATE_____

GROUP_____ SCORE_____

Part 1 (True/False)

DIRECTIONS: Read the following statements carefully. Circle the letter "T" for TRUE or "F" for FALSE at beginning of statement.

T F 1. There are three main types of tools, namely electric, hand, and compressed air.

T F 2. The hammer and the air wrench are examples of hand tools.

T F 3. Wrenches are used to turn screws or bolts that have six-sided heads.

T F 4. Hammers are used to knock out rivets and pins from machine parts.

T F 5. The bench vise is used to hold an object that is being worked on.

T F 6. Pliers have two legs that move on a pivot.

T F 7. The common screwdriver is an excellent substitute for the chisel.

Part 2 (Matching)

DIRECTIONS: Match statements on left side of paper with answers on the right side. Place your answer (letter) on the appropriate line in the column on the left.

_____ 1. For striking easily marred surfaces	A	Common Screwdriver
_____ 2. Most misused tool	B	Wire Cutters
_____ 3. Used in restricted places	C	Rubber Hammer
_____ 4. To drive screws with slotted heads	D	Phillips Screwdriver

_____ 5. To grip or turn an object

_____ 6. To cut wire or small cable

_____ 7. The simplest wrench to use

_____ 8. To drive screws with v-shaped heads

E Hacksaw

F Socket Wrench

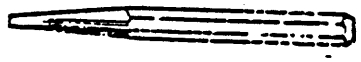
G Pliers

H Box Wrench

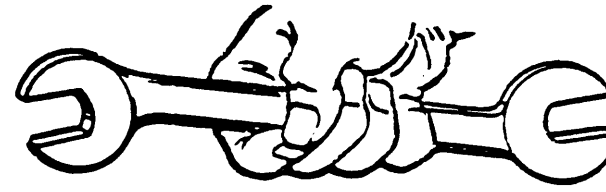
I Ball Peen Hammer

Part 3 (Identification)

DIRECTIONS: In the blank space beneath each picture, write the name of the tool shown.



1. _____



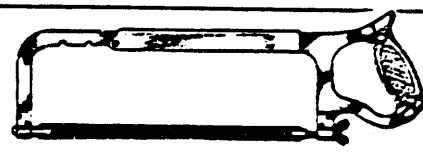
2. _____

3. _____

4. _____

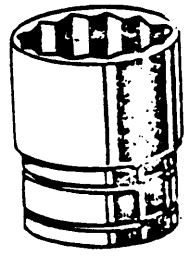
5. _____

6. _____

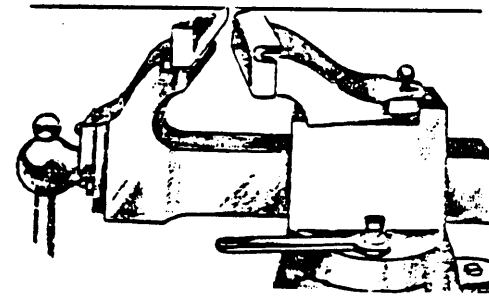


7. _____

8. _____



9. _____



10. _____

FI PRETEST/POSTTEST

NAME_____ DATE_____

GROUP_____ SCORE_____

Part 1 (True/False)

DIRECTIONS: If the statements below are true, write the word True in the spaces provided. If the statements are false, write the word False in the spaces.

_____1. Tossed salads are lightly mixed by tumbling with a fork and spoon.

_____2. Shortening is cut in flour to make pie crust dough.

_____3. Parsley is one of the most common garnishes.

_____4. To beat an egg, stir it round and round.

_____5. Sugar and flour mixed well is an example of a blended mixture.

_____6. Potatoes cut to make potato salad are minced.

_____7. Vegetables are chilled in the refrigerator.

_____8. Diced celery is cut into larger pieces than minced onions.

Part 2 (Matching)

DIRECTIONS: In order to perform the cooking activities listed in the left column, you need certain equipment or foods. The column to the right lists these items of equipment or foods. Write the correct letter beside the food or equipment in the blank space that correspond with the cooking activity.

_____1.	Chill	A	Spoon
_____2.	Stir	B	Strainer
_____3.	Garnish	C	Banana

_____4.	Cut in	D	Refrigerator
_____5.	Sift	E	Pastry Blender
_____6.	Chop	F	Fine Sieve or Sifter
_____7.	Peel	G	Parsley
_____8.	Drain	H	Knife

Part 3 (Multiple-Choice)

DIRECTIONS: Write the letter beside the word that best completes the statement in the blank space of that statement.

1. _____an orange to remove the skin.
(a) Pare (b) Peel (c) Beat (d) Chop

2. _____pie dough before rolling it out to make a crust.
(a) Drain (b) Garnish (c) Chill (d) Chop

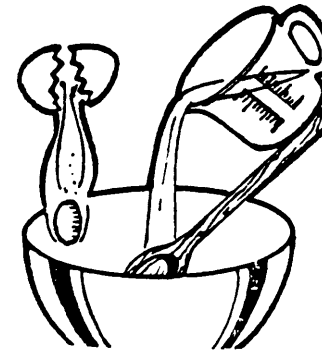
3. In order to separate the sliced peaches from the juice, you would _____ it.
(a) mince (b) mix (c) sift (d) drain

4. _____a white potato to remove the skin.
(a) Pare (b) Peel (c) Beat (d) Chop

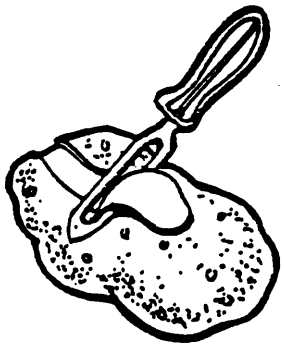
5. In order to _____an onion, cut it into tiny pieces.
(a) chop (b) dice (c) mince (d) cube

Part 4 (Identification)

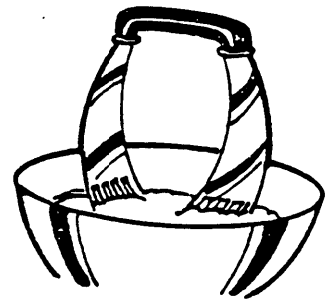
DIRECTIONS: Write the name of the term in the space provided that identifies the activity shown in the picture.



1._____ 2._____



3._____



4._____

APPENDIX D

COGNITIVE TRAINING SESSIONS

COGNITIVE TRAINING SESSION I

Introduction, Grouping, and Imagery

Good morning, I am Mr. Cooper. I would first like to thank each of you for agreeing to take part in this experiment. As you were told earlier, I am conducting an experiment in order to find out if we can help you to learn better the things that are taught in a vocational school like this one. Therefore, it is important that you listen carefully to everything that I say and do. We will meet here two days out of each week for four weeks. Every day that you meet with me you will receive 2 extra points. Since each point is worth 5 cents, you can easily earn $.25 a day just by cooperating in the training sessions which are an important part of this experiment.

Please do not discuss what we do here with other students although you may discuss the training procedures with your parents and other members of your family. We will begin our training program today and we will meet for one and one-half hours.

I would now like to show you how you can improve your memory. Listen to this example:

Suppose you were sent to a supermarket to get the following items: (Use transparency)

eggs	hamburger
bacon	butter
milk	bleach
soap powder	paper towels
cheese	

Could you remember all of these items without writing a list? Could you remember them better if you organized the list on paper and then in your mind? Tell me how you would organize this list. (Obtain their ideas)

Study this transparency and tell me what is different about this list:

Meat	Grocery	Dairy
1. bacon	1. soap powder	1. cheese
2. hamburger	2. bleach	2. eggs
	3. paper towels	3. milk
		4. butter

A. The list is now divided into three categories or groups based on departments or areas in a supermarket.

B. In the groups you now have two meat items, three grocery items and four dairy items - two, three, and four.

C. Remembering the names of each group and the number of items in each group will help you to remember your complete list in an organized manner. To group means to put things together that belong together.

D. A good way to remember the items in each group is to use your imagination. In the meat group, there are two items, bacon and hamburger (Project Key Words). Can you imagine a hamburger wrapped with a strip of bacon? Think about it for a while. (Pause) Instead of washing clothes, can you imagine what would happen if you washed paper towels using soap powder and bleach (Project Key Words)? Try to visualize a picture of this scene in your mind. Can you smell the bleach? Don't use too much soap powder. You're

washing holes in the paper towels. (Pause) Now think of a breakfast with cheese and eggs fried with butter and a glass of milk. (Transparency) Get a picture of these things as part of a breakfast menu. (Pause)

E. I wonder how many persons remember the names of our three groups. You will now be given a piece of paper and a pencil. Please try to supply the answers to questions as I read them to you. Don't worry I will not collect your paper unless you want to share them with me.

