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ABSTRACT

The effects of integrated pictures of nouns, training in imagining relations between separate pictures of nouns, and the combination of training and integrated pictures on the recall of noun triplets were assessed in children from grades one, three, and six. The cued recall of nouns under these three conditions was from 2 to 6 times greater than that of the control group in all 3 grades. In grade 6, these children who had been trained to generate their own relations between the pictured nouns recalled significantly more than those who had been shown integrated (i.e., already related) pictures of the nouns. It was suggested that encouraging young children to seek out and generate relations between items to be learned might help them become aware of and more confident of their ability to improve their own learning efficiency. (Author)

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Integrated Pictures and Relational Imagery Training in Children's Learning[1]

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Abstract

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Two factors which influence the paired-associate recall of nouns are the method of presentation and the instructions given to the subjects. For example, it has been demonstrated that recall is facilitated when the noun pairs are presented in the form of integrated pictures (Davidson & Adams, 1970; Milgram, 1967; Reese, 1967; Rohwer, 1967) and when subjects are instructed to actively search for or generate relations between the nouns (Bobrow & Bower, 1969; Bower & Winzenz, 1970). The present study was designed to assess the effects of integrated pictures, training in imagining relations between pictured nouns, and the combination of integrated pictures and training on the recall of noun triplets. It was hypothesized that all three of the experimental conditions defined by these variables would facilitate recall relative to a control group at each age level tested. Children from grades, one, three, and six were chosen for study because it appears that there is a considerable variation in the facilitation of paired-associate recall across this age range due to 1) pictorial presentation, and 2) the nature of the instructions designed to elicit the use of imagined relations as mediators (Reese, 1970a; Rohwer, 1970, Wolff & Levin, in press).

Several investigators have suggested that the paired-associate recall of children younger than seven or eight years old is not

facilitated by instructions to imagine relations between nouns because the children are unable to do so (Montague, 1970; Rohwer & Ammon, 1971; Wolff & Levin, in press). It is also possible, however, that recall may not have been facilitated in the latter studies due to performance constraints such as inadequate or confusing instructions, lack of practice, or insufficient time to generate relations rather than to the children's inability to imagine relations between the nouns.

In one condition of the present study, subjects received training in imagining relations between separated pictures of nouns (relational imagery training). In another condition, subjects received no training but were presented with pictures which incorporated the nouns into an integrated scene (integrated pictures). These two conditions allowed a comparison of the effects on recall of noun relations generated by the subject and noun relations imposed by the experimenter. The results of previous research comparing the effects of self-generated and imposed relations on recall in paired-associate tasks suggest the following trend: only imposed relations effective at age five (Rohwer, Ammon, & Levin, 1971), both sources of relations equally effective from grades one through eleven (Bean & Rohwer, 1970 cited in Rohwer, 1971), and self-generated relations even more effective than imposed relations for college students (Bobrow & Bower, 1969; Bower & Winzenz, 1970).

Bower and his associates attributed the superior recall with self-generated relations to the active processing involved in the construction of idiosyncratic relations. However, it is difficult to

understand why active processing only appeared to facilitate recall in adult subjects. As suggested above, confusion and/or lack of practice may have limited the number and quality of relations generated by the children instructed to relate nouns in previous studies and therefore reduced their recall relative to that of children who were provided with relations. However, the training in the present study was designed to make the task of generating relations clear. Similar procedures have proven particularly effective with sixth-grade children (Levin & Kaplan, in press; Taylor & Whitely, 1971); therefore it was hypothesized that relational imagery training (i.e., self-generated relations) would facilitate recall more than would the presentation of integrated pictures (i.e., imposed relations) at least for the sixth-grade children.

The third experimental condition combined relational imagery training with integrated pictures, that is, subjects were presented with integrated pictures and were trained to focus on the relations between items within each picture. It was hypothesized that this combination of training and integrated pictures would facilitate recall more than would either condition separately, at least for the first-grade children. This hypothesis was based on the assumption that it would be easier to focus the young child's attention on the relations depicted in integrated pictures than to rely either on his spontaneous attention to relations or his ability to quickly generate relations of his own.

METHOD

Subjects. A total of 120 suburban school children -- 20 boys and 20 girls from each of grades one, three, and six -- served as Ss[3]. The mean age for each grade was as follows (in years-months): grade one, 7-3; grade three, 9-1; grade six, 12-2. Standardized test scores were unavailable, therefore the sample was selected from a list of the middle-ability students which was prepared by the teachers.

