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ABSTRACT

Compared was the effectiveness of language development training in 29 educable retarded children (mean CA 7.7 years) and associative grouping training in 32 educable retarded children (mean CA 8.3 years). Trained teachers instructed the children for daily half-hour sessions using either the Peabody Language Development Kit or sequenced activities designed to teach organization and learning and recall strategy. Analysis of test data (including the sampling organization and recall through strategies test and two subtests of the Illinois Test of Psycholinguistic Abilities) indicated that the Ss trained to seek and utilize associations between stimuli improved significantly on sorting and recall measures. Although training in associative grouping improved utilization of presented organization, no differences were found between the groups on measures of total recall. (CL)

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THE EFFECTS OF TRAINING IN THE USE OF A GROUPING STRATEGY ON THE LEARNING AND MEMORY CAPABILITIES OF YOUNG EMR CHILDREN

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The University of Minnesota Research, Development and Demonstration Center in Education of Handicapped Children has been established to concentrate on intervention strategies and materials which develop and improve language and communication skills in young handicapped children.

The long term objective of the Center is to improve the language and communication abilities of handicapped children by means of identification of linguistically and potentially linguistically handicapped children, development and evaluation of intervention strategies with young handicapped children and dissemination of findings and products of benefit to young handicapped children.

Abstract

Two groups of EMR children were trained for four weeks on either language development activities or associative grouping activities. Children trained to seek and utilize associative relations between stimuli improved significantly on a measure of organization of input (sorting) and of recall (clustering). No differences were found on total recall, although associative grouping training enhanced the children's utilization of presented organization. The results were disucssed in terms of the ability to receive information organized in adult-like or categorical ways.

The Effects of Training in the Use of a Grouping Strategy on the Learning and Memory Capabilities of Young EMR Children

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Overview

Educable mentally retarded (EMR) children are generally seen by professional educators as unable to compete in everyday school activities with their "normal" chronological agemates. They appear to be somewhat slower in learning new skills, and are identified early in school as failing to attain curricular objectives as readily as the majority of school age children. Their fund of general information also seems quite low. Accordingly these children are provided with special programs designed to remediate specific skill and content deficits. Curricula emphasizing perceptual activities and high levels of repetition have been developed, and are generally recommended for use with EMR children.

Because these children are frequently retarded in both oral and written communication skills, much emphasis has been placed on language development activities early in the child's school experience. Often these packages emphasize a language enrichment or oral vocabulary approach (as in the Peabody Language Development Kits), in which specific lesson contents are provided in a variety of contexts, the implicit assumption being that enough repetition of the content will eventually lead to adequate retention and usage. Thus, the emphasis in language development programs continues to be on content mastery

through repetitive presentation.

It has also been found that EMR children not only lag in the area of language acquisition and usage, but that the processes they tend to use in learning new material are less efficient than those of their non-retarded peers. This inefficiency of young EMR children in processing information is particularly evident in tasks which require the generation of a plan for learning. In his review of research with EMR children, Iano (1971) suggests that when a strategy for assimilating new information is needed, the retarded are found to be wanting. However, similar children have recently demonstrated gains in the production and utilization of organizational strategies following specially designed training sessions (Riegel, 1972).

The present study seeks to apply the findings of research on organizational strategies to the improvement of the educationally handicapped child's learning capabilities in the classroom. Two assumptions are made: (1) there are qualitative differences with age in the development of more effective organizational strategies in children, and (2) organizational strategies and their effects on recall can be measured. Furthermore, this study seeks to test the hypothesis that EMR children can be trained in the use of more effective organizational strategies.

Trends in the development of organization in children. It is by now axiomatic that learning is facilitated by relating new information to information which is already a part of the child's experience (Ausubel, 1963; Gagné, 1965). It appears to be equally

true that the extent to which new information is learned is also a function of the kind of relation generated in associating it with prior knowledge. Developmental theorists hold that overt behavior at all levels of functioning reflects an underlying cognitive structuring. They further suggest that it is the particular nature of this structuring which is of importance to understanding learning problems. In observing the subjects' behavior, therefore, we are attempting to identify structures underlying that behavior, rather than only cataloging the variety of specific information available to the subjects. The position taken here is that the organization of recalled information is related to the way in which that information was previously stored. Thus, we shall be looking at both the quantity of recalled items as well as the ways in which those items are organized by children.