I. Write the names of the three groups.

1. _____

2. _____

3. _____

II. How many items are there in the first group that you listed?

_____

III. How many items are there in your second group? _____

IV. Name the items in each of your groups.

1. _____	2. _____	3. _____
a _____	a _____	a _____
b _____	b _____	b _____
c _____	c _____	c _____
d _____	d _____	d _____
e _____	e _____	e _____

V. How well do you think you did on this quiz?

(Circle your answer)

1. Very good

2. Fair

3. Not so good

Let us go over the procedure once again - but quickly.

1. First, we studied our list of words and decided how we would try to remember them. We began to get organized.
2. Next, we decided to group our words according to things we know about them. We group them according to departments in a supermarket.
3. We then thought about the number of items that belong to each group.
4. We then formed relationships between the items in each group.
5. Last, we checked our knowledge by quizing ourselves to find out how much we remembered.

Are there any questions?

COGNITIVE TRAINING SESSION II

Grouping, Imagery, and Rehearsal

Today, we are going to continue where we ended on our first meeting. Do you recall how we tried to remember a list of items that were to be purchased from a supermarket? Let us review the procedure we used to remember our list: (Use chalkboard)

1. First, we looked at our list as it was written and thought about how we would try to remember each item on the list. We called this "getting organized," which is a very important step.
2. We decided to group our words according to things we know about them. We grouped our list according to departments in a supermarket. However, we probably could have found other ways to group them.
3. We then counted and remembered the number of items in each group.
4. We formed relationships between the items in each group and used our imagination. What were some of the images or pictures we formed in our minds? (Wait for responses.)
5. The last thing that we did was to quiz ourselves to see how much we remembered.

I am going to leave these procedures on the chalkboard. However, this time I am going to give you a new list of words. The list is as follows: (Use chalkboard)

pencil	fish
horse	nail
chair	screwdriver
notebook	desk
hammer	hat

How would you group this list? (Discuss and list their ideas using the chalkboard)

(Stand by with my grouping on transparency if needed).

Animals	School Items	Tools and Things
1. fish	1. notebook	1. hammer
2. horse	2. pencil	2. nail
	3. desk	3. screwdriver
	4. chair	4. hat

Why is it important to divide the items into meaningful groups? (Pause) What is meaningful about the names that you selected for your groups? Is it important to know the number of items in each group? Why? (Pause) Now, try to form a relationship with the items in each group. Use your imagination. (Pause) If you are having some difficulty, you could add "horse" to your school listing and use your imagination to visualize a horse sitting in a chair at a desk writing with a pencil in a notebook. If you think about this relationship as if you were turning on a television, the picture will be clearer. You could also rehearse your list by saying the key words in the sentence. If the sentence is "the horse is sitting in a chair at the desk writing with a pencil in a notebook," you should rehearse the key words in the same order - such as: "horse, chair, desk, pencil, notebook - horse, chair, desk, pencil, notebook."

Under the grouping, "tools and things," what relationships can you form? Do you have any ideas? (Pause) Alright, I see a fish wearing a hat - it's using a hammer to drive a nail, and in the other "hand" it is holding a screwdriver. The key words to be rehearsed are "fish, hat, hammer, nail and screwdriver." Rehearse them in that order - "fish, hat, hammer, nail, screwdriver."

It is best to work first with one group of words at a time when you are rehearsing. You have to repeat the words over and over again in the same order and think about the words and the relationship as you repeat them. Form the picture of the words you are saying as you repeat them:

"fish, hat, hammer, nail, screwdriver"

"fish, hat, hammer, nail, screwdriver"

How many of you get the idea? Do you think that you can do this? Suppose I gave you a new list of words - then could you do it? Okay now, some words do not work too well with images. It is difficult to form relationships with some words. I am talking about words like careful, slow, behave and manners. This is also true with words for which we do not know the meaning or we very seldom use or hear. I am talking about words like "scafford" or "plumb." These two words, scafford and plumb were taken from a masonry textbook. Bricklayers and other trained workers use words in their trade which we call technical terms. Just like young people today have their own special language, the trained worker must use words that serve as shortcuts in communication. One word could explain an entire process. To get along in your trade, you must speak the language. The strategy or

method for remembering a technical word and its meaning is as follows:

1. First, test yourself in order to determine if the word and its meaning are going to be difficult or hard to learn. Ask yourself, "What do I have to learn?" and "What is the best way to learn it?"
2. If the term and its meaning are easy to remember and understand, such as the term "tube cutter" (a tool used to cut thin wall plastic or metal pipes), you may want to simply think about the term and its definition and rehearse over and over again. A slightly more difficult word may be the automotive term "crankshaft," which is a revolving engine part that along with the connecting rods change piston motion into more useful rotary motion . (Diagram) You can easily remember the crankshaft and its function or purpose if you can picture a person cranking or turning a metal shaft that would be straight if it were not for the two "U" shaped turns going in the opposite directions. The person cranks the shaft by pushing down the "U" turns one then the other (diagram) as the pistons pushed down the "U" shape parts of the crankshaft in order to gain rotary motion.
3. In order to remember the term crankshaft and its function, think about this person cranking the shaft.

Many of the technical terms that are used in vocational or trade classes are used to describe complete systems or processes. If I said to you, "I am going to (1) get in the car, (2) start the engine, (3) move the car forward while (4) watching the road, (5) steer without bumping

into anything or anybody, and (6) stop the car in fromt of my house," I have merely said, "I am going to drive home." Saying, "I am going to drive home" describes a whole process that everybody understands. Therefore, when the carpet cleaner says "spot clean" he or she is using two words to describe a process. The carpet cleaner does not say, I am going to (1) remove the excess stained material, (2) apply a dry-cleaning fluid, (3) apply detergent - vinegar - water solution, (4) reapply dry-cleaning fluid, (5) dry the carpet and, (6) gently brush the pile. When you know the process involved you can merely use the technical term "spot clean." It is important to learn the names of processes, such as "hemming a skirt," "setting a table," and "stripping a floor." However, it is when we know the steps involved in hemming a dress, setting a table, or stripping a floor, that the name of the process gives greater meaning.

Let us practice a few situations wherein I will name the process and the first step involved and you raise your hand if you know the rest of the steps involved in the process:

Process - Making a sundae

Step 1. Scoop ice cream into dish

2. (Obtain and list their ideas stressing a reasonable sequence)

3. _____

4. _____

Process - Polishing leather shoes

Step 1. Clean shoes of grime and dirt

2. (Obtain and list their ideas)

3. _____

4. _____

Process - Washing dishes

Step 1. Run hot water in a large container

2. (Again, obtain and list their ideas)

3. _____

4. _____

When you understand the system or process, you understand the steps that make up the process. The steps are easier to remember when we remember the process or system involved and remember it by name. Every process, system, product, job or skill has a name. If you are dealing with something with parts or steps that does not have a name, give it a name because it will help you to remember just what is involved.

Alright, we have talked about a number of things today. Before we leave, I would like for each of you to ask yourself the following questions and think about what your answer would be:

1. Do I understand how grouping things that are alike will help me to remember these items better? (Pause)
2. How do I go about forming meaningful relationships between items in a group? (Pause)
3. Does rehearsing a list or repeating the items in a list over and over again while thinking about those items help me to remember the items in the list? (Pause)
4. Will I remember the steps or parts to a process or system better if I know the name of the process or system? (Pause).

COGNITIVE TRAINING SESSION III

Reflectivity, Visual Discrimination and Verbalization:

As we continue to work on ways of improving memory and learning, we need to be mindful of our good and bad habits. Each of us needs to be aware of the ways in which we learn best. Some people learn best by reading and rehearsing, while others learn best by listening and thinking and a third group may learn best by observing and asking questions. There are different ways to learn different things and we can learn to learn just as well as we can learn anything else. Today we are going to learn how to learn by improving our listening and visual skills.

For the next ten seconds, when I say go, hold your hand tightly over your ears, close your eyes so that you can not see and count to yourself to ten. Ready, go! (Hold up a ruler and say in a normal voice, "This ruler is twelve inches long." (Place the ruler on a table.) Now, I've just presented some information to you. However, with your eyes closed and your ears covered you've prevented yourself from learning what was presented. This time cover your ears and only watch what I am doing. Ready, go! (Repeat the presentation.) Those of you who know what I said and did please raise your hands. (Observe the number of students who did not raise their hands.) I will repeat my presentation for the third time to determine if more students will learn with their eyes and ears uncovered and with full concentration. (Repeat presentation and stress the difference in learning.)

