THE EFFECTS OF ANALYZING TASK DEMANDS ON CHILDREN'S SELECTION AND TRANSFER OF EFFECTIVE MEMORY STRATEGIES

by

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Abstract

This study examined the effects of analyzing task demands on children's selection and spontaneous transfer of effective memory strategies. Two learning tasks and a transfer task were used. One hundred and eight children in grades 3 and 5 were randomly assigned to one of the three conditions, Control, Simple Instruction (SI), and Elaborated Instruction (EI). No strategy was taught to subjects in the Control condition. Subjects in the SI and EI conditions were instructed to use appropriate memory strategies for the learning task. In addition, subjects in the EI condition also received task-specific strategies information prior to the transfer task. Their application of the memory strategies to the transfer task was examined. Results indicated that the main effect of grade was significant for the categorical word-list task but not for the paired-associate task at both learning and transfer phases. In general, subjects in the two experimental conditions (SI and EI) performed better than the subjects in the Control condition, and that the EI subjects out performed the SI subjects. Transfer of the strategies occurred mainly in the EI condition which
included the task-specific information. In other words, the more task-specific information subjects received concerning the memory strategies, the more likely they would transfer the strategies appropriately to new learning situations.
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Chapter I

RESEARCH PROBLEM

STATEMENT OF THE PROBLEM

Early work in memory development indicates that young children often do not generate strategies spontaneously to aid their performance on learning tasks (Kail & Hagen, 1977; Rohwer, 1973; Salatas & Flavell, 1976). Recently, researchers have employed different training programs in order to enhance children's knowledge and their appropriate use of memory strategies (Lodico, Ghatala, Levin, Pressley, & Bell, 1983; O'Sullivan & Pressley, 1984; Ghatala, Levin, Pressley, & Lodico, 1985; Waters & Andreassen, 1983). Results from these experiments show that it is possible to teach young children to use appropriate memory strategies to enhance their performance on specific tasks. However, while particular strategies are appropriate and helpful for particular tasks, it was also found that children often do not transfer their knowledge of strategies to novel learning situations (Belmont, Butterfield, & Ferretti, 1982; Waters, 1982). Although there are cases in which some transfer did take place, the occurrences are often resulted from experimenters' explicit prompts (Pressley & Dennis-Rounds, 1980). Researchers are thus confronted
with the difficult task of how to teach children a variety of efficient memory strategies, so that they will transfer them spontaneously when they face novel learning tasks.

Closer examination of the training programs used by other studies reveals that the previous studies seemed to have neglected one aspect in their training, namely, memory strategies being task-specific rather than task-general (i.e., strategy A is better than strategy B for some learning tasks while the opposite is true for some other learning tasks). Consequently, one may not indiscriminately apply the same memory strategy to all learning tasks.

The principal objective of the present study was to define an alternative training program which aimed at enhancing children's spontaneous transfer of effective strategies. In this study, the primary focus was on examining the notion that spontaneous transfer of effective memory strategies depends in part on whether or not one has knowledge and ability to distinguish strategies that are appropriate from those inappropriate for the learning task at hand. In other words, not all memory strategies are equally appropriate and effective for all learning tasks. It was postulated that memory performance depends on the learner's ability to select an effective memory strategy according to the learning task
demand. Specifically, having the necessary knowledge to differentiate strategies that are appropriate to the task at hand would facilitate children to transfer the acquired strategies to novel learning tasks.