Bruner and Olver (1963) assumed that grouping was determined by gradually emerging "rules" resulting from transformations imposed on data by the subject. In order to assess the nature of the rule determining the subject's current grouping behavior, they developed a procedure for successive presentation of a series of concrete nouns, with each new item followed by instructions to the subject to specify both the differences and the similarities between the accumulated items. Responses were classified in terms of the extent to which all items in the list were subsumed under a single attribute or set of attributes (i.e., the degree of superordination), as opposed to less efficient load-reduction rules relating individual items within a collection. Three general classes of response were noted in Bruner

& Olver's study: subjects were found to employ superordinate groupings, less effective collections of items, or no grouping response at all. With increasing age, the proportion of superordinate responses increased.

In another study of equivalence transformation (Olver & Hornsby, 1966), subjects were asked to select several items from an array that went together and to give their reasons for the choices made. Using the classification types identified by Bruner & Olver in the earlier study, the age trends in transformational responses were confirmed (cf. Inhelder and Piaget, 1964; Sigel, Jarman and Hanesian, 1967).

The assessment of recall and related organizational processes has typically been conducted independently of the kinds of classification studies mentioned above. Analysis of recall organization, in the form of clustering scores, describes the extent to which the order of items recalled corresponds to a predetermined organization of the items during presentation (Bousfield, 1953; Frankel and Cole, 1971). Generally, the occurrence of clustering in a subject's recall is taken as a direct reflection of a covert organizing operation and, as such, constitutes evidence for the development of higher-order memory units. Evidence regarding the development of clustering skills is analogous to that for classification skills, in that clustering, too, has been found to increase with age (e.g., Bousfield, Esterson and Whitmarsh, 1968; Rossi, 1964).

While the studies cited above differ distinctly along several dimensions (e.g., input vs. output variables), there is an underlying

consistency in the fact that all have illustrated age-related increases in the use of superordinate strategies for grouping, increases in recall of a list of stimulus items, and increases in clustering of items during recall. The retarded, however, have been consistently found to use less effective organizational strategies than their non-retarded counterparts.

In a study comparing MR and normal children of equal CA, Stephens (1964) asked subjects to identify instances of experimenter-defined categories. He found that the retarded subjects identified fewer instances of the categories than the non-retarded subjects, and concluded that the retarded had fewer and simpler categories than non-retarded subjects, and were thus less able to profit from normal experiences. In a later study this conclusion was related to other literature in support of the contention that the extent to which new experiences can be related to old may in fact limit the meaning of the new experience (Stephens, 1966). Thus, if MR subjects have fewer and simpler categories, the range of possible new-to-old associations is narrower (cf., Ausubel, 1963; Bruner, Goodnow & Austin, 1956).

Parallel to the findings related to organization at input, recall organization (i.e., clustering) also appears to be lower in retarded than in normal subjects. Rossi (1963) compared EMR and MA-matched normal subjects on recall and clustering of a 20-item list. He found no significant total recall differences, but the normals clustered more at recall, and clustering improved consistently with both MA and practice.

In studies related to the effects on recall performance of specific instructions there is consistent support for the "production deficiency" hypothesis advanced in a series of studies conducted by Flavell and his colleagues (Flavell, 1970). In its most general form, this hypothesis suggests that instructions or conditions inducing the subject to process presented information in a specific way yield higher recall scores than conditions which do not. In terms of grouping skills, Russian psychologists have noted that before becoming a conscious process, intelligent grouping occurs in an unconscious form (Smirnov & Zinchenko, 1969). It therefore seems that the ability to generate a strategy for processing a given set of information must be developmentally preceded by the ability to utilize that strategy once it has been generated.

For example, in a study related to grouping and category clustering Moely, Olson, Halwes & Flavell (1969) compared kindergarten, first, third, and fifth graders on sorting, recall and clustering performance under conditions of rehearsal, category naming and induced sorting instructions. Evidence was found for a production deficiency in the younger subjects in both sorting and recall clustering, but under experimental induction of a grouping strategy, no mediation difficulties were evident. In his summary of this and other studies, Flavell (1970) concludes that spontaneous generation (production) of a mediational strategy is a function of age, and that "developmental transitions from nonproduction to production for several kinds of mediational activities have been consistently observed..." (p. 198).

