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ABSTRACT

Developmental changes leading to mature judgments of the relative effectiveness of verbal memory strategies were examined in 60 subjects (20 each from second-, fourth-, and sixth-grade classrooms). Subjects viewed videotapes of a female child who was given the task of remembering a set of categorizable pictures. Demonstrations of four memory strategies (grouping, repeating, naming, and looking) were made. Following these demonstrations, 24 pairs of strategies were presented for paired comparison judgments. Subsequently, subjects were administered memory tasks involving picture stimuli from four taxonomic categories. Subjects were told to remember the pictures in the way that would help them remember best. Half the children in each grade first made strategy judgments and then performed the memory tasks; the order was reversed for the remaining half. Results indicated that second graders showed no significant preference for grouping over rehearsal. Fourth graders chose grouping over rehearsal as being most effective. Sixth graders demonstrated a clear preference for the grouping strategy. This increasing strategic awareness was also reflected in developmental increases in individual strategic awareness scores. Thus, although some awareness of the benefits of a categorization strategy may be evident as early as first grade, understanding of the relative benefits of categorization over rehearsal appears to develop during elementary school. (RH)

The Best Way to Remember Is . . .:

The Development of Strategic Awareness during Elementary School

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The Best Way to Remember is...:

The Development of Strategic Awareness during Elementary School

Research indicates that awareness of the mnemonic benefits of verbal memory strategies begins to emerge around five years of age (Flavell & Wellman, 1977). During the early school years children show increasing awareness of the benefits of rehearsal (Kreutzer, Leonard, & Flavell, 1975) and categorization (Moynahan, 1973) strategies. Several recent studies investigating awareness of the relative effectiveness of different memory strategies, however, indicate that early elementary school children are unaware of the mnemonic benefits of categorization over rehearsal for some memory tasks. Justice (in press) found that although second graders, unlike younger children, judged rehearsal and categorization as more effective than looking or naming for increasing recall. However, second graders also judged random rehearsal and categorization as equally effective for a task using categorizable stimuli. Similarly, Cox and Paris (1979) found that fourth graders chose rehearsal as more effective than categorization even when instructed to categorize. These findings are in contrast to comparable data indicating that adults consistently choose categorization as more effective (Justice & Johnson-Bailey, 1980; Cox & Paris, 1979). The current study extends the age range used by Justice (in press) to examine developmental changes leading to mature judgments of relative strategy effectiveness.

This study also addresses the relationship between awareness

of strategic effectiveness and memory performance. Unlike previous research which examined the relationship between awareness of individual memory strategies (e.g. categorization) and strategy use (Moynahan, 1973), the current study obtained a strategic awareness score reflecting the general level of the child's knowledge concerning the relative effectiveness of the four strategies. This score was then correlated with clustering and recall performance. In addition strategy judgements and memory tasks were counterbalanced across subjects to examine the effect of exposure to the strategies on subsequent performance, and vice versa.

Method

Subjects. The subjects were 60 children, 20 each from second, fourth, and sixth grade classrooms. Equal numbers of males and females were tested at each grade level. The mean ages of the second, fourth and sixth graders were 7 years, 9 months, 9 years, 11 months, and 11 years, 10 months, respectively.

Materials. Stimuli for the strategy judgments were black and white videotapes featuring a 10-year-old female model seated at a child-size table. Videotaped activities were shown from over the model's shoulder and an attempt was made to minimize cues as to the sex of the model. After an introductory section showing the model (referred to as "Lee") playing with some blocks, the model was given the task of remembering a set of categorizable pictures. The child was told the model would try and remember the pictures in different ways. Forty-five second segments of the model demonstrating each of the four memory

strategies were then presented. The four strategies were: (a) grouping: placing the pictures into a 3 x 4 matrix by category and naming each group of three aloud, two times, e.g., apple, pear, banana; apple, pear, banana; (b) repeating: placing the pictures into a random 3 x 4 matrix and naming each group of three together, aloud, two times, e.g., truck, apple, hand; truck, apple, hand; (c) naming: labeling the pictures one at a time with no spatial rearrangement; and (d) looking: visually focusing on the pictures one at a time with no spatial rearrangement. Each picture was verbalized or looked at twice in the demonstration of each strategy.

Following demonstration of the strategies, 24 pairs of strategies were presented for paired comparison judgments. Each pair consisted of a 15 sec. demonstration segment of each of two strategies. The 24 trials were divided into two blocks of 12 trials. Each block contained 12 strategy pairs comprising all possible permutations of the four strategies. The two blocks of trials were reversed to provide two stimulus orders for the paired comparison trials. Half of the children at each grade level received each stimulus order. Line drawings illustrating the four strategies were also prepared to supplement the videotapes during the paired comparison trials.