THEORETICAL BACKGROUND

Since the landmark symposium of Flavell (1971) "what is memory development the development of?", increasing attention has been directed towards children's awareness of the development of their own memory. As a result, there is now a large body of literature on children's awareness of their own cognitive processes, particularly on metamemory. The phenomenon of metamemory was defined by Flavell (1971) as one's awareness of his/her own memory state or any knowledge germane to information storage and retrieval. In other words, a person has metamemory if s/he shows knowledge that some things are easier for him/her to remember than others, and is aware that while one item is on the verge of recall, another is wholly irretrievable (Flavell & Wellman, 1977). Generally, a person showing metamemory would be knowledgeable about his/her own memory state in a given situation, and would also be aware of the appropriate strategies for storing and retrieving information from memory.
Findings from various studies indicate that older children generally show greater metamemorial knowledge and awareness than younger children (Bjorklund & de Marchena, 1984; Brown, 1978; Flavell & Wellman, 1977; Moynahan, 1978; Rohwer, 1980). For example, very young children (e.g., kindergartners) know that a memory task is harder if it has a large number of items whereas only older children (e.g., grade 5) know that a recall task is harder if one has to learn two sets words that are easily confused (Kreutzer, Leonard, & Flavell, 1975).

Moreover, compared to older children, younger children were found to engage in memorization nonstrategically, have poor understanding of when some things have been memorized, and recall poorly (Appel, Cooper, McCarrell, Sims-Knight, Yussen, & Flavell, 1972). Brown (1978) also reported that kindergartners, compared to third-graders, were less aware of the fact that words are easier to remember in a narrative form than in a list. Moreover, they were less aware that it is easier to learn lists of high associates than low associates, and that it is easier to paraphrase than to recall verbatim.

Given that young children are relatively naive about their own memory process as well as how task parameters may influence memory, recent investigations on memory development mainly have focused on strategy usage under
instruction (Pressley, Heisel, McCormick, & Nakamur, 1982). The rationale behind these investigations is that if young children are unaware of their own memory abilities, perhaps they can be taught to learn memory strategies and implement them under appropriate conditions. Results from various studies show that young children can be readily trained to use strategies. However, experimenters often face a perplexing problem; young children tend to abandon the trained strategies unless they were explicitly prompted to continue (Brown, 1978; Paris, Newman, & McVey, 1982; Pressley and Dennis-Rounds, 1980; Pressley, Ross, Levin, & Ghatala, 1984c).

One reason for the limited durability and generalizability of acquired strategies appears to be the inadequacy of strategy instruction during training trials (O'Sullivan & Pressley, 1984). The strategy instructions usually do not include more than a description of how to execute the component processes of a strategy. For example, rehearsal is one of the most frequently studied strategies for simple list learning. The procedures used by Naus, Ornstein, and Aivano (1977) were typical of those used in research on rehearsal. Children instructed to rehearse were simply told to practice the presented word aloud with any two other words in the list. They were encouraged to do this during the entire presentation. Notably lacking from the instructions was
any information on why the rehearsal strategy was linked to the goal of memory, or how and in what circumstances this strategy might be varied.

No strategy for paired-associate learning has received as much attention as elaboration (Pressley, 1982). The directions used by Pressley & Levin (1977) in their research on children's use of elaboration were somewhat more specific than those provided by Naus et al. (1977). All subjects in the study by Pressley & Levin (1977) were told to remember which items paired together. Some subjects were told to generate mental images of the paired items interacting since these images would aid learning. It seems that these instructions include specific strategy knowledge about learning gains associated with strategy use. However, they were still too vague and involved too little specific or detailed information about the strategy.

As they became more aware of instruction inadequacy, researchers began to provide more specific strategy instructions during the training trials. It has been suggested by many researchers (Brown, Campione, & Day, 1981; Lodico et al., 1983; Pairs, et al., 1982; Ringel & Springer, 1980) that in order for children to transfer strategies on their own, they must possess knowledge on the respective values of the strategies in improving their performance. Some studies examined the effect of
experimenter-provided information concerning the value or effectiveness of the trained strategy. They showed that, in general, when children are made aware of the value of a strategy, they are more likely to continue to use that strategy after training (e.g., Cavanaugh & Borkowski, 1979; Kramer & Engle, 1981). For instance, Lodico et al. (1983) trained 7 to 8 year old children about general principles of strategy monitoring before exposing them to different effective acquisition strategies in a memory task. Their study suggests that engaging children in monitoring and evaluating a range of strategies results in selecting more appropriate strategies in various tasks.