In a recent series of studies, Riegel and his associates have attempted to isolate variables related to the identification and utilization of associative grouping strategies in children. Based on the findings of this line of inquiry a training sequence was developed for use with young EMR children (Riegel, Danner and Taylor, 1972). Following three weeks of training in the original sequence, 29 young EMR children changed significantly in the kinds of groupings they generated with an array of pictures and in their overall recall of items. A second group of children was trained for a month at 1/2 hour per day with a revised version of this sequence, following which their sorting levels and recall also increased significantly. In the latter study (Riegel, Taylor, Clarren & Danner, 1972), a group of control subjects did not show similar increases on the dependent measures. A final revision of this training sequence, emphasizing a variety of grouping attributes, and progressing from perceptual to higher-level associative relations, constitutes one on the treatments in the current study.

Summary of Characteristic Organizational Strategies Used by EMR Children

In general, there is consistent evidence that:

1. Retarded subjects utilize fewer and simpler associative groupings than non-retarded subjects. These groupings tend to be either syncretic or perceptual in retarded subjects, and more associative or superordinate in non-retarded subjects.

2. Retarded subjects appear to have fewer "public" definitions for things in their environment, manifesting fewer associations between items and utilizing inherent associations to a lesser

degree than non-retarded subjects.

3. Retarded subjects tend to recall fewer items and to cluster significantly less during recall than non-retarded subjects. When compared with non-retarded subjects of equal MA, recall and clustering are less than or equal to the comparison sample.

a) Variables related to both input and output organization appear to be mental age-related, although in many cases retarded subjects' performance is lower than that of an MA-matched sample.

4. Experimental instructions related to either input or output organization have facilitated the performance of retarded subjects.

Many writers have suggested that the retarded child is not incapable of using effective learning strategies -- only that he doesn't. Blount (1968) recommends strategies training in an effort to overcome the retarded child's "lack of public definitions." Hagen (1971) and Bilsky & Evans (1970) suggest that remediation of organizational deficiencies would significantly enhance the poor learner's potential in academic tasks. If indeed, as Iano (1971) suggests, the significance of higher levels of intelligence lies in the fact that the subject organizes and utilizes knowledge differently, and can therefore respond to his environment in new ways, then it seems a reasonable hypothesis that a child's relative "mental retardation" may decrease if he can be explicitly trained to do what his non-retarded peer does spon-

taneously: to organize, associate and remember the events in his environment more effectively.

Method

Subjects. The subjects for this study were young EMR children in special classes in St. Paul, Minnesota. Three classes were randomly selected from a pool of eight for each condition. Class size ranged from 8 to 15. The mean chronological age of the "PLDK" group (see below) was 93.5 months, while that for the "SIS" group was 99.7 months. The mean I.Q. scores for these samples were 72.3 and 72.5 respectively. There were 29 subjects in the "PLDK" group and 32 in the "SIS" condition. The remaining two classes participated in a third condition, to be discussed later.

Although there was a mean C.A. difference of 6 months between the two samples, this difference was not significant. In addition, there were no significant differences on any of the pretest measures. Therefore, it was assumed that the two samples were indeed from the same population.

Procedure

The six teachers were contacted first through the Special Education Office of the St. Paul Schools, and then directly by the writers. All teachers were asked to participate in a study exploring how children learn, and were offered one in-service credit for participation in a training workshop and ongoing consultation during the study.

Teachers were randomly assigned to each condition, with one exception; one teacher had worked previously with the writers in a

strategies study. Because of her prior experience with the approach she was assigned to the condition in which such experience would not contaminate the results of the study (i.e., the "SIS" condition). The two conditions were:

1. "PLDK": Three classes in which the children continued in the use of the Peabody Language Development Kits, and in which the teachers received training in the PLDK activities from a consultant well versed in its theoretical and practical use. Prior to this study, all classes in the population had been exposed to the PLDK, although this exposure had typically not been as consistent as its use in this condition. Thus, incidental use of the PLDK constitutes a component of the "natural" classroom environment prior to the present study.
2. "SIS": Three classes in which the children received training in a specified sequence of activities (Riegel, Danner & Taylor, 1972) designed to teach skills of organization and the process of generating a strategy for learning and remembering. This sequence was used <u>in place of</u> the PLDK, and the teachers involved were given training in the presentation of these activities by a consultant who had used the sequence before and was knowledgeable in its theoretical and practical implications.