Materials. Fifty-four pictures were selected from a pool of 500 pictures of concrete nouns,[4] and pilot tests indicated that the youngest children in the sample could name all of them. The 54 nouns were divided into 18 three-picture sets (i.e., triplets). Triplets were used rather than pairs on the assumption that larger associative units would be more sensitive to the changes in associative strategies which the integrated pictures and relational imagery training were designed to produce (cf. Taylor & Whitely, 1971).

Two versions of the three-picture sets were constructed. In one version, the three pictured nouns in each set were presented in an integrated scene which related the nouns by action and/or spatial position (e.g., an elephant driving a car over a football). The second version of the three-picture sets consisted of separate drawings of the nouns placed side-by-side. All of the three-picture sets, both integrated and separated, were mounted on 5 by 8 inch cards.

A set of 18 one-item pictures was prepared for the cued-recall test. One picture was copied from each of the separated sets such

that six cues each were selected from the left, right, and middle positions.

Design. A 2 x 3 x 4 factorial design was used. Boys and girls from each of three grades (one, three, and six) were assigned to one of four conditions (integrated pictures, relational imagery training, the combination of integrated pictures and relational imagery training, or control).

Procedure. All Ss were individually tested by one of three Es -- two males and one female. Each S was told that he was to play a game with pictures and was asked to try to remember them. At this point, S was given different instructions depending on his condition. Ss in the integrated picture condition received practice on three sets of integrated pictures. E showed S the first integrated picture, named the items, and asked S to remember them. This first picture was presented for a total of 20 seconds. S's recall of two of the items was then cued with a picture of the third. Practice sets two and three were then presented for 20 seconds each and E again named the items and asked S to remember them.

Ss receiving relational imagery training were required to generate and draw three integrated pictures while viewing separated pictures of nouns. These Ss had to incorporate three pictures at a time into an active, and/or spatially contiguous scene. On the first practice set, an integrated picture served as a model for S's drawing. E asked S to describe the relations between the three items in S's drawing and then cued S's recall of two of the items with a picture

of the third. On practice sets two and three, S received as much encouragement and correction as was necessary to produce an integrated scene in which each of the three items was related to at least one of the other two items by virtue of position or action. Thus, S's task -- imagining relations between separated pictures -- was externalized and clarified.

Ss in the combined condition received practice on three integrated pictures which was designed to focus their attention on the relations between items. E presented the first integrated picture, named the three items, said that they were doing something together, and asked S to describe the activity. If S's description focused on the items rather than the relations between them, he was asked specific questions about the relations (e.g., What is the elephant doing to the car?, What is the car doing to the football?). E then removed the picture, asked S to recall the relations between the items in the picture, and cued his recall of two of the items with a picture of the third. On the second and third practice sets, S was asked not only to describe the relations between items in the scene but also to make a quick sketch of the scene from memory and to describe the relations in his drawing. This procedure allowed E to direct and assess S's attention to pictorial relations.

Ss in the control condition practiced on three sets of separated pictures. The first separated picture set was presented for a total of 20 seconds during which E named the items, and asked S to remember them. S's recall of two of the items was then cued with a picture of

the third. Practice sets two and three were then presented for 20 seconds each and E again named the items and asked S to remember them.

Because of the drawing and discussions in the relational imagery training and the combined condition, more time was spent with Ss in these two conditions than with Ss in the integrated picture or control conditions. It was not readily apparent how to control for time without distracting the Ss in the latter two conditions from the learning task, so no activities were interpolated between the practice and experimental trials.

After the initial training or practice session, a cued-recall test of the three practice sets was administered to all Ss with a maximum of 15 seconds allowed for each response. S was praised for his good memory and was asked to play the game with some more pictures. Each S was then given instructions on how to proceed. Ss in the integrated picture and control conditions were simply asked to remember which pictures go together. Ss in the training condition were asked to "try to make up a picture of the three things doing something together" but were not asked to make any more drawings. Ss in the combined condition were asked to "try to remember what the three things are doing together." The 15 experimental sets were then presented to each S at a 20-sec. rate. Immediately after presentation of all 15 sets, a recall test using the single-item pictures as cues was administered. The 15 cues were presented in the same order for all Ss which was a different random order than the

presentation order of the 15 three-picture sets. A maximum of 15 seconds was allowed for a response to each cue.

RESULTS

A three-way analysis of variance of the recall data revealed no significant main or interaction effects of sex; therefore recall data for boys and girls were combined. Figure 1 presents mean number of items recalled as a function of grade and condition.