Moreover, Pressley, Borkowski, and O'Sullivan (1984a) proposed that strategy usage is closely related to knowledge about the strategy, and they suggested that explicit metamemorial information on a strategy makes that strategy more effective when needed. In other words, an additional factor to be considered is the learner's comprehensive knowledge of the strategy when a memory strategy is taught. Pressley et al. (1984a) referred to this type of knowledge as specific strategy knowledge which includes types of task materials, one's own knowledge and skill in using the strategy, information about its utility, as well as the knowledge about when, why, and how to use various strategies.
appropriately in different contexts. More specifically, children need to possess a general principle that would guide them in how and when to apply the strategies appropriately.

O'Sullivan & Pressley (1984) had incorporated some of the above components in their study. Children in grades 5 and 6 and adults were presented two memory tasks with an associative component. First, they learned pairings between names of cities and their products; then they acquired definitions of Latin vocabulary words. Control subjects learned both sets of materials with no strategy instructions. Subjects in the experimental conditions learned the city-product pairs using the keyword method which is effective with such learning materials (Pressley & Dennis-Rounds, 1980). These experimental conditions varied with respect to how explicitly subjects were told how and when the keyword mnemonics are helpful. In one of the experimental conditions, subjects were presented with only the "how" information about the memory strategy and the "where" and "when" information was not presented. Their application of the memory strategy to the Latin task was examined.

The most important dependent variable in their study is whether subjects had transferred the keyword strategy to the Latin vocabulary task. In general, children's transfer was found to be greater when the keyword
instruction explicitly contained a lot of information about how and when to use the strategy. On the other hand, adults' transfer was high regardless of the explicitness of strategy information included in the instructions. Adults probably abstract more knowledge about a strategy from simple instructions and practice than children do (Chi, 1976; Pressley, Levin, Ghatala, 1984b), thus, making the explicit provision of specific strategy information much more crucial with children.

Although the study by O'Sullivan & Pressley (1984) allows for stronger cause-and-effect conclusions than previous studies, it has not provided clear directions on the critical aspects of specific strategy knowledge, nor has it provided useful insights into optimal ways of inducing metamemory strategy. However, it did provide some preliminary evidence that increasing provision of information on a strategy during instruction makes an important difference in children's generalized strategy usage. This pointed to the need for additional studies.

RATIONALE AND THEORETICAL HYPOTHESES

From an educational perspective, the main objective in cognitive strategy research is to identify methods and techniques to produce "good strategy users" (Pressley, Borkowski, & Schneider, 1987). In recent years, there
has been an increasing emphasis upon factors associated with the continued use and transfer of strategies following strategy instruction. It is hypothesized that subjects' metamemorial information plays a critical role in their subsequent strategy selections and use (Borkowski, 1985; Pressley et al., 1984a). According to this hypothesis, the often documented failure on the part of young children to maintain and generalize newly acquired memory strategies may be largely attributable to deficient knowledge about the instructed strategy (Kendall, Borkowski, & Cavanaugh, 1980; Kramer & Engle, 1981).

Closer examination revealed that most research methodologies involve the training of a single strategy which is presumed to be effective. However, according to Kreutzer, Leonard, & Flavell (1975), choosing an effective strategy to enhance one's memory performance depends partly on having various strategies to choose from. Young children often have fewer mnemonic strategies at their disposal than adults. This difference in knowledge and availability of strategies may be one of the major factors underlying the different performance between children and adults on memory learning tasks.

The majority of investigations on memory strategies conducted to date involved an immediate transfer of a
newly acquired strategy, and their focus usually was only on a single strategy. Pressley et al. (1984a) suggested that one way to facilitate the long-term maintenance of effective strategies is to teach children a general, nonspecific principle that is relevant to all memory strategies. The present study examined one such general principal that is crucial to the use and transfer of strategies following strategy instruction. It involved teaching children to focus on the task demand. Such knowledge is important for the deployment of strategies. For example, to remember the gist of a long prose passage is a much less demanding retrieval task than to recall it verbatim. Therefore, one needs to recognize the task demand at hand and select the most appropriate strategy accordingly rather than apply the same strategy indiscriminately to all tasks. Consequently, the use of different strategies based on the task demand at hand would aid one's performance.

