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Maintenance and Generalization of a Semantic Rehearsal Strategy in Educable Mentally Retarded Children

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Two groups of 11- to 12-year-old educable mentally retarded children, equated on the basis of a free recall pretest, were given a series of lists for free recall. Approximately half the subjects were trained in the use of a strategy designed to induce deeper level semantic encoding and the discovery of categorical relationships and half constituted a "no-training" control group with standard free recall instructions. The subjects received either related or unrelated lists during the training phase and related or unrelated lists during two post-tests, immediately following and 1 week after training. There was evidence not only that the semantic strategy was maintained over the 1-week delay, but that it also generalized to word lists unlike those used during training. The degree of generalization was greater for those subjects receiving related lists during training.

The memory deficit frequently found with educable mentally retarded (EMR) has been characterized as the result of passive information processing (Brown, 1974; Kellas, Ashcraft, & Johnson, 1973) and a general difficulty with self-regulation and control of their behaviors (Brown, Campione, & Barclay, 1979). In particular, the development of elaborative mnemonic strategies for acquisition and retrieval of information in these individuals seems to be very poor or even nonexistent when compared to nonretarded individuals (Belmont & Butterfield, 1969; Ellis, 1970).

Research has started to appear, however, demonstrating that memory performance by retarded subjects can be improved through instruction in the use of active information processing strategies appropriate for the various memory tasks. For example, Brown and her associates (Brown, Campione, Bray, & Wilcox, 1973; Brown, Campione, & Murphy, 1974) trained retarded subjects to use a cumulative rehearsal strategy and found that training enhanced performance on a keeping track task and was

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maintained up to 6 months later. Other researchers have used strategy training techniques aimed at inducing "deeper level" or more semantic encoding of the items to be learned. Turnure and Thurlow (1973), for example, demonstrated that imagery and sentence elaboration instruction improved recall in a paired-associate task. The present authors (Engle & Nagle, 1979), used an instructional package in a free recall task in which EMR subjects were instructed to think of each object within a list according to any functions that the object might have, any personal experiences he or she might have had with the object, and any other objects in the list that were related or similar in any way. The free recall lists were unblocked presentations of categorizable items. The instructions were directed at inducing deeper or more semantic levels of encoding following Craik and Tulving's (1975) argument that the strength of a memory trace is determined by the dimensions along which a stimulus is encoded and the extent to which the internal representation of the stimulus is associated with existing memory traces. Engle and Nagle (1979) found that the semantic instruction improved recall and categorical clustering, both during training and on post-tests 1 week later.

Campione and Brown (1977) have argued that the existing evidence shows that strategy training will be effective and that subjects will remember or maintain the strategy over time if given enough training, but that there is little or no evidence suggesting that retarded subjects will generalize to novel stimuli and tasks. Demonstration of the generalization of strategy training seems imperative for its eventual implementation. Thus, the current research was directed at investigating whether subjects who learned to use the semantic encoding strategy taught in our earlier research would generalize that stragegy to stimuli unlike those used in training. This constitutes what Borkowski and Cavanaugh (1979) call a test of "near generalization," i.e., a test of transfer to a situation similar in many ways to the task used during training but different in at least one respect. Conditions were also included in the current work to serve as internal replications of the previous study and to serve as "no training" control conditions.

In addition to number of words recalled, the amount of organization during recall was an important variable observed in the present study. Measures of organization, particularly categorical clustering, have been shown to be positively correlated with measures of recall (Shuell, 1975). There is general agreement, however, that retarded subjects show much less of a tendency to organize their recall than do nonretarded subjects (Spitz, 1966) and repeated attempts to increase their organization at recall have shown only marginal success. This is particularly true when the subject was shifted to words different than those used during training (Bilsky, Evans, & Gilbert, 1972; Gerjuoy & Spitz, 1966). The failure to demonstrate any sizable increment in clustering and a concomitant increase in recall is probably due to the fact that most studies have simply manipulated the stimulus materials to induce strategic behavior rather than instituting procedures aimed at directly affecting the way the subject encodes the stimulus materials.

The current study tests the notion that retarded subjects will increase their recall organization after semantic strategy training and that they will generalize their organizational behavior when given novel categories to learn. The recall of both Related and Unrelated lists was also scored for subjective organization to compare differential training effects as a function of the nature of the stimuli to be learned.