Following teacher assignment, workshops were held for three hours one afternoon, in which teachers in each of the conditions were trained in the systematic application of the material they would be asked to teach. Each workshop included training and follow-up consultation by an expert in the particular treatment to which the

teachers were assigned. On the Wednesday following this three-hour workshop, training began in the classrooms. The first two lessons in each class were taught by their respective consultants, with the teachers observing. For the following four weeks, the teachers continued training the children for 1/2 hour per day.

Dependent Measures

The three most central dependent measures are derived from the Sampling Organization and Recall Through Strategies (SORTS) test, developed for earlier exploratory studies of memory strategies and grouping training across a range of age levels and educational handicaps (Riegel, 1972). A brief description of each of these three indices follows:

1. The Sorting level index: This score represents the sorting skill level demonstrated by the child, and is derived from a combination of the groups formed by the child, his stated reasons for those groups, and the experimenter's judgment of the grouping strategy employed. Each group formed is assigned a value according to the specifications in the SORTS coding key, and yields a score for each child which correspond to one of the following four levels of grouping:

Level 1: Syncretic strategies. Groupings at this level reflect a general failure to generate relations between items on the basis of an attribute or set of attributes. Grouping items by their spatial contiguity ("because they were next to each other") or subordinating the sorting task to an unrelated manipulative operation ("I wanted to make a square with the pictures") are examples of this level. Also included are instances of no strategy for grouping at all, such as the case of a subject simply pulling all items into a single pile or not moving them at all.

Level 2: Perceptual strategies. Groupings at this level were suggested by the results of Riegel's studies, in which a

sizeable proportion of EMR subjects (Approximately 30%) sorted items on the basis of characteristics of attributes related to color, shape or size. When color, for example, was introduced as an irrelevant attribute of the stimulus materials, younger children tended to sort items on that basis, rather than attending to more intrinsic characteristics of the items such as function or category membership (cf. Birch & Bortner, 1971; McGurk, 1972).

Level 3: Low Associative strategies. This level includes associations based on intrinsic or semantic attributes. Such groupings as thematic collections (formed by creating a story about the items) and complexes (collections of items for which interitem associations are formed, but for which no overall defining attribute is available) are examples of level three strategies.

Level 4: Superordinate and categorical strategies. Groupings at this level include superordinate groupings in which all items in a group are subsumed under a single intrinsic attribute or attribute set. Examples of groupings at this level include groups based on items having similar function (e.g., they all are for eating; you can live in them) or on category membership (e.g., they are furniture).

In this study, sorts 1 and 2 of the SORTS test were treated as warm-up trials for the more important (recalled) sort 3. Of these 3 sorts, only the data from sort 3 is analyzed in this study, as it is this sort which is directly related to the recall and clustering scores obtained.

Sort 4 was administered only on the posttest to avoid possible categorical bias due to pretest exposure. Because the groupings in Sort 4 were formed by the experimenter, the range of possible subject responses was narrower. A separate coding key, analogous to the first, but modified to account for the differing responses due to forced groupings, was used to score this sort.

2. The Recall Score: The second score is the total number of correctly recalled items in sort three (and on the posttest, in sort four), obtained by simple counting of verbatim protocols taken during the recall phase.

3. The Clustering Index: This index, based on a theory of runs has been adapted for use with recall data by Frankel and Cole (1971). Their paper presents a thorough analysis of the various clustering indices in use, and is recommended for readers interested in this aspect of organizational analysis. This analysis of clustering yields a Z score reflecting the extent to which the organization of recall items corresponds to the organization of those items during the grouping phase of the SORTS test. Thus, in Sort 3, the clustering score is an index of the correspondence in organization of the subject's recall with the subject's groupings. In Sort 4, the clustering score is an index of the degree of correspondence between the organization of the subject's recall and the experimenter's groupings.