According to Wessell (1982), the ability to differentiate strategies that are appropriate from those inappropriate to the task at hand may be a prerequisite for adopting and maintaining an effective mnemonic strategy. Choosing an effective strategy for improving one's learning depends on what the nature of the task calls for. For instance, if the task calls for remembering a long list of new vocabulary items, a
strategy involving rote memory or rehearsal may not be the most effective strategy one could use. Rather, some form of elaboration (verbal or imagery) would be more appropriate. On the other hand, rehearsal would be useful for remembering a telephone number for a short period of time. Since the type and nature of the task vary greatly from one to another, training children to focus on the task demand would enable them to have the knowledge to determine when and under what circumstances to apply a strategy effectively.

There has been little research on teaching children to analyze the task before applying such a strategy. The primary objective of the present study was thus to design a new training program to teach primary grade children about the specific-task information of different memory strategies. Specifically, two experimental conditions, Simple Instruction (SI) and Elaborated Instruction (EI) were employed. For the SI condition, a general principle of HOW to use the memory strategies was taught to the subjects without any specific information on the WHY and WHEN components. On the other hand, subjects in the EI condition received task-specific strategies information with emphasis placed on the WHY and the WHEN components. Instead of merely focusing on teaching children the strategies as most researchers have done, the main focus of training in the EI condition was on the analysis of
task materials. During the training trial, children were told that the trained strategies could help them on a variety of similar tasks and that the trick was to know which ones. The instruction was focused on why certain strategies were more appropriate for certain tasks than others. Children were then be exposed to a variety of prototypic tasks and the utility of the strategy in such situations demonstrated. At the same time, examples of and reasons why the trained strategies were inappropriate for some tasks were also discussed and demonstrated. Children were given opportunities to practice after the instructions. Finally, they were presented with a transfer test containing new prototypic tasks and their application of the strategies examined.

The principal goal of the present experiment was to examine the effect of analyzing the task at hand on spontaneous transfer of effective strategies. It is believed that not all strategies are equally appropriate to all tasks; rather, some strategies are more effective for certain types of tasks than others (McDaniel & Kerarney, 1984). Hence, it is hypothesized that having the knowledge and ability to differentiate strategies that are appropriate from those that are inappropriate to the task at hand would facilitate children in transferring the newly acquired strategy to new learning materials.
Once naive subjects are induced to acquire simple memory strategies (i.e., Simple Instruction) or elaborated memory strategies (i.e., Elaborated Instruction) through the appropriate training conditions, such strategies information should be effective when performing on a transfer task. In particular, the elaborated version of such strategies should be more effective in greater transfer than the, simple ones. Of course, both experimental conditions should be more effective as compared to the Control condition.
Chapter II

METHOD

SUBJECTS AND DESIGN

A number of investigations have proposed in their studies that there is a shift in development with respect to children's use of memory strategies (Bjorklund, 1985; Bjorklund & de Marchena, 1984). In particular, younger children (e.g., grade 1) tend to be more naive in their use of strategies as compared with old children (e.g., grade 7). Beginning at around grade 3, however, children tend to become more conscious of the strategies that are available to them (Lang, 1973; Bjorklund & de Marchena, 1984). In the present study, grade 3 and 5 children were selected in order to examine whether the same developmental trend would occur as in the previous studies.