METHOD

Subjects. Fifty-two EMR children were chosen from an urban public school system serving predominantly lower and lower middle-class communities. All the children were enrolled in fifth and sixth grades and were receiving special educational assistance in a resource class for EMR children for either one or two periods a day. The average chronological age for the group was 11.5 years (SD = 1.2 years). The mean IQ based on the Wechsler Intelligence Scale for Children- Revised Full Scale IQ scores was 64.7 (SD = 6.6). Children who also were diagnosed as emotionally disturbed, neurologically impaired, and/or severely language disabled were excluded from the study. One child failed to complete all the experimental sessions and data from this child were not included in the statistical analysis. Thus, the final sample size was 51.

Materials. A pool of high-frequency concrete nouns from 23 common taxonomic categories was selected. The items were taken from the Posnansky (1974) norms and were selected from the six most common exemplars of each category. The norms were obtained for children of comparable mental ages to the EMR children participating in the present study.

Two types of 20-item lists were composed: (1) related lists consisting of four words from each of five different categories, and (2) unrelated lists containing one item from 20 different categories. For subjects receiving all Related lists in both training and post-test, a given category was presented only once over all conditions. For subjects receiving Unrelated lists, categories were obviously repeated across lists but different exemplars were always used. For subjects shifting from Related lists to Unrelated lists (or vice versa), categories were also repeated, but a category represented in one Related list was never repeated in another Related list. For each of the items selected, drawings of relatively uniform size were made and pasted onto 8 × 11-in. cardboard sheets.

Conditions. Subjects were assigned to one of eight conditions derived by manipulating three factors in a completely balanced design. These factors were (1) the type of instructions given to the child—Semantic strategy instructions or standard free recall instructions (i.e., "No train ing"), (2) Related or Unrelated lists during training and (3) Related or Unrelated lists for the post-tests.

Half of the children received training on the use of the semantic strategy, while the other half received the standard free recall instructions. Of the children receiving strategy training, half learned the strategy with lists of Related items and half learned using lists of Unrelated items. Each of these groups was further subdivided, with half of the subjects receiving two post-tests on Related lists and half on Unrelated lists.

Pretest. All children were administered a pretest before their assignment to conditions. The pretest consisted of two free recall trials on a list of 20 unrelated items. On each of the two trials, a different random ordering of the items was used. Items were presented at a 10-sec per item rate with the experimenter presenting the picture of the item and saying the name of the item aloud. Prior to the list presentation, the subjects were instructed to recall aloud in any order as many of the items from the list as possible. The mean number of words recalled on the pretest as well as the chronological age of the children was used for assignment to one of the eight conditions. Mean and *SD* for the pretest values and chronological ages for the subjects in each condition are shown in Table 1. The mean pretest scores did not differ statistically for the eight groups ($F < 1$). The small variability in the pretest values may have been due, in part, to the nature of the task. Using pictorial representations of familiar and concrete objects as stimulus materials, together with an ample amount of study time (i.e., 10-sec per item on each of two trials), would clearly have optimized learning conditions for these children. The combination of interesting, meaningful stimulus materials and a slow presentation rate would have allowed each child the opportunity to organize the material using whatever encoding and retrieval cues he or she may have possessed. Furthermore, the small amount of variability in IQ scores would tend to indicate that the EMR children used in the present study were a relatively homogeneous group.

TABLE 1
CHARACTERISTIC PRETEST SCORE AND AGE OF SUBJECTS

Group	Number of subjects	Pretest score $\bar{X}$	Pretest score *SD*	Age (years) $\bar{X}$	Age (years) *SD*
SRR	6	9.6	1.4	11.3	1.4
SRU	6	10.0	2.0	11.6	1.1
SUR	7	9.8	2.4	11.0	1.1
SUU	6	10.0	2.2	10.8	1.1
NRR	7	9.6	1.5	11.8	1.5
NRU	6	9.0	2.4	11.5	1.5
NUR	6	9.8	1.6	12.2	1.2
NUU	7	9.4	1.4	11.7	0.9

As is evident from examination of Table 1, the number of subjects in each of the eight conditions vary between six and seven. The unequal number of subjects across the eight conditions was the result of the small number of subjects that met our criterion for EMR status but no evidence of organicity and an attempt to distribute as equally as possible an equivalent number of subjects from each of the two instruction groups (i.e., Semantic strategy and Neutral instructions) to four subgroups of approximately equal size.