Some students fail to understand or remember because they fail to listen and then think about what they are hearing. They tend to react or respond too quickly or impulsively to what is being presented. Please raise your hand if you think that the following statements are true: (Ask each question and assess responses rather quickly.)

There are twelve inches in a foot.

There are now fifty states in the United States.

Virginia is the capitol of Richmond.

There are twelve months in a year.

Boys and girls must register for the draft when they are 18 years of age.

Most of you know which statements were true and which statements were false. (For each statement obtain correct answer from the group.) Did any of you raise your hand incorrectly even though you know the correct answer? How many persons simply raised their hands too quickly, just because others did so? How many persons did not listen or concentrate on what I was saying? Could you do better if you <u>pause</u> and <u>think</u> a few seconds before indicating an answer? Pausing gives you an opportunity and time to (list on chalkboard) (1) think about what is being asked of you, (2) concentrate and give full attention to the problem or question, (3) look for relationships between the question and things you already know, (4) rehearse, form images, or group things that must be remembered. (Discuss each item in some detail.)

Right now, I would like for each of you to study the following numbers without writing them down: (Write on chalkboard) 2468101216 How would you remember this number? How would you study it? Those of you who answered too quickly did not give yourselves a chance to think,

concentrate, and look for relationships. Would you try to learn the series of numbers by rehearsing, forming images or grouping? If you paused long enough to study the numbers you might see a pattern. (Erase the numbers) Is there anyone who could now tell me the numbers in the correct order? (Give all who wish an opportunity to respond) If you had paused and looked for a pattern among the numbers, you would have perhaps noticed the special relationship of the number series 2-4-6-8-10-12. Adding 16 to the end of the number pattern would not have been hard to remember.

Study the number patterns as they are shown on the screen and try to figure out the next number as it would appear in sequence for each of the items: (Use transparency)

(1) 2, 3, 4, 5, 6, _____

(2) 3, 5, 7, 9, 11, _____

(3) 10, 9, 8, 7, 6, _____

(4) 3, 6, 9, 12, 15, _____

(5) 5, 10, 15, 20, 25, _____

(6) 1, 2, 4, 7, 11, _____

(7) 25, 21, 17, 13, 9, _____

(8) 61, 64, 67, 70, 73, _____

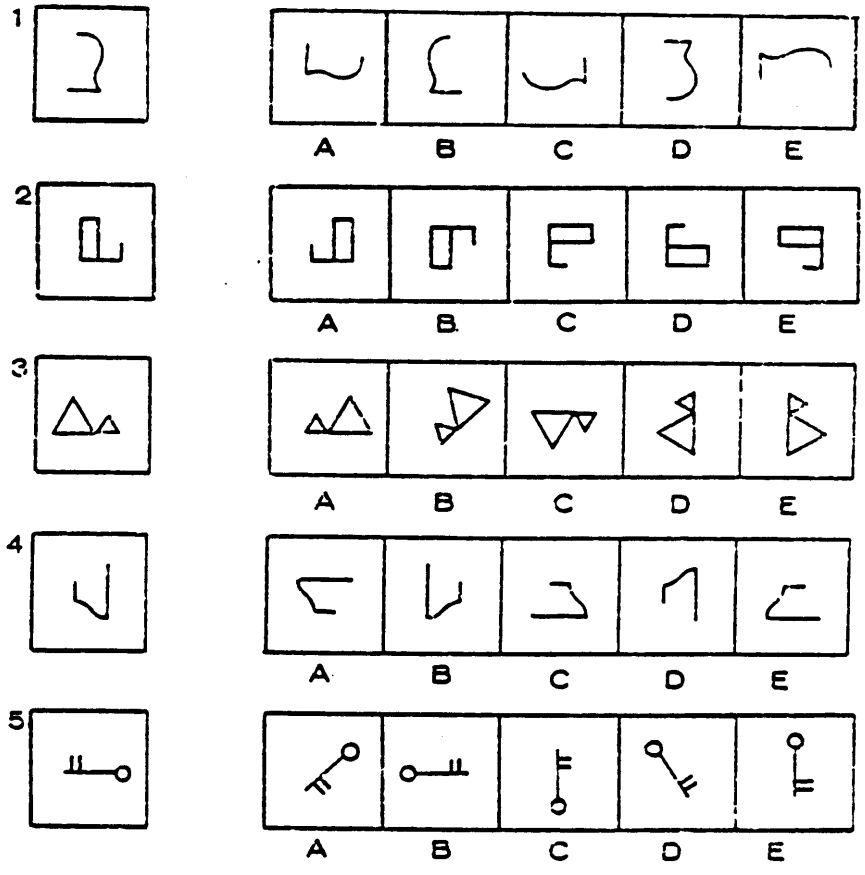
(9) 2, 4, 8, 14, 22, _____

(10) 3, 6, 12, 21, 33, _____

You have to stop and think in order to complete the number patterns. The same would be true for other patterns and shapes. Turn to page 7 of your Think I, Book 1 and find problem 15 (Innovative Science, Inc., 1978). This sequence involves a pattern of letters. Can you complete the sequence? If so, try to complete the number and/or

letter patterns by completing the blank spaces found in problem 16 on page 8.

Pausing helps you to stop and think before you act. Therefore, pausing and thinking is important to learning. It is also important to use your eyes to look for small details that make one thing different from another. Study the five items shown on your handout. If you observed each item very carefully, turned it around in your mind, it would match up with one of the figures in box A, B, C, D or E. On your paper circle the correct answer.



(The Allington Corporation, 1968)

When you study a figure in order to learn something about it, whether it be a drawing, a picture or the real object, you should look for the details that make that item what it really is. Look at the

color and if the color is silver, say to yourself, "The color is silver." Look at the shape and if the shape is like an S-shaped rod, say to yourself, "The shape is like an S-shaped rod." Look at the size and look at the finish or color. Is it bright and shiny? Does it move or is it stationary? Whatever you see, express it in words and think about what you are seeing and saying. (Hold up a masonry jointer.) Raise your hand if you can describe to me what I am holding. Tell me about the color or finish, the shape, the size, and the function or purpose. What do you call it? Why do you think it's called a jointer? (Repeat this activity with several parts and tools from various trade areas.)

COGNITIVE TRAINING SESSION IV

Practice Reflectivity, Visual Discrimination and Verbalization:

Do you remember what we talked about during our last meeting? (Pause.) One of the subjects we discussed was the importance of pausing to give thought, reflective thought to what we are trying to learn, to do or to answer. We often answer too quickly. We sometimes fail to give enough thought to what is really being asked of us. People who learn well are often people who stop to think and to plan their next step. From this day forward, if you want to improve in your ability to remember and to learn, you will take the time to stop, think, and plan what you are going to learn and how you are going to learn it.

You will use your eyes to observe the important details that make one object different from another. You will be concerned also about those details that make things similar. For practice, I am going to show you some slides. For each one I want you to study the picture and think about how they are different and how they are alike. I will call on different persons to explain. Please do not answer out; however, you may raise your hand if you think you know the answer. (Show slide as portrayed below:)

Slide #1 - Assorted pieces of fruit.

Answer - The objects are all pieces of fruit (alike); the fruits are of different types (different).

Slide #2 - A hammer, screwdriver and saw.

Answer - The objects are all tools (alike); the tools are used for different things (different).

Slide #3 - A typewriter, a pen and a pencil.

Answer - The objects are all things used for writing (alike); the objects are all used to provide a different type of writing (different).

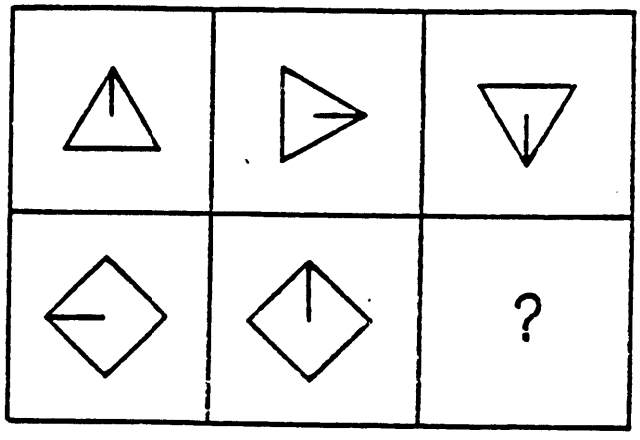
Slide #4 - A newspaper, looseleaf paper, and a telephone book.