ITPA Subtests

A second set of scores employed in the analyses for this study was obtained by administration of two subtests of the Illinois Test of Psycholinguistic Abilities (ITPA). Both the PLDK and the ITPA are based to a large extent on Osgood's (1957) model of language development. The two subtests selected for use in this study were chosen on the basis of their relationship both to the PLDK objectives and their apparent similarity with the SORTS test in terms of underlying abilities being tapped.

1. The Visual Association Test: The score derived from this test reflects the total number of correct responses to instructions to point to one of four pictures which "goes with" a central stimulus picture. This test is more limited than the sorting

index described above, in that only one response is considered correct, based on conventional associations, and the subject does not supply reasons for his selection.

2. The Auditory Association Test: This test presents the child with a word in sentence context and asks him to supply another word in an analogous context (e.g., "I sit on a chair. I sleep on a _____."). Again, the responses considered correct correspond to conventional associations, based usually on functional attributes of the items.

The Word Families test

The Word Families test (WF) was developed for use as a measure of transfer in an earlier pilot study of the grouping sequence (Riegel, Taylor, Clarren and Danner, 1972). It consists of a 20-minute lesson in which four groups of four phonetically regular CVC trigrams were presented in an organized array to each class. Following this lesson children were asked to write as many of the words as they could remember, and then to circle on separate worksheets those words belonging to the families presented. An analysis of true and false recognitions was made, as well as a count of total words reconstructed. It was hypothesized that children trained to seek and utilize relations between items as a mnemonic strategy would reconstruct more items per family recalled and show fewer false recognitions than children trained in the use of oral language.

Scoring

All scoring of tests was directed by the first author according to criteria specified in the SORTS coding key and the ITPA manual.

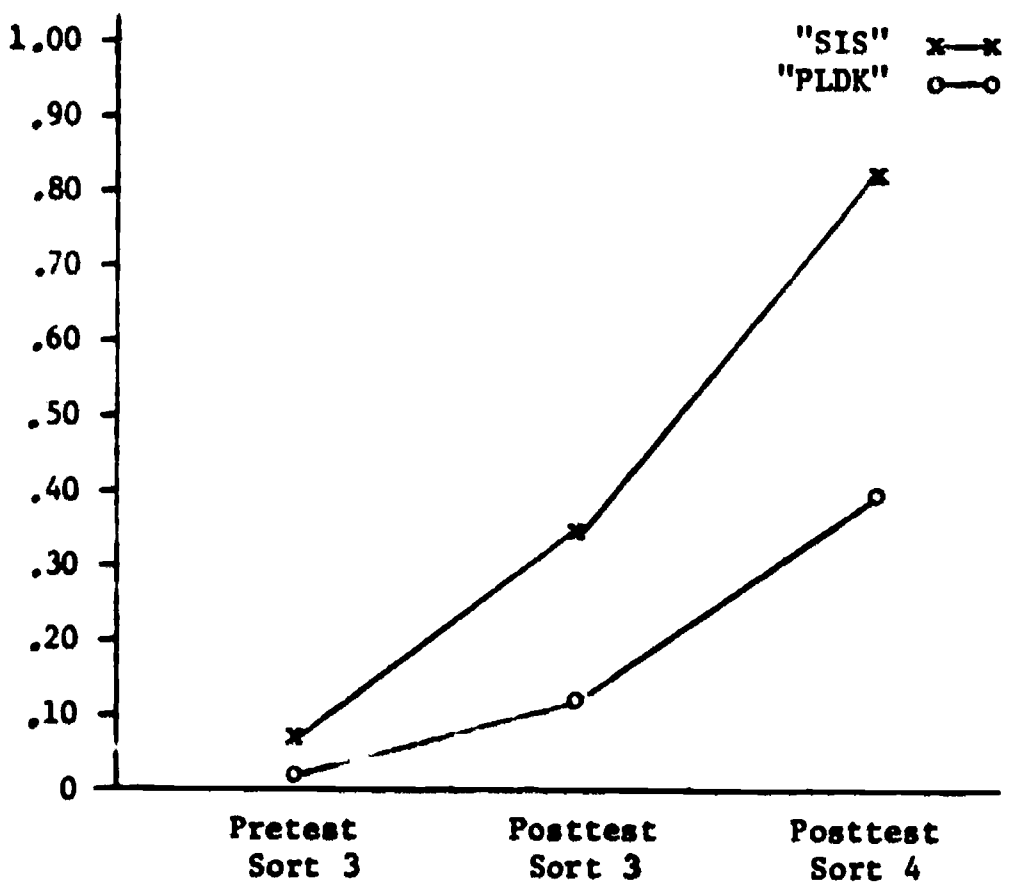
Scorers included the first author and two graduate students who had been trained by him.