Training procedures. Approximately 4 weeks after the pretest the experimenter returned to the school and administered the two training lists of Session 1. For children assigned to the Semantic strategy training conditions, the training lists were preceded by instruction on a semantic mnemonic strategy with practice on examples of Related items. All subjects were told that the best way to remember a list was to think about each of its items in the following terms: (1) its function, (2) personal experiences with the item, and (3) other items from the list that were related to it. During the instruction period, the experimenter stressed the importance of the child's active participation in asking him or herself the three questions about each of the items in the list. Thus, the strategy employed self-interrogation as an integral part of rehearsal activity. Throughout the training session the usefulness of the semantic strategy to "help you learn" was stressed to the child in an effort to increase his or her awareness of the benefit from using the strategy.

Following the semantic instruction period, the first of the two 20-item training lists was presented at a 15-sec per item presentation rate. As each picture was presented, the experimenter prompted strategy usage by asking the child questions about each item relevant to the above three criteria. Following presentation of the list, an unpaced oral free recall was performed without any prompts or retrieval cues from the experimenter. Immediately after recall, a second trial was performed on the same list but with items in a different random order at a 10-sec per item presentation rate. All other lists for training and post-tests employed this same procedure of two different randomized presentations of a given word list at a 10-sec per item presentation rate.

The second day of training occurred generally within 3 days of the first session. For children receiving the Semantic strategy training, the experimenter reiterated the strategy. The active role of the experimenter was faded out gradually over the training lists so that by the last trial of the last training list, all children were to be using the strategy with little or no assistance or guidance from the experimenter. Children in the No-training conditions were given standard free recall instructions prior to all training and post-test lists.

Post-test. Immediately after the last training list, subjects received the first post-test (PT1). The second post-test (PT2) occurred 1 week later and consisted of two trials on a new list of words with the second trial being a different ordering of the words. Prior to and during the presentation of both post-tests, no reference or prompts were made to the use of the training strategy or to any particular recall strategy.

RESULTS

The dependent variables of primary interest were (1) the number of correct words recalled, (2) the measure of category clustering exhibited in recall of the Related lists, and (3) the measure of subjective organization exhibited in the recall for both Related and Unrelated lists. All significant differences referred to below reflect Tukey HSD tests at the .05 level.

Recall. The mean number of words correctly recalled for the training lists and post-test averaged over the two trials for each list are shown in Fig. 1 for each of the eight conditions. The recall data from the training phase were analyzed by an analysis of variance with instruction condition (Semantic or No training), type of word list (Related or Unrelated), list (3), and trial (2) as factors.

The results of training showed significant main effects of type of instruction ($F(1, 47) = 16.7, p < .01$) and list type ($F(1, 47) = 24.7, p < .01$). However, this resulted from the single condition of Semantic instructions