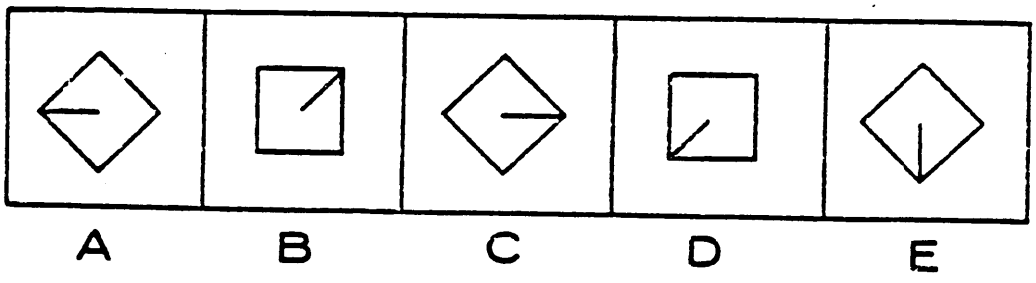
Answer - The items are all made of paper (alike); the paper items are used for different purposes (different).

Slide #5 - A briefcase, a paper bag, a book rack.

Answer - Certain things may be placed into each of these objects (alike); they are designed or made to serve different purposes (different).

As we begin to solve problems by first pausing to give thought to what we have to learn or do before we act, we will have come a long way toward improving our abilities to learn. Very often problems can be solved by looking for rules which explain how things work. The transparency now being shown to you involves using your eyes and your mind in order to solve the problems. However, first, you must determine the ideas or rules behind the problems.





(The Allington Corporation, 1968)

In the top six boxes, observe how the three triangles with the lines and the two boxes with the lines appear to turn like a clock as you look from left to right. In the last box you will notice a question mark. Looking at boxes A, B, C, D, and E, you are to determine which box should replace the question mark. (Pause.) By observing the line in each triangle and comparing the direction the triangles appear to turn with those of the square, we soon get the idea and are able to solve the problem. The answer to this problem is, of course, C. In order to solve this problem and others similar to it you must first stop and think and at the same time use your eyes and look for clues and patterns among the details that are available to you. In this case, shape and direction were two important details that gave clues to the solution. Other important details are color, finish, size, function, and location. (Explain each in concept.) For the sake of practice, study the problems one through twelve on pages 36 and 37 in your Talent Training Exercises, Part I book (The Allington Corporation, 1968). Observe that these problems are very much like the one we just solved. Notice also that the details include shapes, directions, colors or tones, and sizes. Pausing or stopping to use your eyes to look for details should help you to solve these problems much, much easier than trying to solve them without an organized method or strategy. Before you begin, please take two minutes and look over all of the problems. Write at the top of your page the number of problems you think you will be able to solve correctly. You may now begin. (Allow time for the completion of the exercises.) Before I give you the correct answers, I want you to look over your answers, write "yes" beside those answers that you know are correct

and write "no" beside the answers that you know are probably incorrect. It would be good for you to know when you are sure of your answers and when you are not. I will now give you the correct answers. Check those that are incorrect.

When it comes to remembering things that you will be working with in your trade, always stress the important details. Again, I am talking about details such as what? What are the details that you should observe? I am talking about color, finish, shape, size, how it is to be used and why. You must rehearse these details by repeating them to yourself. You must also repeat the name of the object. When you study an object by its name and by examining its details, and when you rehearse those details by repeating them to yourself, you form lasting impressions that will improve learning and recall.

As a short drill, I will hold up four tools for you to see.

I will tell you the name of each tool, explain how it is to be used, and write the name of the tool on the chalkboard. In addition, I will wait two minutes for you to rehearse the name and whatever details you observe about each tool. Finally, I will ask you to raise your hand if you think you will be able to tell me the names of the four tools without help from anyone else. Ready, let's try it. (Use the following tools: 1. mason's edger, 2. auto body repairer's dolly block, 3. woodworker's auger bit, 4. upholsterer button covering machine.

COGNITIVE TRAINING SESSION V

Review Reflectivity, Grouping, Imagery, Cumulative Rehearsal, Visual Discrimination and Verbalization:

Today's session will be a review of most of the things that we have already practiced. We need to review these learning strategies because once you learn how to use them as individuals to improve learning then you need only to know when to select the technique that will work best for the occasion. Therefore, today we will review the following: (List on the chalkboard.)

1. Pausing to reflect on what is asked of you and the approach that you will take to solve the problem.
2. Grouping items in categories according to their similarities.
3. Visualizing relationships or forming imageries between items that can be visualized.
4. Rehearsing or repeating items in a list over and over again while thinking about those items.
5. Looking for important details in objects or parts of objects such as color, size, finish, shape and function.
6. Verbalizing or repeating the name of the object or process out loud.

These learning strategies will improve your memory if you use them correctly. This takes practice, and with practice you will be using the correct strategy at the best time. There are occasions when you will use more than one strategy at a time. For instance, if you

are called upon to learn the names and functions of a list of tools commonly used in your trade, you would probably want to do the following:

1. Group the tools according to function.
2. Look for the special details that allow each tool to be functional or the feature which gives the tool its name. (Show how the ball pen and the claw hammer are so named)
3. Work with one group of tools at a time and rehearse each tool by repeating its name several times while concentrating on its features and functional details.

In studying our tools, we used four learning strategies. We grouped according to function, we looked for special details, we rehearsed each tool by name repeatedly, and we did so loudly enough so that we could hear ourselves. Remember, the learning strategies will not help you unless you use them. However, you must make the decision as to which strategies you will use at any given time. No one will remind you. This is the main reason why I suggested that you pause. Pausing gives you the opportunity to stop, think, and concentrate on what you will do in response to a given task.

Suppose you were given a task which involved following a certain order or procedure. An example task might be to learn the general procedures for following a recipe, any cooking recipe. Remember, this is only an example. Your teacher may want you to learn the following general steps: (List on chalkboard)

1. Wash your hands before entering the kitchen or cooking area.
2. Read your recipe carefully and determine if you are going to prepare for the number of servings recommended in your recipe.
3. Make certain that you have all of the necessary ingredients to do the job.
4. Make certain that you have all of the necessary tools and equipment to do the job.
5. Assemble all of your tools and ingredients as final preparation.

Given this list to learn, how would you simplify your learning? What strategies would you use? (Obtain their responses and acknowledge all replies)

If I might add to what you have said, I believe that I would try first to concentrate on the important details of each step. I believe these details would be as listed:

1. Wash hands.
2. Read, determine servings.
3. Check ingredients.
4. Check tools and equipment.
5. Get tools and ingredients.

After I have rehearsed and learned these steps in the correct order, I would then use these key words or details to cue my memory to a complete understanding. In other words, when I think of the expression "wash hands," I would know that this means before I enter the kitchen or cooking area. If I already know that the second step

is "read, determine servings," I would just make certain that I understand what the statement means - that if the recipe is designed for four persons and I plan to serve eight persons, I will need to double each of my ingredients. If I remember step three is to "check ingredients" then I need to also remember that I will check my ingredients to make certain I have everything that I need. For each step, I need to remember the important details. I will determine the key words that explain the step and I will rehearse them in the correct order. Next, I will make certain that I know what these key words or expressions are really saying. It may be helpful to use your imagination and picture your teacher performing each of these steps as you rehearse them in your mind.

A nursing instructor may discuss with you the steps for making an unoccupied bed. If the teacher demonstrated this task and provided you with the list of steps in writing, what strategies would you use to learn them in the correct order? (Obtain their responses.) Learning to follow steps in a correct order is an important skill in most trade areas. Students in masonry, while learning to spread mortar, must learn specifically the task of seating the mortar correctly to the trowel. I am going to use a trowel and a mortarboard with mortar on it and demonstrate the four steps to seating mortar to a trowel. The four steps are also listed on a handout now being passed to you. Follow these steps as I read them to you and demonstrate this task:

1. Placing your thumb over the end of the handle of your trowel go over to the mortar on your mortarboard.

2. Bend or stoop over the mortarboard so you can get to the mortar.

3. Use your trowel and scoop up some mortar. Do not push your trowel away from you. Bring or drag your trowel towards you.

4. Now lift your trowel up. This is called a "loaded trowel." A trowel is loaded when it has mortar sitting on it.

How would you learn this task? (Obtain their responses.) What are the important details? How important is it to observe from a good angle or location? Was it helpful for you to hear and see everything that I said and did? How do you rehearse or practice in order to develop this skill? Would it help for you to talk through each step as you attempt to do it for the first time? These are questions that you should ask yourself and consider in order to select the learning strategies to use for a particular learning activity.