Results

Sorting Level

Few Ss in either the "PLDK" or "SIS" groups generated associative (levels 3 and 4) responses on the pretest as can be seen in Figure 1. On the posttest, however, a significantly greater proportion of the "SIS" subjects generated associative responses on Sort 3 ($Z = 1.88$, $p < .05$, one-tail test). Similarly, a significantly greater proportion

Figure 1. Proportion of subjects generating associative (levels 3 and 4) responses on Sorts 3 and 4.



of SIS subjects than "PLDK" subjects discovered associative relations on Sort 4 ($Z = 3.36$, $p < .001$, one-tail test).

Recall

No significant differences in mean recall were found between groups on the pretest or posttest, and neither group increased significantly in recall following training. Table 1 presents mean recall by condition. It is interesting to note that mean recall increased nearly 2 1/2 items from Sort 3 to Sort 4 among the "SIS" subjects and increased less than 1 item among the "PLDK" subjects. However, because Sort 3 and Sort 4 recall contexts were not considered comparable, significance tests on this increase were not run.

Table 1. Mean recall by condition

		Sort 3		Sort 4
		Pretest	Posttest	Posttest
PLDK	$\bar{X}$	5.28	6.45	7.35
	s.d.	(3.49)	(3.66)	(4.29)
SIS	$\bar{X}$	5.48	5.87	8.31
	s.d.	(2.93)	(4.30)	(3.81)

Clustering

There were no significant pretest differences between the samples in proportion of subjects clustering their recall. Analysis of gains revealed a significant increase in the proportion of subjects clustering in the "PLDK" group only ($Z = 3.08$, $p < .01$). There was, however, no difference between the groups on proportion of subjects clustering on the posttest. On Sort 4, where the subjects were able to utilize the experimenter's groups for recall, significantly more "SIS" subjects clustered than "PLDK" subjects ($Z = 1.88$, $p < .05$). Table 2 presents the proportion of each sample clustering.

Table 2. Proportion of samples clustering during recall.

	Sort 3		Sort 4
	Pre	Post	Post
PLDK	.034	.136	.18
SIS	.120	.124	.40

ITPA Subtests

On the Auditory Association subtest, the "SIS" group increased significantly after training ($Z = 2.50$, $p < .05$, one-tail test). No other gains reached significance at the .05 level. Table 3 presents the mean scores for each group on each subtest. No differences were found between the groups on this measure.

Table 3. Mean scores on subtests of ITPA

		Visual Association		Auditory Association	
		Pre	Post	Pre	Post
PLDK	$\bar{X}$	20.05	20.42	17.10	18.30
	s.d.	(4.60)	(4.05)	(5.31)	(6.13)
SIS	$\bar{X}$	17.04	17.96	16.60	18.48
	s.d.	(4.52)	(4.34)	(5.87)	(3.99)

Word Families Test

There were no significant differences between groups in the mean number of items reconstructed, the mean number of items correctly recognized, or the mean number of false recognitions. Table 4 presents these data.

Table 4. Results of the Word Families Test

		Items Reconstructed	Items Recognized	False Recognitions
PLDK	$\bar{X}$	6.13	13.86	6.54
	s.d.	(5.42)	(5.57)	(6.16)
SIS	$\bar{X}$	5.89	14.43	4.40
	s.d.	(6.74)	(5.48)	(5.19)

Discussion

Comparisons between groups on the posttest data indicate that a significantly greater proportion of "SIS" than "PLDK" subjects

produced associative responses when asked to sort an array of pictures (Sort 3), and discovered more associative relations when the pictures were presented in conventional categories (Sort 4). Although, only the "SIS" subjects demonstrated a significant gain on the Auditory Association subtest of the ITPA, this gain was not considered particularly strong. However, the pattern of these findings suggests that EMR treatment did train EMR children to discover and use meaningful relations between items as a basis for associating them.