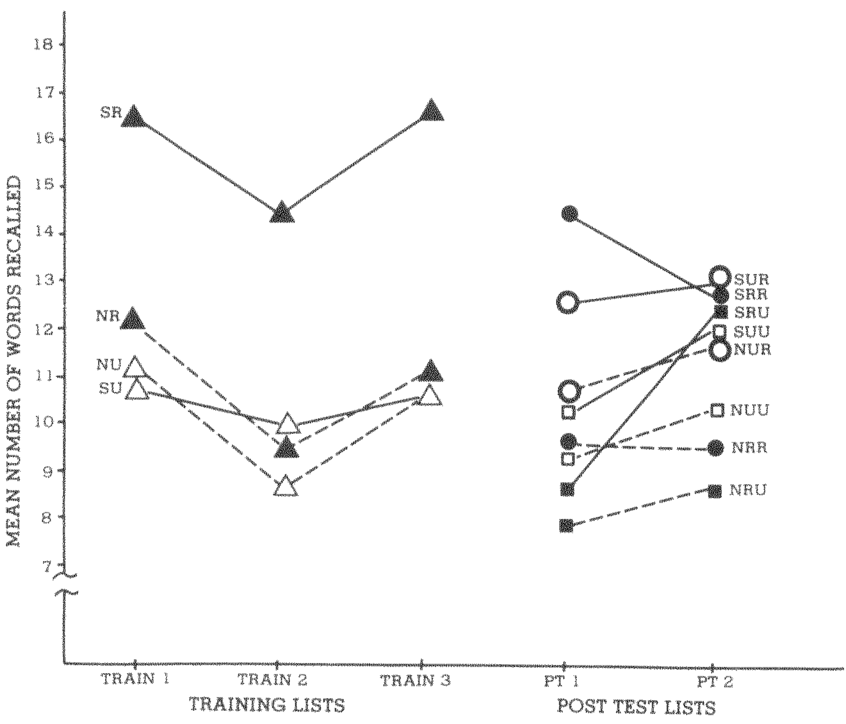

FIG. 1. Mean number of words recalled as a function of Instructions, Nature of Lists (Related or Unrelated), and Lists.

and Related lists (SR) performing significantly better (mean = 15.8) than either the Semantic–Unrelated (SU) condition (mean = 10.4), the No-training–Related (NR) condition (mean = 10.9), or the No-training–Unrelated (NU) condition (mean = 10.1), the three of which did not differ from each other. This was reflected in the significant interaction of Instruction × List Type, ($F(1, 47) = 13.3, p < .01$). In other words, subjects only recalled Related lists better than Unrelated lists if they also received Semantic instructions and Semantic instructions were only effective during training if the subjects also received Related lists.

The significant main effect for list ($F(2, 47) = 13.7, p < .01$) simply reflects the decline in performance for all groups on the second training list of the first day of training. The Semantic–Related (SR) condition maintained its superiority over all three training lists. While the Trial main effect reflected an improvement from Trial 1 to Trial 2, $F(1, 47) = 64.8, p < .001$, the absence of a Trial X Instructions interaction ($F < 1.0$) means that the Semantic group showed no more improvement over trials than did the No-training group.

Category clustering. While there is no widespread agreement as to which measure of clustering is the most appropriate for different populations of subjects (Shuell, 1975), we decided to use two commonly used measures: (1) the Adjusted Ratio of Clustering (ARC) (Roenker, Thompson, & Brown, 1971) and (2) the z score measure (Cole, Frankel, & Sharp, 1971). Since the two measures produced nearly identical conclusions, the z score with its more straightforward interpretation will be presented here. The z measure normalizes scores to adjust for differences in the total number of words recalled. With this measure, the number of runs of words for each recalled list is calculated, where a run is defined as a group of consecutively recalled words from the same category. A single word from any given category was also counted as a run. Above chance clustering is said to have occurred when the number of runs observed in the recall are significantly fewer than would be expected by chance (i.e., $z > 1.64$).

The degree of clustering (shown in Fig. 2) exhibited by those groups given Related training lists was examined by analysis of variance with Instruction condition and List as factors. Main effects of Instruction condition ($F(1, 21) = 74.9, p < .001$) and Lists ($F(2, 21) = 5.77, p < .05$) were significant but the interaction failed to obtain. Subjects taught the Semantic strategy showed significantly more clustering (mean = 5.05) than the No-training subjects (mean = 1.94). It should be pointed out, however, that the z score of 1.94 for the No-training subjects represented significant above chance ($p < .02$) clustering.

Subjective organization. In addition to analyzing the recall of the Related lists for categorical clustering, an analysis was done on the output of both Related and Unrelated lists for subjective organization (SO). SO is

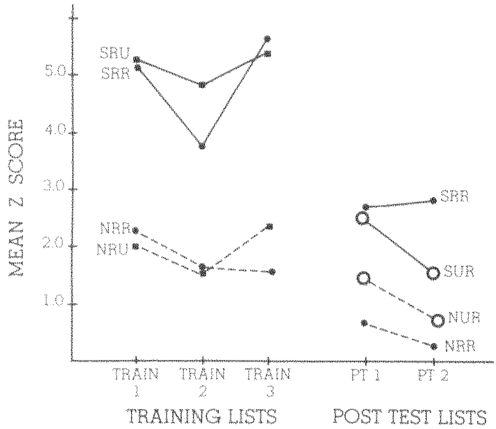

FIG. 2. Mean z scores for the subjects given Related lists.

assumed to reflect the extent to which a subject uses idiosyncratic associations to organize the retrieval of memory items and is measured by the degree to which a subject recalls items adjacently on consecutive trials. Several SO measures have been reported in the literature and we chose to use the intertrial repetition (ITR) score proposed by Bousfield & Bousfield (1966). The ITR has been shown to be highly correlated with other measures of SO and under certain circumstances more useful than the other measures (Woods, 1972).