A total of 108 grade 3 and 5 students were selected from two elementary schools in Burnaby and Vancouver, British Columbia. As it was considered that memory ability might be confounded by language ability, the subject pool was selected to include only those students whose native language is English. All subjects in this study were administered the Peabody Picture Vocabulary Test-Revised (PPVT-R), Form L (Dunn & Dunn, 1981) as a
screening measure for language. This was to control for the possible effect of verbal ability on learning the verbal materials in the study. Subjects were rank ordered by their score on the PPVT-R and blocked into 18 triads (54 subjects for each grade); one of each triad was randomly assigned to one of the three conditions of the study, Control, Simple Instruction (SI), and Elaborated Instruction (EI). There were 17 boys and 19 girls for the Control and SI conditions, and 19 boys and 17 girls in the EI condition. The mean age for the grade 3 students was 8.10 years (range=7.6 to 10.0 years), and the mean age for grade 5 students was 10.10 years (range=10.6 to 12.2 years).

For all conditions, subjects were given two sets of learning materials (paired-associate and word-list), and a transfer task to study. Subjects were randomly assigned to one of the three conditions, Control, Simple Instruction, and Elaborated Instruction. No strategies were taught to subjects in the Control condition. Subjects in the Simple Instruction and Elaborated Instruction were instructed to use appropriate memory strategies for the learning tasks. In addition, subjects in the Elaborated Instruction condition received task-specific strategies information prior to the transfer task. Their application of the memory strategies were examined for the transfer task when explicit instruction
of what strategies to use was absent. Upon completion of the transfer test, subjects were probed as to the strategies that they had employed in recall during the transfer test. The contrasting features of the three treatment conditions are specified in Table 1.

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Insert Table 1 about here
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LEARNING AND TRANSFER TASKS

1. Paired-Associate (PA)

The first learning task was a 20-item paired-associate list in which the stimulus and response members are concrete nouns (see Appendix A). In addition, two practice lists were also constructed (see Appendix C). These noun pairs were chosen from the study by Rohwer & Bean (1973) dealing with grades 1 to 11 children. The median word frequency for the PA list was 232.0 (range=28 to 2316) (Carroll, Davies, & Richman, 1971).

2. Categorical Word-list (WL)

The second learning task was a 30-item structured word-list containing 3 words from each of 10 categories (see Appendix B). Also two practice lists were
constructed (see Appendix D). The median word frequency for the WL set was 262.5 (range=3 to 2625) (Carroll, et al., 1971).

3. Transfer Task

The transfer task consisted of both paired-associate and word-list items which different from the learning tasks. There were 10-items from the PA list with the stimulus and response in each pair and 15-item structured word-lists containing 3 words from each of the 5 categories (see Appendix E).

For all tasks, the words were pre-recorded on an audio tape as well as printed on 12.7 x 7.6 cm index cards with two words per card for the PA task, and three words per card for the WL task. Subjects were presented with one of three randomly selected sequences of cards for each task. For each presentation, the audio tape played the appropriate sequence of the cards to which the subject was randomly assigned to and at the same time, s/he was presented with the printed cards. Each card was displayed for 15-seconds for the PA task and 20-seconds for the WL task. The onset of every card was signaled by a bell so as to alert the subject to the presentation of the next card.
PROCEDURE

The experiment was conducted in a classroom with a table and chairs. Each subject was tested individually. They were told that they were going to play a memory game. All subjects received instructions appropriate for the condition to which they were assigned. They read each card aloud as it was presented in order to ensure that the words were understood correctly.

For the paired-associate task, subjects in the two experimental groups were instructed to use the sentence strategy to help them learn the PA task whereas no strategy was instructed to the subjects in the Control condition. They were told to remember which two words go together as they would have to supply the response words when given the stimulus word. A sample list of two noun pairs were presented first to illustrate the procedure, followed by another two pairs (see Appendix C). They were presented as practice trials to ensure that the subjects had indeed understood the instructions and the procedure to follow. Any apparent misunderstanding of instructions was clarified before they proceeded to the learning trials. For the recall test, the stimulus words were presented one at a time, and subjects were given 30 seconds to recall the corresponding response word. The
recall test was given immediately after each learning trial.