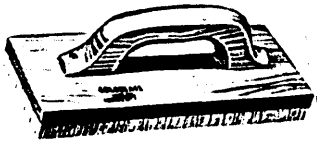
COGNITIVE TRAINING SESSION VI

Discuss Generalization: Review and Practice All Strategies. Meta-cognitive Activities:

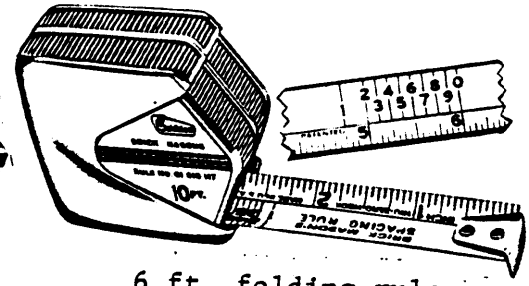
The last time we met, we reviewed the six learning strategies that could make learning easier when used at the right time. We have been talking about pausing, grouping, visualizing, rehearsing, looking for details and verbalizing. It is not important that you remember the names of these strategies. However, it is very important that you remember to use them. Using the strategy that will help you to remember will become an automatic process with practice. Pausing to think before answering out should become an automatic process when you are not exactly certain of your answer. No one whould have to remind you. Grouping things that are alike will help you to recall them later. This strategy works in any situation, whether you are rying to remember tools, materials, food, animals or whatever. Again, no one should have to tell you to group them so that you will remember them. Grouping things that are alike should be an automatic procedure.

Let us try a short drill involving the learning strategy "grouping" as it applies generally to several types of tools used in food services and auto servicing. (Pass out Exercise VI-1 to students and discuss the name and use of each tool. Answer all questions - now pass out questions.)

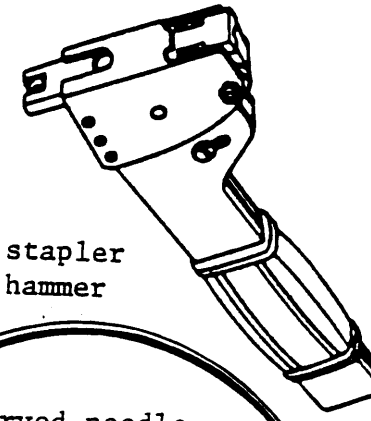
DIRECTIONS: Listed below are tools and equipment used in the upholstery and masonry classrooms. For each question or statement, place your answers in the space provided.



wood float



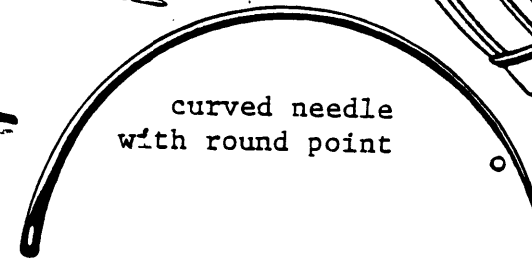
6 ft. folding rule



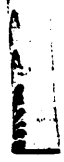
stapler hammer

claw tool

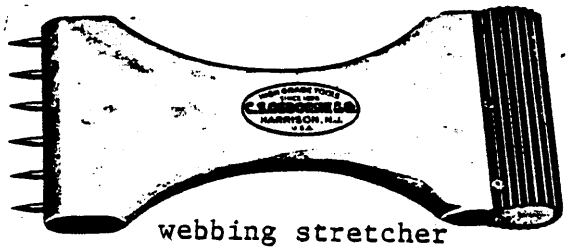
convex brick jointer



curved needle with round point

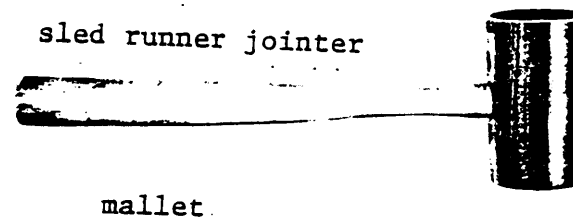


brick hammer



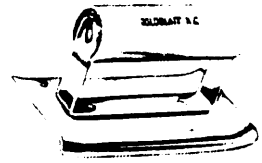
webbing stretcher

sled runner jointer



mallet

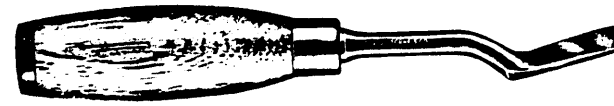
blocking chisel



edger

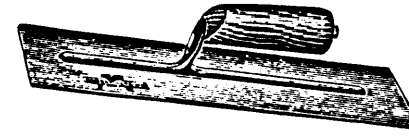
webbing pliers

level



ripping tool

straight needle



cement finishing trowel

Exercise VI-1

Questions to Exercise VI-1

1. What are the two major groups of tools? _____

   _____

2. How many smaller groups can you identify? _____

3. How many upholstery groups are there? _____

4. How many masonry groups are there? _____

5. What tools shown are correctly used to stretch webbing?

   _____

   _____

6. What tools shown are correctly used for sewing?

   _____

   _____

7. What tools shown are correctly used to finish the surface of mortar joints? _____ _____

   _____

8. What tools shown are correctly used in the stripping operation for removing tacks? _____

   _____

9. What tools are correctly used for cutting or breaking masonry materials? _____

   _____

10. Please explain what strategies you would use in order to remember the names and uses of these tools. _____

    _____

    _____

Now, let us take another look at the learning strategy that requires you to visualize or imagine certain relationships or patterns in your mind. This strategy is best used when you are trying to remember a list of items such as the tools needed to install, repair or remove something mechanical. If you are trying to remember the tools needed to change the oil in an automobile engine, you simply turn on your mind just as you would turn on a television set. You then imagine each step that you would take and the tools that you would use. This strategy, of course, helps you to remember the correct steps or procedure also, but you must remember to use it.

The following directions are generally used for heating canned vegetables: (Refer to list on chalkboard and read to students)

1. Drain liquid into saucepan (retain vegetables in can; boil quickly to reduce liquid to about one-fourth of original volume).
2. Add vegetables and heat quickly but do not boil (canned vegetables are already cooked).
3. Season to taste and serve immediately.

Now, I will use a can of vegetables and demonstrate this procedure to you but only pretending to heat the food. Watch each step and form a mental picture of each step as I carry out this procedure. (Demonstrate each step as explained)

If you observed the details of each step as I demonstrated this procedure to you, the mental picture should be still fresh in your mind. You should continue to visualize each step and use your mind as you would a television and replay the activity in the form of a mental rehearsal. Next, you should actually practice the activity

if it is possible.

When you carefully observe the many details of a demonstration as performed by your teacher and mentally picture yourself performing these activities in the exact manner, you are using two important learning strategies. You are observing details such as: the selection of tools, the size, color, shape and function of parts, and the procedures that are followed. You are also picturing or visualizing the entire operation step by step in your mind strengthening your understanding of the task. Adding the strategy of "rehearsal," you should, as soon as possible, practice the activity over and over again under the observation of your teacher. At home or when you have the opportunity, you can go back to the visualization process; that is, picture yourself performing the task, however, this time with "sound." Talk yourself through each step, try to remember the names of tools and parts or materials, and repeat them by name. When you talk yourself through an activity, you learn that activity better and faster.

Observe as I rehearse and talk through the activity of heating a can of vegetables. (Talk through and act out the strategies in demonstration. Call on and observe students repeat the demonstration, and give feedback on their performances.)

Remember the expression "practice makes perfect." It is a very true expression. However, only you know truly how much practice of these strategies that you will need in order to make them a part of you. With every opportunity, you should test yourself regularly. Whenever you have something to learn, ask yourself the following questions: (List on chalkboard.)

1. Do I know what I am supposed to do?
2. Is there anything more I need to know before I can begin?
3. Is there anything I already know that will help me?
4. What learning strategy will best work for me this time?

COGNITIVE TRAINING SESSION VII

Test for Generalization and Metacognitive Skills:

For several sessions we have met, discussed and practiced six different learning strategies. Would someone like to name one of these strategies and tell me how it is to be used? (Attempt to get the students to name each of the strategies; list them on the chalkboard as they are given.)

Once you have learned how to use these learning strategies, the next important task is to use the one or as many as you choose that will help you to remember and understand best. You must take the learning strategies that you've learned here and generally use them at any time and in any learning situation. The poor learner will fail to use learning strategies. The improved learner will use strategies and will continue to learn better.

At the end of our last session, I gave you four questions that you should ask yourself whenever you have something to learn in any class. It will help if you are able to remember these questions. Again, I will list them on the chalkboard:

1. Do I know what I am supposed to do?
2. Is there anything more I need to know before I can begin?
3. Is there anything I already know that will help me?
4. What learning strategy will best work for me this time?