Insert Figure 1 about here

Duncan's multiple range test was used to make pair-wise comparisons of mean recall between the 12 grade by condition cells. Mean recall of nouns in all three experimental groups was from two to six times higher than in the corresponding control group in all three grades. All these differences were significant at the .01 level. In grade six, the mean number of items recalled was significantly higher in the training condition than in the integrated picture condition ($p < .05$). Comparisons within conditions between grades one and six revealed significantly higher recall in grade six than grade one in both the training and control conditions ($p < .05$), but not in the integrated picture or combined conditions. Although it can be seen in Figure 1 that recall in the combined condition was higher than in the integrated picture condition in all three grades, these differences and all of the remaining within-grade differences were non-significant ($p > .05$).

DISCUSSION

The major finding was that all three experimental conditions -- relational imagery training, integrated pictures, and the combination of both -- greatly facilitated recall. The following discussion considers age differences within these conditions, comparisons between conditions, and the potential educational benefits of relational training.

Contrary to the results of most previous studies, no support was found for a developmental trend toward greater effectiveness of integrated pictures. Reese (1970b) also failed to obtain an age trend although his Ss only ranged in age from 40 to 64 months. In the present study, integrated pictures were highly effective at all three ages. It is possible that this lack of an age trend was an artifact of the materials. In order to fairly assess the ability of the youngest subjects to use pictorial relations as an aid to memory, the materials were designed to appeal to them. The first-graders were especially amused by the drawings and this probably increased attention to the relations within them.

Although there was an increase with age in the effectiveness of relational imagery training, inspection of the individual recall scores indicated that all of the children who received relational training were using relatively efficient memory strategies. In fact, there were only two instances where recall scores from the control condition overlapped those of the age-equivalent training condition. Furthermore, as Bugelski, Kidd, and Segmen (1968) noted

with college subjects, the children during post-test questioning eagerly recalled the active and often humorous relations which they had generated. Evidently, even the first-grade children were able to effectively utilize a relational strategy which greatly improved their recall.

The only deficiency the children exhibited was one of spontaneous production (cf. Flavell, Beach, & Chinsky, 1966). Among the control subjects, no grade-one subject indicated that he had attempted to relate the items; one grade-three subject reported that he had generated sentences using the items; and two grade-six subjects reported that they had generated stories to relate the items. It is interesting to note that the latter two subjects recalled 12 and 29 items apiece while the other eight grade-six control subjects recalled an average of six items apiece. The age trend in the control condition might therefore be due, at least in part, to an increase with age in the spontaneous use of relational strategies.

Rohwer (1971) concluded from similar evidence of age changes in the spontaneous and deliberate use of relational strategies in memory tasks that age 12 is the best time to begin teaching such strategies. The data from the sixth-graders in the present study might be taken as support for this view. Sixth-graders had the highest mean recall of all three grades after relational imagery training and were the only group which appear to have generated more effective relations than those which were presented in the integrated picture condition. However, the fact that relational

imagery training was so effective even with first-grade children indicates that such training might profitably begin much earlier than age 12.

Nevertheless, it is intriguing that sixth-graders recalled more items when they generated their own relations than when relations were supplied. With the exception of the results of a Russian study of verbal mediators (Mal'tseva, 1958 cited in Smirnov & Zinchenko, 1969), this result is the only demonstration of superior recall with self-generated relations as opposed to imposed relations in subjects younger than college age. The length of presentation per picture in the present study probably contributed to this result. Subjects were allowed more time to generate relations than has been allowed in previous studies but even the 15-20 seconds per triplet may not have been enough time for each subject to construct a relation for each triplet. Therefore, any recall facilitation derived from the generation as opposed to the viewing of relations may have been underestimated. On the other hand, it might be argued that the integrated pictures either did not capture the sixth-grader's attention or interfered with some other strategy they were attempting to use and therefore contributed to the difference between the training and integrated picture conditions. If such were the case, the integrated pictures would not have substantially improved the sixth-grader's recall, but as Figure 1 shows, mean recall in the integrated picture condition was nearly double that in the control condition. This large recall difference makes the even higher

recall in the relational training condition more noteworthy.

The hypothesis that the combination of trainirg and integrated pictures would facilitate recall more than would either condition separately for the younger children was not supported. This result reflects the surprising ability of the first-grade children to utilize and generate relations. The procedures of the present study might be used to capitalize on this ability in a classroom setting so that young children might become more aware of and more confident in their ability to improve their own learning efficiency. Taylor and Riegel (1972), for example, conducted a classroom intervention with retarded children which was based on increasing the children's awareness and use of organizational and memory skills. The modest success of Taylor and Riegel's pilot project suggests that training and encouraging children to organize new material and to relate it to previously learned material can help them in school-related tasks.