The mean ITR scores for the various groups are shown in Fig. 3. It is clear that, for the performance during training, the only effect was the enhanced ITR for the group given Semantic instructions and Related lists. This was reflected in the significant Instruction × List type interaction, $F(1, 47) = 5.60$, $p < .05$. The other three groups were not statistically different from one another with means of .38, .35, and .31, respectively, for the SU, NR, and NU groups.

Post-test Data

Recall. Recall data from the two post-tests were analyzed by means of analysis of variance with Instruction condition (S or N), Type of Training List (R or U), Type of Post-Test List (R or U), and List (i.e., PT1 and PT2) as independent variables. The analysis was performed on the mean number of words recalled on the two trials for each post-test. The purpose of the post-test was to: (1) examine whether the advantage observed for the Semantic–Related condition during training would remain when no prompts were used and after a week retention interval and (2) examine whether the Semantic strategy would transfer to word lists unlike those used during training

The question of whether or not the strategy was learned and maintained

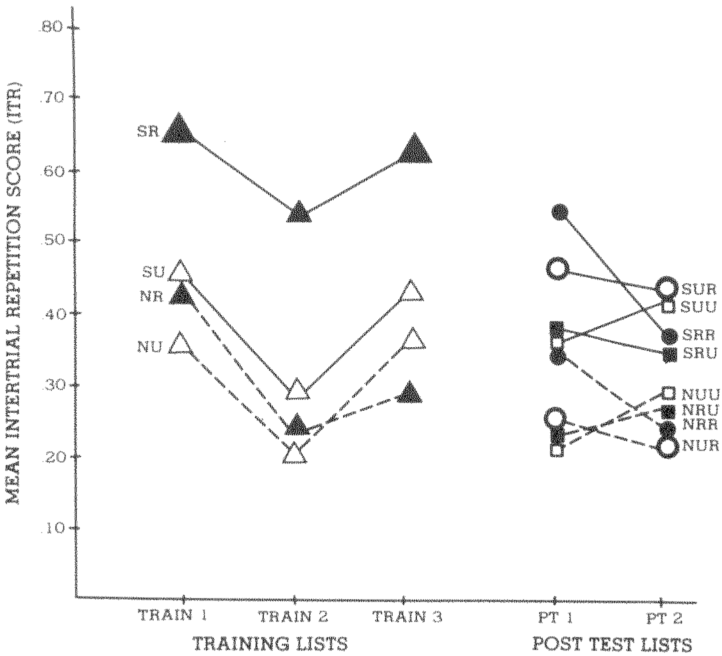

FIG. 3. Mean ITR scores for subjects given both Related and Unrelated lists.

is answered by comparing the groups that received the same type of list during training and post-test. Inspection of Fig. 1 shows that the SRR group remained superior to the NRR group both on the immediate post-test and on the test given 1 week later. Surprisingly, the SUU group also was superior to the NUU group on both post-tests in spite of the fact that these two groups were nearly equal during training.

Overall, subjects receiving Semantic strategy training recalled more words than did subjects from the No-training condition on both post-tests ($F(1, 43) = 9.70$, $p < .01$). In addition, the effect of the strategy training did not diminish over time from PT1 to PT2 as demonstrated by the nonsignificant interaction of Instruction × List ($F < 1.0$). That is, the Semantic strategy was just as effective after the 1-week retention interval as immediately after the last training list.

Type of list interacted with both Instruction condition and List ($F(1, 43) = 5.90$, $p < .05$). Subsequent comparisons revealed that while children receiving the Semantic strategy training recalled more words from Related lists (13.4) than from Unrelated lists (9.4) on PT1, this difference had disappeared by PT2 with the Semantic subjects recalling 12.7 words from Related lists and 12.2 words from Unrelated lists. Inspection of Fig. 1 shows that this result was largely due to an increase on PT2 for the recall from Unrelated lists for the Semantic subjects. In contrast, as can be seen

TABLE 2
MEAN NUMBER OF WORDS RECALLED ACCORDING TO EXPERIMENTAL GROUP AND POST-TEST

		PT1	PT2	$\bar{X}$
Semantic instructions	Related	13.4	12.7	13.0
	Unrelated	9.5	12.2	10.8
Neutral instructions	Related	10.2	10.6	10.4
	Unrelated	8.8	9.6	9.2

in Table 2, the No-training subjects showed little difference in recall from PT1 and PT2 for either Related or Unrelated lists.