Similarly, for the word-list task, subjects in the two experimental conditions were instructed to group the words into a category and use the category-name as a cue to assist their learning of the words and no strategy was mentioned to the subjects in the Control condition. At the end of the task, they were given the category name, and subjects had to recall the three items in that category. Two word cards were used as a demonstration, followed by another two cards as practice trials (see Appendix D). After all potential misunderstandings were clarified, subjects were given the actual word-list task to learn followed immediately by the recall test. The order of the tasks (i.e., paired-associate and word-list) presentation were counterbalanced. For clarity, the following procedure descriptions assumed that the paired-associate task preceded the word-list task.

**CONTROL CONDITION.** A list of paired-associate items in Task 1 (see Appendix A) were presented to the subjects and they were asked to study and remember as many pairs as they could in the recall test. Recall test for the Task 1 was given. Then subjects were presented with the word-list in Task 2 (see Appendix B), and followed by the recall test (see Appendix F).
SIMPLE INSTRUCTION CONDITION. Subjects were told that one way to remember which pair of words goes together is to make a sentence to connect the words. This instruction was illustrated by using the two sample cards, and subjects were given another two cards to practice. A list of paired-associate items in Task 1 (see Appendix A) were then presented to them and subjects were asked to use the sentence generation strategy to remember these pairs. The recall test was then given.

Following the recall test, the word-list in Task 2 (see Appendix B) was presented to the subjects. They were instructed to learn the words on each card as a group and use the category name to help them remember. The instructions were illustrated with two sample cards and, subjects were given another two cards to practice. Recall test of the ten word-lists was then administered (see Appendix G).

ELABORATED INSTRUCTION CONDITION. Subjects assigned to this condition received the same instructions and followed the identical procedure as those given to the subjects in the Simple Instruction condition. However, after the second recall test, they received additional task-specific information on memory strategies, with
emphasis placed on detailing the type of task to which the strategies could be employed (see Appendix H).

Following the second recall test, subjects in all conditions were told that they could play the game one more time and that they could play the game however they want. It was emphasized that the goal was to remember as many items as possible using strategies they think would be helpful to the task (see Appendix E). At the end of the experiment, all subjects were interviewed to examine which strategy they had used during the transfer task and why they selected that particular strategy (see Appendix I).

The dependent variables in this study are the mean number of items correctly recalled and the use of appropriate strategies on the transfer task. It was predicted that the Elaborated Instruction condition would result in the best recall and transfer the strategies appropriately, followed by the Simple Instruction condition. By comparison, the Control condition would result in least recall and less effective in transfer of the memory strategies.
Chapter III

RESULTS

To assess the effect of the experimental variable on both learning and transfer performance, the mean number of items correctly recalled was used as the sole dependent variable. A preliminary inspection of the data revealed no difference due to gender, the data were collapsed across girls and boys in all conditions. Since the two performance measures for the paired-associate and the categorical word-list were not directly comparable, they were analyzed separately in a 2 Grades (3 and 5) x 3 Conditions (Control, Simple Instruction, and Elaborated Instruction) factorial design.

The mean standard score of the PPVT-R for the grade 3 was 102 (range=72 to 137, standard deviation=16.83), and for the grade 5 was 105 (range=75 to 137, standard deviation=18.03). An initial examination of the PPVT-R scores shows no significant treatment and aptitude interaction (p>.05) with any other factor. Therefore, it was decided to drop the PPVT-R test scores from further analyses in order to gain statistical power and parsimony for examining data.
ANALYSIS OF LEARNING PERFORMANCE

1. Paired-Associate (PA)

The mean number of items correctly recalled for paired-associate and word-list at the learning and transfer phases are shown in Table 2.

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Insert Table 2 about here

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Inspection of Table 2 shows that, in general, subjects in the Elaborated Instruction (EI) and Simple Instruction (SI) conditions recalled about the same mean number of correct responses (8.72 vs. 8.44 for grade 3 and 9.06 vs. 8.83 for grade 5, respectively). Subjects in the Control condition had the least recall of correct items (4.44 and 5.61 for grade 3 and 5, respectively).