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FOOTNOTES

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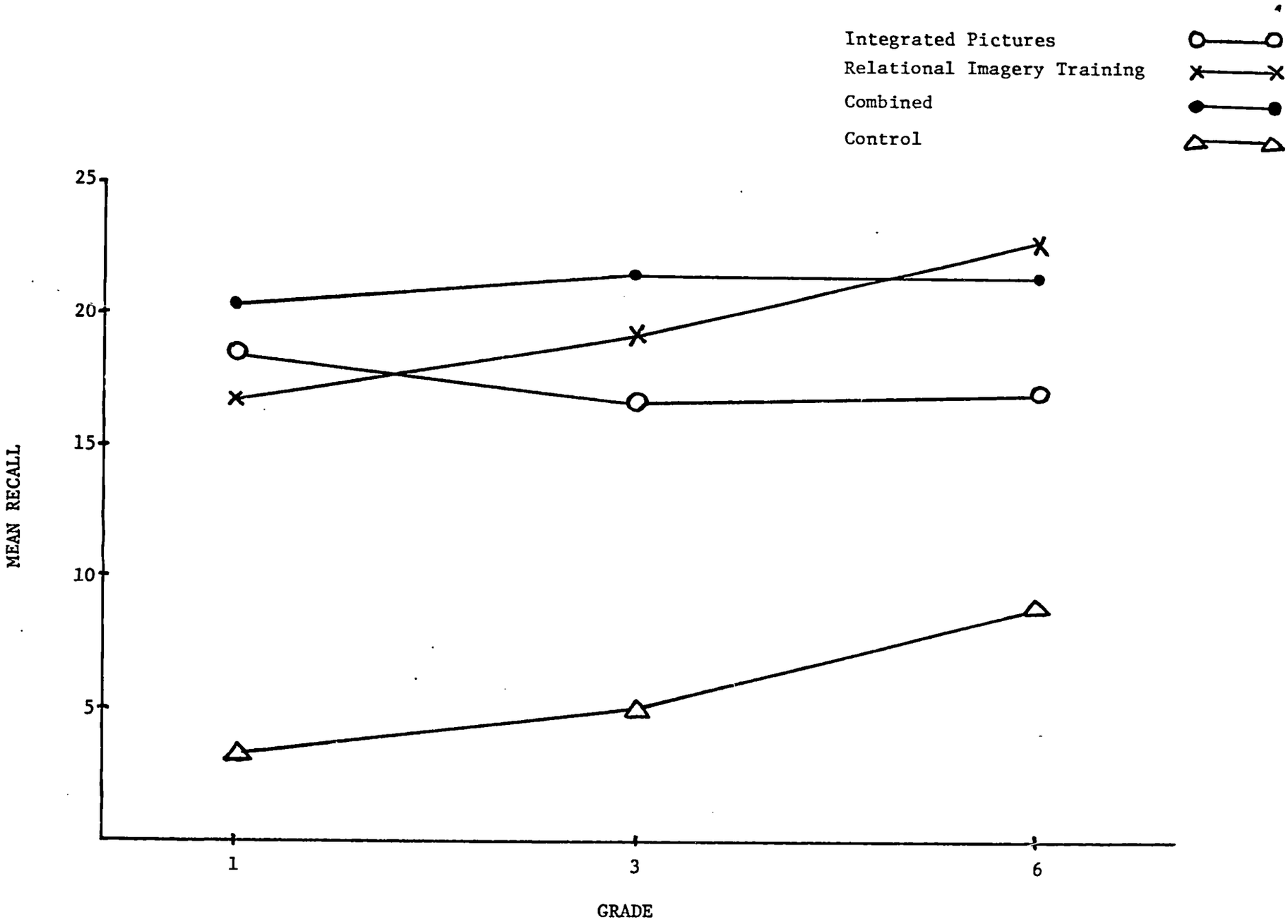
[2]The first author conducted this study as an NSF graduate fellow at the Institute of Child Development. The authors wish to thank Drs. Anne Pick, John Flavell, and James Tournure for critically evaluating earlier versions of this paper.

[3]The authors wish to thank the administrators, teachers, and students of the Mounds View Minnesota Public School System for their help and cooperation. Special thanks to Mary Bounds and Henry Taxis for helping to collect the data.

[4]The pictures were adapted from "Word Making Cards," a product of Word Making Productions, Box 305, Salt Lake City, Utah.

Figure Caption

Figure 1. Mean number of items recalled as a function of grade and condition.


Integrated Pictures
Relational Imagery Training
Combined
Control
25
20
15
10
5
MEAN RECALL
1
3
6
GRADE