For several reasons the first post-test data are probably not the best index for evaluating the amount of generalization or transfer of the Semantic strategy from one type of material to another. Since the first post-test was presented immediately following the last training trial of the second session, this post-test is subject to the same factors responsible for the decline in recall and organization observed in all groups following the second training list in the first day of training. Performance on PT1 was probably affected in a negative direction by factors such as subject fatigue and reduced motivation. These same subject factors would not be operating 1 week later on the second post-test. A second variable possibly affecting the usefulness of the results from PT1 for inferences about generalization is the disruptive effect of shifting from one type of list material to another with no prior warning of such a change. If this explanation is accurate, then the disruptive effects were particularly damaging to the group given Semantic training on Related lists and transferred to Unrelated lists for the post-tests, group SRU.

The Post-test 2 data seem to offer a more clear view of the effects of transfer and generalization. When the two Semantic shift groups, SUR and SRU, are compared with their two No-training control groups, NUR and NRU, we can observe the amount of generalization shown for the Semantic strategy training. While the SUR group, given Semantic training on Unrelated lists but tested on Related lists, showed about 11% transfer on PT2, the SRU group, given Semantic training on Related lists but tested on Unrelated lists, showed approximately 42% positive transfer. This seems to be evidence that the Semantic strategy does, indeed, generalize to novel stimuli. While the evidence for generalization is greater for subjects trained on Related lists and transferred to Unrelated lists, there is also evidence that those subjects trained on Unrelated lists and transferred to Related lists show positive transfer.

Category clustering. The z scores for those groups receiving Related lists on the post-tests were submitted to analysis of variance with Instruction type, Type of Training List, and List as factors. Only one main effect, that of Instruction condition ($F(1, 22) = 22.70$, $p < .001$), proved significant, indicating greater clustering over the post-tests for the Semantic groups. The interaction of Instruction condition × Type of Training List was significant ($F(1, 22) = 4.53$, $p < .05$) and reflects the fact that the group given Semantic instructions showed the most clustering if they also were trained on Related lists. Surprisingly, however, the Semantic group trained on Unrelated lists (SUR) also showed significant clustering, averaged over post-tests ($z = 2.02$, $p < .02$), and even marginally significant clustering for PT2 alone ($z = 1.59$, $p < .06$). The clustering scores thus reveal that subjects given the Semantic strategy training organized their recall on both post-tests more than did the No-training subjects, and this was true regardless of whether their training had been with Related or Unrelated lists. This seems to constitute evidence, again, that EMR subjects will generalize the Semantic strategy to at least novel stimuli in the same task. The superiority of the Semantic group over the No-training condition after a 1-week interval attests to the dramatic impact of the training program.

Subjective organization. An analysis of variance was computed on the ITR scores for the post-test data. It is obvious from Fig. 3 that the main effect of Instruction condition ($F(1, 47) = 15.4$, $p < .001$) reflects the superior organization of the Semantic groups over both post-test lists. This is perhaps most clear on the second post-test, given 1 week after training, where the mean ITR for the Semantic groups was .41 while the mean for the No-training groups was .25.

Other Analyses

Several supplementary analyses help to clarify the manner in which the Semantic strategy brought about the improved performance.

Components analysis. The subjects receiving Semantic strategy training could show an improvement for recall of Related lists in either or both of two not necessarily mutually exclusive ways; they could recall from more categories than the No-training subjects or they could recall more items from each of the categories. For example, Tulving and Pearlstone (1966) showed that, with normal adult subjects, increased cued recall was a result of an increase in the number of categories sampled, not the number of words per category. Moely and Jeffrey (1974), in a strategy training study with normal children, showed that trained subjects improved their recall as a result of both more categories recalled and more items recalled from each category.