When you ask yourself these questions, you are already using one learning strategy - pausing. You are first questioning to make certain that you understand your assignment. Many students fail the test because they fail to follow the directions. You may have to

clarify your directions before you begin. Once you are sure that you understand the assignment, consider everything that you already know about the problem. Will what you already know about a similar problem help you with this one? Finally, the answer to the question as to which strategies to use requires a knowledge of each of the strategies. You must know the six strategies and become aware of how these strategies work for you in different kinds of learning situations. You become knowledgable through practice, practice, and practice. The practice, of course, adds up to "experience" which gives you the knowledge about your own ability to learn using certain strategies in certain circumstances. Are there questions?

How about a few exercises? (Provide students with a handout, read items aloud, and after allowing some time compare their answers with yours.)

The U. S. Customary System (U.S.C.S.) of measuring includes the following measurements for liquids, length, and weight:

12 inches	=	1 foot
16 ounces	=	1 pint
4 quarts	=	1 gallon
16 ounces	=	1 pound
5,280 feet	=	1 mile
3 feet	=	1 yard
2,000 pounds	=	1 ton
2 pints	=	1 quart

Question #1 - How would you attempt to learn these eight facts in measuring?

The following items must be purchased by you in a supermarket:

Turkey wings	Peas
Butter beans	Bacon
Paper plates	Chicken
Onions	Paper towels
Birthday card	Liver
Lunch bags	Tomatoes
Hamburgers	Napkins
Carrots	

Question #2 - Using a list, how could you save time in shopping for these items?

Question #3 - How would you go about memorizing this list?

In a classroom situation, your teacher wants you to remember the procedures for changing tires of an automobile. In another class, students are asked to list the steps for frosting a layer cake. A teacher in a nursing assistant class asks students to demonstrate the proper method for making an unoccupied hospital bed.

Question #4 - What strategies would be helpful in learning any of the above skills?

Question #5 - How would you use the strategies that you selected in any of the classroom situations given above?

Question #6 - How would your strategies help you to remember any of the procedures better?

Boiling is a suitable method for cooking all fresh vegetables. After carefully washing the vegetables, they are added to a small amount of boiling water and covered. The water is quickly returned to a boil, and the heat is reduced so that the water simmers gently. To protect the color of bright green vegetables, cook them without a cover for the first few minutes. All vegetables should be cooked only until they are fork tender.

Question #7 - In what order would you place the list below? Write a 1 next to the step that is taken first, a 2 next to the second step, and so on.

a. _____ The water is quickly returned to a boil.

b. _____ Carefully wash the vegetables.

c. _____ Cook vegetables until they are fork tender.

d. _____ The heat is reduced so that the water simmers gently.

e. _____ The vegetables are added to a small amount of boiling water and covered.

Question #8 - What strategies would you use to learn these steps in the correct order?

COGNITIVE TRAINING SESSION VIII

Stress Generalization and Metacognitive Skills; Review Importance of Selecting Appropriate Strategies:

Today is the last of our training sessions. All of our efforts have been to teach you how to select and use learning strategies in order to be a better learner and a smarter student. I feel very strongly that you will be a better learner and a smarter student if you always make use of learning strategies. Those who forget to apply what has been learned in these sessions will not do as well as those who remember. Use your strategies in any learning situation - in school, at work or at home. If you try using them enough, you will soon be able to determine which learning strategy works best for you for various types of learning tasks.

We have talked about many kinds of things that you must learn in a vocational course. A partial list of such things, I'll call them learning activities, are as follows: (List on chalkboard)

A. Names of tools, machines, processes, etc. . . .

B. Procedures or steps for doing something.

C. Names and functions of parts or materials.

D. Spelling words and technical terms.

E. Linear, dry and liquid measurements.

F. Following and remembering detailed instructions.

G. Proper use and care of tools and equipment.

H. Understanding of differences and similarities of tools and materials.

This list could go on, however, for the moment these learning activities will be sufficient. Now, suppose we list the six learning

strategies that we have learned to use during our training sessions:

1. Pausing to reflect on what is asked of you and the approach that you will take to solve the problem.
2. Grouping items in categories according to their similarities.
3. Visualizing relationships or forming imageries between items that can be visualized.
4. Rehearsing or repeating items in a list over and over again while thinking about those items. Practicing a skill is a form of rehearsal.)
5. Looking for important details in objects or parts of objects such as color, size, finish, shape, and function.
6. Verbalizing or repeating the name of the object or process out loud.

The overall purpose of these training sessions is for you to learn to make use of these learning strategies whenever you are faced with a learning situation. When you are able to select and use learning strategies as you attempt to perform "learning activities," your learning will be greatly improved and the purpose of these sessions will be accomplished.

The worksheet that we are giving to you will help you to determine how much you really know and understand about your ability to select learning strategies to perform learning activities. Your answers will be compared by you to those of your classmates. Only you can determine if your answers will really work for you. Under each learning activity listed on your worksheet will be two specific examples. Beside each example is a space for you to list the number assigned to the learning strategy that you would use in order to best

learn and perform the learning activity. You may use one or several strategies, however, you should list all that you would use in the space to the right of each example of a learning activity. (Go over each item on the worksheet. Invite their questions at any time during this activity.)

Worksheet

Name _____ Date _____

Directions: In the space to the right of each learning activity write the numbers of the corresponding learning strategies that you would use to best learn this activity. Be able to explain your answers.

Learning Strategies

1 - Pausing
2 - Grouping
3 - Visualizing
4 - Rehearsing
5 - Looking for Details
6 - Verbalizing

Learning Activities

A. Names of tools, machines, processes:

(1) Be able to identify twelve basic tools as they are pictured on a test. (1) _____

(2) Be able to name the tools used to perform certain processes. (2) _____

B. Procedures or steps for doing something:

(3) Be able to take a given list of written steps and place them in the correct order. (3) _____

(4) Be able to follow a set procedure for performing a skill after it has been demonstrated by the instructor. (4) _____

C. Names and functions of parts or materials:

(5) Be able to match certain food items to certain food groups. (5) _____

(6) Be able to name certain auto engine parts that are visible under the hood and tell what they are designed to do.

(6) _____

D. Spelling words and technical terms:

(7) Be able to spell correctly a list of ten new words used in your trade. (7) _____

(8) Be able to recognize when certain words used often in your trade are spelled incorrectly. (8) _____

E. Linear, dry and liquid measurement:

(9) Be able to identify correctly the tools used for linear, dry and liquid measurements. (9) _____

(10) Be able to select and use the correct measuring tool for the job to be done in a cooking situation.

(10) _____

F. Following and remembering detailed instructions.

(11) Be able to obtain and understand the necessary information before attempting to do something.

(11) _____

(12) Be able to demonstrate and explain an activity to someone else.

(12) _____

G. Proper use and care of tools and equipment:

(13) Be able to continue to use tools correctly long after initial or first instruction. (13) _____

(14) Be able to determine if tools are safe and in good operating condition. (14) _____

H. Understanding of differences and similarities of tools and materials:

(15) Be able to explain why certain tools are appropriate for certain jobs and inappropriate for others.

(15) _____

(16) Be able to group tools and materials according to their use.

(16) _____

(At the conclusion of worksheet activity, lead a discussion as to why certain strategies were selected for certain learning activities. Remind them that if the strategy works, it's the right one to use. Thank all participants and encourage continued use of the learning strategies.)

APPENDIX E

INSTRUCTIONAL POINTS COVERED DURING TEACHER INSERVICE IN PREPARATION FOR COGNITIVE TEACHING

Learning Strategies taught to some of the students
during special training sessions

1. Pausing to reflect on what is asked of you, to think and to concentrate on the approach that you will take to solve the problem.

2. Grouping things together that are similar or have similar functions.

3. Visualizing relationships or forming imageries between items that can be visualized.

4. Rehearsing or repeating items in a list over and over again while thinking about those items.

5. Looking for important details in objects or parts of objects such as color, size, finish, shape and function.

6. Verbalizing or repeating the name of the object or process out loud.

Cognitive considerations in teaching certain skills

1. Simplify steps in a minimum of words and list them on the chalkboard and on a student handout.

2. Go over handout steps, explain to students that you want them to observe demonstration at least twice.

   (a) First, talk through the activity referring to the handout steps as you slowly perform these steps.
   (b) Again, refer to the steps but perform the activity at the normal speed.

3. Ask the students to visualize each step in his or her mind and to prepare to rehearse the steps at home using the handout as a guide.

4. Have each student explain each step in the activity before attempting to perform alone. This is done without using the written handout.