Unfortunately, the increase in associative responses by the "SIS" subjects did not produce a corresponding increase in recall and clustering. Evidently, the "memory" portion of the training sequence was not explicit enough to significantly increase the children's intentional use of associations to improve the amount and organization of their recall. When presented with categorized groups, however, subjects in the "SIS" group increased their average recall by nearly two and one-half items and clustered significantly more than did "PLDK" subjects. It therefore appears that children trained in grouping strategies were better able to understand the organization of stimulus materials and better able to maintain that organization during recall than children who were not so trained. The results of the Word Families Test are understandable in light of the pattern of results mentioned above. The reconstruction phase of this test was primarily tapping recall rather than organization, and as with the SORTS data, no differences in recall were found between groups.

One of the difficulties in conducting applied research of the nature reported here is the construction of appropriate transfer

tasks in order to assess strategies utilization in contexts other than the SORTS test itself. Prior use of the Word Families test (Riegel, et. al., 1972) had shown a difference between experimental and control groups on the completeness with which a family was reconstructed once a single item had been recalled. No such difference was found in this study, with the mean items per family for each condition virtually identical. Confounding factors such as novelty of the written symbols and differential prior experience with phonetically regular words also contribute to the difficulty in interpreting these data. Although the problem of selecting a good measure of transfer does not appear to have been solved, there is evidence that the integration of the strategies training approach with other classroom related activities may be accomplished to good effect. This evidence is summarized below.

An additional group of EMR children was trained during the period of the present study in a set of activities which combined the oral language stimulation components of the PLDK with the information processing approach of the SIS condition. On nearly every measure reported above, this "PLDK + SIS" group scored midway between the "PLDK" and the "SIS" groups. The third (combined) condition produced sorting and clustering scores on the SORTS test closer to those of the "SIS" group, although they were somewhat lower. The nature of the training in this ancillary condition was less specifiable than that of the "PLDK" and "SIS" groups, but the results lend support to the notion that EMR children may be trained to utilize organization more effectively. Apparently the explicitness

of the grouping training can be related to its effects, at least on the SORTS test. That is, the "PLDK + SIS" group sorted items more associatively, identified more associative relations between categorized items, and clustered more in recall than did the "PLDK" group. Furthermore, the "SIS" group performed still better.

Improvement in the ability to utilize associative relations and to discover imbedded functional relationships between items is important to the young EMR child's cognitive adaptation to the educational environment. In an earlier study (Riegel and Taylor, 1973) it was suggested that there are three distinct phases in the development of effective utilization of organization for retention. Comparisons of EMR and non-retarded children suggested that children must first learn to construct or perceive relationships between items which are intrinsic or functional, rather than relying on perceptual cues and idiosyncratic, transitory associations. Only when the identification of common functions and the strategy of naming groups and subordinating grouped items to their common attributes or classes is available to the child can he then apply this skill to the second end of remembering. This application of a strategy to a second end constitutes the second phase of effective organizational mediation. The development of effective memory units, characteristic of this phase, has been described primarily as the result of goal-oriented procedures (such as grouping) being "converted to automatic operations" (Smirnow and Zinchenko, 1969, p.495). The third phase of this developmental progression involves the simulteneous or successive

use of a variety of strategies for remembering, and has been observed in "normal" children as early as second grade (Riegel and Taylor, 1973).

The results of the present study indicate that the children were challenged primarily in their functioning within the first phase by the training sequence. Within this level of operation there were significant changes in the SIS group's facility with grouping procedures. The operation of grouping occurred with greater ease, and appeared to be more automatic than had been observed in the pretest. Further use of the approach embodied in the training sequence would increase the likelihood of an "automatic" grouping response, and bring the young EMR child closer to the development of mnemonic capabilities exemplified by the second phase described above.

In addition to the observed changes in the children's grouping behavior, generally characterized as an expressive component of his cognitive abilities, large gains have been observed in their reception of information due to grouping training. As Piaget (1964) maintains, the child can receive information in the adult-directed educational system "only if he is in a state where he can understand this information. That is, to receive the information he must have a structure which enables him to assimilate this information (p. 13)." The results of this study indicate that the children in the "SIS" condition were, at least on Sort 4, better able to receive the information contained in conventional categories than were the children in the contrast group.

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