The analysis of our data shows quite a different pattern, however, with there being virtually no difference between the number of categories represented in the recall of subjects trained to use the Semantic strategy

(4.44) and those in the No-training control group (4.36). The difference in recall was almost entirely due to an increase in the number of items recalled from each category with the mean number of words recalled per category during training being 3.56 for the Semantic groups and 2.49 for the No-training groups ($F(1, 21) = 73.9$, $p < .001$). The corresponding means for recall of the post-test lists were 2.78 for the Semantic groups and 2.33 for the No-training groups ($F(1, 21) = 6.06$, $p < .05$). Thus, the enhancement in performance for the Semantic group came as a result of recalling more items per category and not more categories. Since the maximum number of categories that could be recalled was 5.0, however, it is possible that the "ceiling" prevents any true difference between the groups on this variable from appearing.

Correlational analysis. One question posed by several recent studies has been whether there is necessarily a relationship between organization and recall in either retarded or nonretarded children (Glidden, 1976; Reichart & Borkowski, 1978). To determine whether our data could address this issue, we calculated the correlations between ITR and mean number of words recalled. The results were about the same for the training and post-test trials so only the data from PT2 are presented. The Semantic strategy group, collapsed across Type of List during training and post-test showed a significant correlation of $r = .55$, $p < .01$, between ITR and mean words recalled. The No-training group, surprisingly, also showed a significant positive and equally strong correlation of $r = .56$, $p < .01$, between organization and recall. This suggests that the relationship between organization and recall is just as strong in the retarded subjects receiving no strategy training as it is in those receiving instruction in the Semantic strategy. It further implies that the organizational processes measured by the ITR are used by the nontrained subjects; just not to the same degree as by the subjects given strategy training.

Interview data. In an attempt to establish a more direct measure of strategy usage, we randomly chose one of the words a subject recalled on the second trial of PT2 and asked them, "What did you do to learn this word?" If that elicited no response, the subject was further asked, "How did you remember this word?" and "Did any other words remind you of this word?" The reports from four such words were recorded verbatim. The written record of these responses were read by raters blind as to the subject's Instructional condition but knowledgeable as to the kind of instructions given to those subjects in the Semantic strategy condition. Each rater used a 7-point scale to rate the degree the subject employed the strategy. The correlation between the two raters was $r = .78$.

When the subjects were regrouped into those rated high in strategy usage and those rated low in usage, there was no significant difference between the groups on either the recall or organization scores. Further, there was no clear discrimination between those subjects given training and those not given training. We interpret this as a failure of the interview technique and assume the oral self-report technique is insensitive to strategy usage.

DISCUSSION

The purpose of this study was to determine whether educable mentally retarded children would acquire and employ an active semantic encoding and retrieval strategy in a memory task, and whether the usage of this strategy would generalize to stimuli different from those used during training. In a previous experiment (Engle & Nagle, 1979), we had shown that EMR children can acquire and effectively employ a similar semantic type strategy to enhance their free recall and clustering performance. The results from the present experiment support the findings of our earlier study in that the EMR children instructed in the Semantic strategy did show enhanced recall suggesting that they were using the strategy as a mnemonic aid. It is clear from the data that instruction in the use of the Semantic strategy resulted in significantly greater increments in recall and clustering than that obtained without such instructions. Overall, the Semantic strategy group showed enhanced performance on all dependent measures from the very first trial on the initial list in training through to the conclusion of all the training trials. These results appear to be relatively stable over time in that, with the most stringent criterion (i.e., PT2), given at a 1-week interval following training, all the Semantic strategy groups yielded higher performance than did their corresponding No-training groups.

Essentially, the present training program involved active participation on the part of the subject with a multifaceted semantic acquisition and retrieval strategy. Theoretically, it would be interesting to isolate the contributions of each of these components on the enhanced recall and clustering performance found with the children taught the semantic strategy and, indeed, our future work will be in that direction. However, the present study assessed the effectiveness of the total training program.