Stimuli used in the memory tasks were three sets of 12 pictures, three pictures from each of four taxonomic categories. Categories and exemplars were those used by Moynahan (1973). Each stimlus was mounted on a 3 1/4 in. x 4 in. (8.26 cm x 10.16 cm) piece of cardboard and laminated. Order of presentation of

the sets was counterbalanced across children within each grade.

Procedure. Each child was tested individually in a room at the school. Half of the children in each grade made the strategy judgments, followed by the memory tasks, while the order was reversed for the other half.

On the strategy judgment task the child viewed the videotape showing the model presented with the memory task and demonstrating the four strategies. Following each strategy demonstration a line drawing showing the model, the pictures arranged appropriately for that strategy, and the strategy label was also presented. Following the demonstrations, the child was told that now he/she would see two of these ways of remembering again and was to choose the one that would "help Lee remember best". Two 15 sec excerpts of the model using two of the strategies were then shown with each followed by presentation of the appropriate line drawing. After both strategies had been shown, the child was asked to choose the more effective strategy from the two line drawings. Two more videotaped strategies were then presented with each child making a total of 24 paired comparison judgments.

For the memory tasks the children were told that they would be given sets of pictures and should try and remember the pictures the way that would help them remember best. A one minute study period was allowed for each set after which recall was tested. Three sets of categorizable pictures were presented for study and recall.

Results

Strategy Judgments. The data from the strategy judgments for each grade and condition were analyzed using the Method of Paired Comparisons originally developed by Thurstone (1927). For each grade and condition these analyses yielded scale values reflecting the order of the judged strategies along a "psychological continuum" of effectiveness for the memory task. That is, the analyses indicated the strategy judged most effective, second most effective, etc. by children in each grade and condition. Table 1 shows the order of preference of the judged strategies going from least to most effective for each age and condition. To test whether each strategy was chosen significantly more often than each of the other strategies, a multiple comparison procedure for testing correlated proportions was used (Zwick, Neuhoff, Marascuilo, & Levin, 1982). Z-values calculated for the estimated proportion values obtained in the paired comparison analyses are also shown in Table 1. A critial value of 2.65 was derived from table provided by Dayton and Schafer (1973). Significant values indicate that the column strategy was chosen significantly more often than the row strategy. As Table 1 shows, 24 of the 30 Z-values were significant indicating awareness of relative strategy effectiveness, however the degree of awareness increased with age.

Second graders in both conditions judged rehearsal to be the most effective strategy, followed by grouping, naming and looking. Significance tests indicated that rehearsal was chosen significantly more often than looking or naming in Condition 1,

while both rehearsal and grouping were chosen more than looking in Condition 2. There was no significant difference in preference for the rehearsal and grouping strategies by second graders in either condition.

Fourth graders in both conditions chose grouping as most effective, followed by rehearsal, naming and looking. Multiple comparisons showed that rehearsal and grouping were judged significantly more effective than looking and naming by children in both conditions. Fourth graders in Condition 1 also judged grouping as significantly more effective than rehearsal, while the preference for grouping over rehearsal did not reach significance for Condition 2.

Sixth graders in both conditions also judged rehearsal and grouping as significantly more effective than the looking and naming strategies. In addition, sixth graders in both conditions judged grouping to be significantly more effective for the memory task than random rehearsal. Thus, second graders as a group showed no significant preference for a grouping over a rehearsal strategy, fourth graders showed this pattern only in Condition 1, while sixth graders showed this preference regardless of condition.

Individual Strategic Awareness Scores. The data in Table 1 reflect group judgments of the relative benefits of the strategies. Individual strategic awareness scores were also calculated based on the number of times the child chose each strategy as more effective. The strategies were assigned weights of from one to four going from least to most effective. The

number of times each strategy was chosen by the child was then multiplied by the weighting and summed across the four strategies. This resulted in a range of possible scores from 40, when the less effective strategy was chosen on every trial, to 80, when the more effective strategy was always chosen. A 3(grade) x 2(condition) analysis of variance showed a significant age effect, $F(2,54) = 6.41$, $p < .01$. Mean metamemory scores for the second, fourth and sixth graders were 67.05, 75.01 and 73.35, respectively. Tukey post hoc comparisons ($p < .05$) indicated that second graders had significantly lower strategic awareness scores than the older two groups who did not differ from one another.