5. Have student practice the activity as demonstrated.

6. Provide instant feedback - both verbal and nonverbal.

   (a) Examples verbal feedback:

   That's great
   I like the way you're working

Good Job
Take your time
Wait
Now you've got the hang of it
Try another way
All right
Fantastic

(b) Examples of nonverbal feedback:

Touching the student, or task
Pointing
Blocking or stopping an error
Guiding the learners movements
Squeezing the shoulder or arm to indicate the beginning of an incorrect movement (Gold, 1979)

7. Ask students to use handout to rehearse procedures at home.

Cognitive considerations in teaching certain concepts

1. When teaching tool identification, ask students to observe the "details" such as color, shape, size, finish, function and movement of parts. Using the term "detail" should serve to cue cognitively trained students to generalize.

2. Stress how the names of certain cooking terms and tools help to describe their meaning with respect to the terms, and function with respect to the tools.

3. Use "grouping" concepts when presenting materials where possible and call this to the attention of the students. Explain to students why certain items in a group.

4. Whenever possible, develop verbal links or relationships between concrete items that go together.

"From small to smallest, its "CDM" (Cube, Dice, and Mince)
"Parsley Makes Pretty" (Garnish)

5. If possible, have each student use the tools that are being presented in order for the student to get the feel of their application. Have student observe pictures as well as actual tools and cooking activities of terms described. Ask student to write the name of the tool or terms on paper and visualize their use.

APPENDIX F

INDIVIDUAL TEST SCORES

Strategy Awareness

Case - N	Pretest Scores	Posttest Scores
Group I		
1	12	18
2	4	14
3	4	12
4	8	12
5	0	8
6	6	16
7	6	18
8	10	16
9	16	16
10	6	18
Total	72	148
Group II		
1	5	8
2	10	22
3	16	22
4	12	8
5	4	14
6	6	18
7	1	2
8	8	16
9	2	4
10	6	6
Total	70	120
Group III		
1	12	14
2	10	8
3	8	12
4	4	4
5	2	6
6	10	8
7	12	10
8	1	8
9	0	4
10	8	12
Total	67	86

Case - N Group IV	Pretest Scores	Posttest Scores
1	8	6
2	12	6
3	8	8
4	4	3
5	15	18
6	3	6
7	14	18
8	6	6
9	0	6
10	18	12
Total	88	89

Skill Learning and Retention

Case - N Group I	Pretest Scores	$Posttest_{c1}$ Scores	$Posttest_{c2}$ Scores
1	10	190	131
2	9	185	143
3	101	181	162
4	64	176	143
5	28	185	144
6	18	183	171
7	82	185	154
8	91	191	143
9	102	190	190
10	101	200	180
Total	606	1866	1561
Group II			
1	82	200	190
2	59	200	200
3	82	200	142
4	73	172	103
5	55	180	123
6	29	172	132
7	73	170	161
8	73	172	142
9	29	152	103
10	64	181	171
Total	619	1799	1467
Group III			
1	27	143	114
2	113	182	171
3	18	173	163
4	29	153	133
5	73	191	191
6	18	163	134
7	64	172	151
8	82	181	142
9	74	153	162
10	82	191	123
Total	580	1702	1484

Case - N Group IV	Pretest Scores	$Posttest_{c1}$ Scores	$Posttest_{c2}$ Scores
1	74	186	190
2	65	184	162
3	82	141	131
4	100	169	153
5	55	185	190
6	55	152	103
7	19	163	163
8	65	162	152
9	27	113	84
10	65	173	143
Total	607	1628	1471

Information Learning and Retention

Case - N	Pretest Scores	Posttest$_{c1}$ Scores	Posttest$_{c2}$ Scores
Group I			
1	28	128	112
2	52	104	84
3	80	100	84
4	56	60	72
5	88	140	112
6	40	112	90
7	88	146	136
8	76	136	112
9	72	144	134
10	80	112	94
Total	630	1182	1030
Group II			
1	88	128	116
2	110	152	140
3	76	144	104
4	60	120	100
5	44	116	78
6	72	128	104
7	60	92	68
8	52	144	112
9	60	112	84
10	60	132	88
Total	682	1268	994
Group III			
1	40	44	60
2	76	72	80
3	62	128	108
4	72	96	76
5	52	136	112
6	88	108	56
7	76	92	88
8	76	104	76
9	88	88	84
10	64	80	72
Total	694	948	812

Case - N Group IV	Pretest Scores	$Posttest_{c1}$ Scores	$Posttest_{c2}$ Scores
1	72	124	108
2	72	104	108
3	88	148	98
4	64	120	104
5	68	92	88
6	72	96	56
7	96	124	112
8	68	112	92
9	52	60	76
10	64	112	96
Total	716	1092	968

Learning and Retention Recall of Tools and Procedures

Case - N Group I	Pretest Scores	$Posttest_{c1}$ Scores	$Posttest_{c2}$ Scores
1	0	95	68.5
2	0	85.5	58
3	32.5	93.5	94
4	22	74.5	47.5
5	5.5	104	57
6	11	88.5	84
7	27.5	121	68
8	16.5	89.5	47.5
9	21	95.5	105.5
10	16.5	99.5	79.5
Total	152.5	946.5	709.5
Group II			
1	22	137	84.5
2	52.5	121.5	116
3	5.5	136	53
4	11	64	37.5
5	22	94.5	63.5
6	5	65	57.5
7	22	64	43.5
8	16.5	80	74
9	5.5	73.5	48
10	16.5	90.3	88
Total	178.5	926	665.5
Group III			
1	0	58.5	58.5
2	26.5	131.5	99
3	11	78	78.5
4	5.5	94.5	58
5	27.5	110	121
6	5.5	83.5	47
7	16.5	94	68.5
8	22	95	47.5
9	16.5	74	78
10	22	95.5	53
Total	153	914.5	719

Case - N Group IV	Pretest Scores	$Posttest_{c1}$ Scores	$Posttest_{c2}$ Scores
1	32.5	95	106
2	37	89	57.5
3	27.5	83.5	58.5
4	16.5	106.5	62.5
5	16.5	126	74
6	11	43.5	53.5
7	5	89.5	83.5
8	11	105	58
9	0	49.5	2
10	5.5	131	68
Total	162.5	918.5	643.5

APPENDIX G

STRATEGY AWARENESS FIELD TEST RESULTS

Strategy Awareness Field Test Results

Questions and Typical Responses (Number of Type Response Shown in *Parentheses)	Not Met	Slightly Met	Almost Met	Met
Question #1: What method would you use to remember the following list of words arranged in any order? Orange Apple Coffee Peach Milk Tea Grape Juice				
Typical Responses:				
"I would just study them until I remember."	(4)			
"I would repeat them over and over again."		(6)		
"I would remember that some of the words are fruits and some are liquids."			(3)	
"I would group them under either fruits or drinks and then I would practice by repeating them."				(3)
Question #2: The number 120269 04157 is a long distance telephone				

Questions and Typical Responses (Number of Type Response Shown in Parentheses) Cont'd.	Not Met	Slightly Met	Almost Met	Met
number. What method would you use to remember this number?				
Typical Responses:				
"I would repeat them until I can remember."	(4)			
"I would write it down."	(3)			
"I would remember a part of it at a time and keep repeating it."			(3)	
"I would keep studying it until I know it."	(4)			
Question #3: What method would you use to remember the following items that you intend to purchase after school? A Basketball, a Pair of Tennis Shoes, Sun Glasses, and a Necktie				
Typical Responses:				
"I would write them on a piece of paper."	(6)			
"I would form a picture of these things in my mind."		(3)		

Questions and Typical Responses (Number of Type Response Shown in Parentheses) Cont'd.	Not Met	Slightly Met	Almost Met	Met
"I would think about them all during the day."	(4)			
"I would keep repeating these things over and over again."	(3)			
Question #4: Students in driver education class have been taught how to make a left turn. Is it possible to study this procedure without the aid of an automobile? If so, explain how.				
Typical Responses:				
"You could practice while sitting in a chair or standing."		(6)		
"You could imagine that you are in a car and practice at the same time."			(5)	
"Someone could explain it to you."	(3)			
"You could study a picture."	(3)			
Question #5: You are shown a strange looking tool for the first time, what can you do to make it				

Questions and Typical Responses (Number of Type Response Shown in Parentheses) Cont'd.	Not Met	Slightly Met	Almost Met	Met
easier for you to recognize that tool when you see it again?				
Typical Responses:				
"Find out the name of the tool and keep repeating it."	(3)			
"Study the tool."		(3)		
"Find out the purpose of the tool."		(4)		
"Study the tool's shape."		(3)		
Question #6: You are interviewing for a job and the interviewer has asked a very difficult question. What should you do first?				
Typical Responses:				
"I would ask him to repeat the question."		(10)		
"I would try to answer the question."	(3)			
"I would try to think about the answer."				(3)
Question #7: What is a good way to learn something that must be remembered in a definite order?				