For any training program to be judged a success, it must be evaluated in terms of two criteria: (1) maintenance over time, and (2) generalization to new material (Brown, 1974; Campione & Brown, 1977). According to the first criterion, if a training program is to be an effective intervention, the mnemonic strategy must be detectable following a reasonable period of time after the completion of the training period. Retarded individuals once taught to use a mediational strategy have often been found to fail to maintain that strategy even 1 to 2 weeks after the completion of training (Jensen & Rohwer, 1963; Milgram, 1967; Wanschura & Borkowski, 1975). Only recently have the long-term effects of a training strategy been observed in the mentally retarded. In the present experiment, evidence for the maintenance of the Semantic strategy was found following a

1-week interval. The data from PT2, collected 7 days after training was completed, and in which no prompting of any kind was used, showed that all the Semantic groups continued to perform at a higher level of recall than did their corresponding No-training control groups. Evidently, the subjects in the Semantic group were continuing to use the instructed mediational strategy 7 days later in the absence of any prompts to do so. Thus, the procedure used in the current study appears to meet the criterion of short-term maintenance and thus, we might argue, would probably meet a criterion of long-term maintenance with more protracted training.

The second index for evaluating the degree of success for any training program is the extent to which the trained strategy generalizes to situations different from those experienced in training. Evidence for the generalization of the Semantic strategy to new materials can be observed through examination of the performance of those subjects given post-test lists different from those used during training. Analyses of both recall and organizational data appear to support the contention that the subjects trained in the use of the Semantic strategy did generalize the use of the strategy to novel stimulus materials. This generalization does not appear to be symmetrical, however, since the group trained on Related lists showed greater generalization than did the group trained on Unrelated lists. This makes intuitive sense if for no other reason than the SRU group got more in the way of positive feedback about their use of the strategy during training than did the SUR group. What is perplexing, however, is why the subjects trained on Unrelated lists showed no enhanced performance during training but did show positive transfer to the Related lists, i.e., the SUR group. One explanation might be that the Semantic strategy is not a useful strategy with Unrelated lists, but the subject may remember the strategy even after being shifted to the Related lists. The fact that the SRU group performed so well on Unrelated post-test lists seems to belie this explanation, however.

Another possibility is that one of the three components of the Semantic strategy training package may suppress recall and/or organization performance. For example, the component directed at categorical organization might facilitate performance on related lists, but may be counterproductive for lists that are not easily clustered, whereas the other components might be useful for both types of lists. For this explanation to account for our findings, it would have to be assumed further that the SUR subjects either forget or stop trying to use a clustering strategy by PT2, but continue using the two more productive components of the strategy. One hint that this maybe true is that the SUR group showed a sharp decline in clustering (z scores) from PT1 to PT2, but showed a slight increase in recall over the same period.

It should be stressed that even our No-training control subjects performed better than would have been predicted from much of the existing literature on memory in EMR populations. For example, those subject showed above chance clustering on the training trials despite the prediction of Spitz (1966) that they should give no evidence of categorical clustering. Likewise, they showed a significant positive correlation between ITR and recall that was identical to that of the Semantic-trained subjects contrary to the prediction of Glidden (1976). It is not clear whether these discrepancies are a result of different subject populations or experimental methodologies; however, our findings tentatively suggest that mentally retarded preadolescents are able to make some use of familiar semantic relations in organizing a list for recall.

Another point of comparison with existing literature concerns the necessity for suggesting to the child at the time of training that the strategy can and should be used for other tasks. Both Kestner and Borkowski (1979) and Brown *et al.* (1979) suggest for generalization to occur it is necessary that "it be made clear to the trainee that generalization is one hoped-for result" (Brown *et al.* 1979). The present procedure did not indicate to the subject during training that generalization would be expected or even tested, yet generalization did occur. One possible explanation for this apparent conflict is in defining what constitutes generalization. "Generalization" is a difficult concept to quantify or even classify when trying to compare different studies because of differences in materials, procedures, and subjects. Borkowski and Cavanaugh (1979) make the distinction between "near" and "far" generalization but these obviously are two arbitrary labels for points on a continuum. It may be that the present test of generalization was so similar to the task used during training that telling the subject to generalize was unnecessary, while such instructions may be necessary on tasks deviating more from those used during training.

Do the current data have any implications for a more general theory of normal or non-EMR subjects? We think they do, particularly since our criteria for selecting subjects were chosen to eliminate subjects retarded due to organic causes. Weisz and Zigler (1979) suggest that the development for normal subjects and for nonorganic retarded subjects follows the same course but retarded subjects reach a given stage behind normal subjects and, ultimately, a lower ceiling on development than normal individuals. We would suggest that normal subjects of approximately the same mental age as our subjects would show a similar pattern of results.

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