The analysis of variance on the recall measure showed that the main effect of the strategy training was significant, \( F(2, 102) = 45.086, \text{MSe}=3.728, p<.01 \), as shown in Figure 1. Neither the main effect of the grade nor that of its interaction with the strategy treatment was significant, however. The significant main effect of the strategy training was further traced to the fact that both training conditions were highly effective during the
learning phase with PA lists, as compared to the Control condition (5.03 vs. 8.76), $F(1,102)=89.87$, $p<.0001$; and that the two strategy conditions did not differ from one another significantly, $F(1,102)<1.0$.

Insert Figure 1 about here

2. Categorical Word-List (WL)

Inspection of Table 2 reveals that the mean number of items correctly recalled increased as a function of grade. In general, grade 5 subjects recalled more items than grade 3 subjects. The developmental trend was also shown in the subsequent analysis which indicated the main effect of Grade [$F(1, 102)=6.182$, MSe=10.568, $p<.05$] was significant. The main effect of the strategy training conditions was not significant, $F(2,102)=1.122$ $p>.05$, nor was its interaction with grades, $F(1,102)<1.0$, indicating that the strategy training did not make any difference on subjects' learning of the word-list. As shown in Figure 2, grade 5 subjects in the Control condition appeared to learn as effectively as the EI subjects or slightly better than the SI subjects (25.22 vs. 25.11 and 23.83, respectively), while grade 3 subjects appeared to perform best under the EI condition, a little better under the SI
condition. However, this interaction between grades and the strategy training conditions was nonsignificant, F(2,102)<1.0.

Insert Figure 2 about here

ANALYSIS OF TRANSFER PERFORMANCE

1. Paired-Associate (PA)

For the transfer task, all subjects were told to use any strategy they thought would be appropriate to help them learn the words. Table 2 shows the means for each condition and grades. The mean number of items correctly recalled by subjects in the Control, SI, and EI condition were 2.61, 3.23, and 3.89 out of the possible score of 5, respectively. Analysis of variance indicated that the main effect of the strategy training Conditions [F(2, 102)=7.253, MSe=2.027, p<.01] was significant, as shown in Figure 3. The main effect of grade appeared to be only marginally significant, F(1,102)=2.631 p<.11, and the interaction between grade and training conditions was not significant, as in the learning phase, F(2,102)<1.0. Further analyses of the significant main effect revealed first that the two strategy conditions were effective in inducing appropriate memory strategies, as compared to
the Control condition (3.56 vs. 2.61), \( F(1,102)=10.56, p<.002 \) and that the EI subjects recalled significantly more than the SI subjects (3.89 vs. 3.23), \( F(1,102)=3.945, p<.05 \).

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Insert Figure 3 about here

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2. Categorical Word-list (WL)

Transfer performance on the categorical word-list task show somewhat different features of the strategy training as well as grades effects, as can be seen in Figure 4. The analysis of variance performed on the recall measure showed that the main effects of Grades \( [F(1, 102)=11.256, p<.01] \) and the strategy training Conditions \( [F(2, 102)=14.221 \text{ MSe}=7.424, p<.01) \) were significant. The developmental trend (5.98 vs. 7.74 out of total possible score of 15 for grade 3 and 5, respectively) is clearly shown, but it does not interact with the effect of the strategy training condition. Further analyses of the effects of the three strategy conditions (5.75 vs. 6.00 vs. 8.83) revealed that the two memory strategies induced are more effective for recall performance than to the Control condition (5.75 vs. 7.42), \( F(1,102)=8.98, p<.003 \), and that the EI subjects
out performed the SI subjects, (8.83 vs. 6.00), $F(1,102)=19.463$, $p<.0001$. An examination of Figure 4 suggests that the effectiveness of the SI strategy on the transfer task is limited. Two post-hoc contrasts were made to investigate it. A simple contrast between the mean of the SI condition and that of the Control was not significant, whereas a complex one between the EI and the SI and Control condition combined was highly significant (Scheffe's $F(2,102)_{.95}=3.94$). This means that the SI strategy as induced did not have a greater effect than the Control condition under which subjects presumably would use their own noninstructed strategy spontaneously, while the EI strategy presumably induced as intended did have great effect on the transfer performance. In other words, the simple, general strategy instruction was no different from subjects' spontaneous strategy of their own; but the elaborate specific strategy instruction was found to be very effective where the task demand is the recall of categorical word-list.