Memory Task Performance. Two measures of performance, mean recall across the three memory trials and mean clustering during recall across the three trials, were examined. Analyses of variance with grade(3) and condition (2) as factors were conducted on each measure. Analysis of the recall data indicated a significant interaction between age and condition, $F(2,54) = 3.55$, $p < .05$. Tukey post hoc analyses ($p < .05$) showed that fourth graders in Condition 1 recalled significantly more than those in Condition 2. There was no significant difference due to condition for the other two grades. Analysis of the clustering data indicated significant effects due to grade, $F(2,54) = 9.77$, p .05, and condition, $F(2,54) = 5.60$, $p < .05$. The interaction between grade and condition did not reach significance, $F(2,54) = 2.86$, $p > .05$.

Correlation of Strategic Awareness and Performance. Individual strategy awareness scores for each subjects were

correlated with mean recall and mean clustering across all grades and conditions. Results indicated a significant relationship between strategy awareness and recall performance, $r(59) = .24$, $p < .05$. There was no significant correlation between strategy awareness and clustering.

Discussion

The results of this study replicate earlier findings indicating that early elementary school children are unaware of the relative mnemonic benefits of a categorization strategy for certain tasks. As in an earlier study (Justice, in press), second graders showed no significant preference for grouping over rehearsal. Fourth graders in both conditions chose grouping more often than rehearsal, however this preference reached significance only in Condition 1. Finally, sixth graders demonstrated a clear preference for the grouping strategy in both conditions. This increasing strategic awareness was also reflected in developmental increases in individual strategic awareness scores. Thus, although some awareness of the benefits of a categorization strategy may be evident as early as first grade (Moynahan, 1973), understanding of the relative benefits of categorization over rehearsal appears to develop during elementary school.

The recall data in the present study suggest some implications of level of strategic awareness for performance. Although the expected increases in recall with age were apparent, an interaction with condition was found for the fourth grade children. Fourth graders who made the strategy judgments prior

to doing the memory tasks recalled significantly more than those doing the memory tasks first. This trend was also apparent in the clustering data, although the grade by condition interaction did not reach significance. These data indicate that the fourth graders, unlike either the second or sixth graders, were effected by the information provided in the demonstration of the strategies. The child's emerging awareness of the relative effectiveness of categorization over rehearsal, apparent in the strategy judgment data, appears to have the effect of sensitizing the child to relevant information concerning the strategies. Further evidence of the relationship between strategic awareness and performance is provided by the significant correlation between the two.

The results of this study indicate that there are developmental changes in awareness of the relative benefits of categorization over rehearsal during elementary school. More importantly, the data suggest that during development of this awareness children are sensitive to information provided concerning these stategies. Although it is not clear in the present study what information provided in the strategy demonstrations resulted in increased subsequent performance, the data indicate that providing children with relevant information at the appropriate point in development may increase their awareness of important task and strategy variables.

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Table 1

Order of Effectiveness and Z - Values for Each Grade and Condition

Strategy

Least Effective → Most Effective

Grade 2, Condition 1

Order of Effectiveness:	Looking	Naming	Grouping	Repeating
Looking	-	.95	1.96	2.71*
Naming		-	2.00	3.50*
Grouping			-	1.05
Repetition				-

Grade 2, Condition 2

Order of Effectiveness:	Looking	Naming	Grouping	Repeating
Looking	-	2.48	3.35*	3.31*
Naming		-	2.33	2.34
Grouping			-	.63
Repeating				-

Grade 4, Condition 1

Order of Effectiveness:	Looking	Naming	Repeating	Grouping
Looking	-	2.32	4.50*	5.34*
Naming		-	4.32*	5.53*
Repeating			-	2.65*
Grouping				-

Grade 4, Condition 2

Order of Effectiveness:	Looking	Naming	Repeating	Grouping
Looking	-	3.09*	4.47*	4.99*
Naming		-	4.55*	5.05*
Repeating			-	2.52
Grouping				-

Table 1 (cont.)

Order of Effectiveness and Z - Values for Each Grade and Condition

Grade 6, Condition 1

	Strategy			
	Least Effective			Most Effective
Order of Effectiveness:	Naming	Looking	Repeating	Grouping
Naming	-	.80	5.43*	5.44*
Looking		-	3.85*	4.84*
Repeating			-	3.70*
Grouping				-

Grade 6, Condition 2

Order of Effectiveness:	Looking	Naming	Repeating	Grouping
Looking	-	1.97	2.95*	4.61*
Naming		-	2.81*	4.97*
Repeating			-	4.38*
Grouping				-

* Column strategy chose significantly more often than row strategy, $p < .05$