Questions and Typical Responses (Number of Type Response Shown in Parentheses) Cont'd.	Not Met	Slightly Met	Almost Met	Met
Typical Responses:				
"I would write them down."		(5)		
"I would keep repeating them."			(4)	
"I would have someone to call them for me to repeat."	(5)			
"I would look at them and try to remember."	(3)			
Question #8: A shopping list consists of the groceries listed below. How would you shop for these items in a supermarket? String Beans Potatoes Paper Bags Corn Chicken Peas Liver Napkins Onions Paper Towels Steak Lamb Chops				
Typical Responses:				
"I would go through each aisle until I have found each item."	(6)			
"I would ask the clerk to tell me where everything is located."	(3)			
"I would just look until I found what I wanted."	(3)			

Questions and Typical Responses (Number of Type Response Shown in Parentheses) Cont'd.	Not Met	Slightly Met	Almost Met	Met
"I would list them in alphabetical order."	(5)			
Question #9: A new task has been demonstrated to you by your teacher. The steps were written on the chalkboard. What would you do in order to remember these steps?				
Typical Responses:				
"I would write the steps down and study them."		(4)		
"I would ask the teacher to repeat the demonstration this time slowly."	(3)			
"I would try to do the task myself."			(4)	
Question #10: Some students are slow to give answers when questioned and others are quick. Are there any advantages to either of these characteristics or methods? Which method do you prefer and why?				

Questions and Typical Responses (Number of Type Response Shown in Parentheses) Cont'd.	Not Met	Slightly Met	Almost Met	Met
Typical Responses:				
"I would answer quickly so that the teacher would know that I know the answer."	(3)			
"I would take my time and be sure."			(5)	
"I would answer quickly if I know the answer."				(4)
"If I think I know the answer I would try to answer first."		(3)		

*Note: Type Response totaling less than three are not indicated.

APPENDIX H

ANOVA AND MULTIPLE COMPARISON TABLES

Table 3

ANOVA for Pretest$_s$ and Posttest$_s$ Scores on Knowledge of Learning and Strategies

Pretest$_s$

Source of variation	Degrees of freedom	Sum of squares	Mean square
Between	3	25.57	8.52
Within	36	655.2	18.2
Total	39	680.77	F = .47

Posttest$_s$

Source of variation	Degrees of freedom	Sum of squares	Mean square
Between	3	235.87	78.62
Within	36	676.90	18.80
Total	39	912.77	F = 4.18**

**P < .05

Table 4

Scheffé's Post Hoc Test for Multiple Comparison on

Knowledge of Learning Strategies

Comparison	F
Groups I & II, III & IV	46.01*

*P < .01

Table 5

ANOVA for $Pretest_c$ and $Posttest_{c\ 1}$ Scores on Skill Learning

$Pretest_c$

Source of variation	Degrees of freedom	Sum of squares	Mean square
Between	3	81	27
Within	36	42913.4	1192.04
Total	39	42994.4	F = .02

$Posttest_{c\ 1}$

Source of variation	Degrees of freedom	Sum of squares	Mean square
Between	3	3313.3	1104.43
Within	36	11534.8	320.41
Total	39	14848.1	F = 3.41**

**P < .05

Table 6

Scheffé's Post Hoc Test For Multiple Comparison on Skill Learning

Comparison	F
I, II	.7
I, III	4.25
I, IV	8.84***
II, III	1.5
II, IV	4.56
III, IV	.83

***P < .10

Table 7

ANOVA for $Pretest_c$ and $Posttest_{c\ 1}$ Scores on Information Learning

$Pretest_c$

Source of variation	Degrees of freedom	Sum of squares	Mean square
Between	3	142.8	47.6
Within	36	12721.6	353.38
Total	39	12864.4	F = .13

$Posttest_{c\ 1}$

Source of variation	Degrees of freedom	Sum of squares	Mean square
Between	3	5633.2	1877.73
Within	36	21695.2	602.64
Total	39	27328.4	F = 3.12**

**P < .05

Table 8

Scheffé's Post Hoc Test For Multiple Comparison On Information Learning

Comparison	F
I, II	.59
I, III	4.62
I, IV	.70
II, III	8.50***
II, IV	2.57
III, IV	1.72

***P < .10

Table 9

ANOVA for Recall of Skill Learning Procedures

$Pretest_c$

Source of variation	Degrees of freedom	Sum of squares	Mean square
Between	3	34.88	11.63
Within	36	4805.11	133.48
Total	39	4839.99	F = .09

$Posttest_{c\ 1}$

Source of variation	Degrees of freedom	Sum of squares	Mean square
Between	3	61.62	20.54
Within	36	20011	555.86
Total	39	20072.62	F = .04

Table 10

ANOVA for Skill Learning Retention

Pretest (Posttest$_{c\ 1}$)

Source of variation	Degrees of freedom	Sum of squares	Mean square
Between	3	3313.3	1104.43
Within	36	11534.8	320.41
Total	39	14848.1	F = 3.45

Posttest$_{c\ 2}$

Source of variation	Degrees of freedom	Sum of squares	Mean square
Between	3	529.1	176.37
Within	36	24447.8	679.11
Total	39	24976.9	F = .26

Table 11

ANOVA for Information Learning Retention

Pretest (Posttest$_{c\ 1}$)

Source of variation	Degrees of freedom	Sum of squares	Mean square
Between	3	5633.2	1877.73
Within	36	21695.2	602.64
Total	39	27328.4	F = 3.12

Posttest$_{c\ 2}$

Source of variation	Degrees of freedom	Sum of squares	Mean square
Between	3	2878.7	959.43
Within	36	13701.6	380.6
Total	39	16580.3	F = 2.52

Table 12

ANOVA for Retention Recall of Tools and Procedures

Pretest (Posttest$_{c\ 1}$)

Source of variation	Degrees of freedom	Sum of squares	Mean square
Between	3	61.62	20.54
Within	36	20011	555.86
Total	39	20077.62	F = .04

Posttest$_{c\ 2}$

Source of variation	Degrees of freedom	Sum of squares	Mean square
Between	3	188.54	62.85
Within	36	17715.65	492.1
Total	39	17904.19	F = .12

VITA

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Joseph Linwood Cooper, Sr.

A STUDY OF THE EFFECTS OF REMEDIAL COGNITIVE TRAINING ON THE ABILITY OF ADOLESCENT EDUCABLE MENTALLY RETARDED STUDENTS TO LEARN AND RETAIN VOCATIONAL COMPETENCIES

by

Joseph Linwood Cooper, Sr.

(ABSTRACT)

Compared with students with normal mental abilities, the mentally retarded student in a competency-based vocational education program generally experience much more difficulty learning and retaining the required competencies. Studies have shown that persons who are mentally retarded do not spontaneously apply efficient learning strategies as do persons with average mental abilities. The purpose of this study was to examine the effects of remedial cognitive training on the abilities of adolescent mildly retarded students to learn and retain occupational competencies and to determine the effects of selected cognitive teaching strategies on learning and retention.

The sample used in the study consisted of 40 subjects randomly selected from approximately 90 tenth grade EMR students of Richmond Public Schools (Virginia). These students entered vocational education training for the first time at the beginning of the 1982-83 school term. The 40 students were further assigned to four subgroups of 10 persons each. The three experimental groups and one control group were subjected to the following treatments: cognitive training plus cognitive teaching (group I), cognitive training plus traditional teaching (group II), no training but cognitive teaching (group III), or no training but traditional teaching (group IV).

Pretests and posttests were used to measure knowledge of learning strategies and learning and retention of vocational competencies among the subjects. From these scores, the means and standard deviations were computed for each group and one-way analyses of variance were used to test the hypotheses of interest. The analyses resulting in significant F ratios were then followed by the Scheffé multiple comparison method.

It was concluded that the EMR students who had been cognitively trained were superior in their knowledge of learning strategies over those who had not been trained. In the area of skill learning, it was found that cognitive training plus cognitive teaching was significantly more effective than traditional teaching and without cognitive training. Information learning proved superior for EMR subjects provided with cognitive training plus traditional teaching over those provided no training and cognitive teaching. The cognitive training and/or cognitive teaching was not effective in altering significantly learning retention among these subjects in either of the three categories of skill, information or recall of tools and procedures.