Insert Figure 4 about here
3. Strategy-Choice Data

Table 3 lists the four categories of strategies reported as employed under the three conditions.

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Insert Table 3 about here

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Inspection of this Table indicates that subjects in the EI condition correctly transferred the appropriate strategies for the PA and WL tasks (91.7% and 88.9%, respectively). About half of the subjects in the SI condition transferred the appropriate strategy in the PA task (52.8%) and less than one-third (30.6%) of the subjects transferred appropriately for the WL task. The majority of the subjects in the Control condition did not employ the strategies appropriately for both of the PA and the WL tasks (63.9% and 55.6%, respectively).

When asked to give their reasons for selecting the strategies for the transfer task, the majority of the subjects in the EI condition acknowledged the benefits of appropriate strategies in helping them to recall both the paired-associate and word-list tasks (89.19% and 86.49%, respectively). On the other hand, only half (52.94%) and less than one-third (32.35%) of the subjects in the SI condition realized the advantages of transferring the
appropriate strategies for the paired-associate and word-list tasks, respectively. Most of the subjects in the Control condition reported that they did not realize the benefits of employing appropriate strategies in assisting their recall (75.68% and 72.97% for the PA and WL tasks, respectively).

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Insert Table 4 about here

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Chapter IV

DISCUSSION AND CONCLUSION

A major goal of the present study was to determine whether task-specific information on memory strategy training would facilitate the transfer of the effective strategies to learning new materials. Results of the present study indicate a positive relationship between the amount of specific information one receives on the strategies and the mean number of items correctly recalled. In general, subjects' use of strategies on the transfer task was very much a function of the task-specific information instruction provided prior to the transfer task. The findings support the hypothesis that the more task-specific information subjects received concerning the memory strategies, the more likely they will transfer the strategies appropriately to new learning situations. Statistically significant transfer of the strategies occurred mainly in the Elaborated Instruction condition which included the task-specific information.

Initially, it was thought that memory performance might be confounded by one's language ability. Although the PPVT-R is used to measure receptive vocabulary (Dunn & Dunn, 1981), it was found not to differentially affect
the metamemorial retrieval strategies of children on the paired-associate and categorical word-list.

Few differences were found between the two experimental groups in the learning trials. Subjects in both experimental conditions recalled about the same mean numbers of items. In contrast, subjects in the Control condition had the least recall of correct items. However, this finding was expected since both groups received identical instruction during the learning trials and no strategy instruction was given to the Control condition. The difference of recalling and transferring appropriate memory strategies appeared in the transfer task, after the subjects in the Elaborated Instruction condition received the task-specific information.

Careful analysis of the results provide evidence for the effectiveness of the task-specific information on the transfer of effective memory strategies. Overall, the transfer of the appropriate memory strategies occurred mainly in the EI condition and not much so in the SI condition (as shown in Table 3). This result is in accord with O'Sullivan and Pressley's (1984) findings. According to these researchers, the more information subjects received about the memory strategies, the more likely they will transfer the information to the new situation. Similarly, results in the present study indicate that the task-specific information did provide a
guiding function for subjects' ability to transfer effective memory strategies to new materials on their own.

It is interesting to point out that grade 5 subjects in the Control condition appeared to learn as effectively as the EI subjects for the WL in the learning trial. It seemed to the experimenter that these subjects had spontaneously discovered an effective strategy in assisting their learning of the word-list. However, their self-induced strategy had limited effects on the transfer task. This was evident from their poor performance during the transfer test, as shown in Table 2.

It is also interesting to note that only grade 5 subjects in the Control condition were assumed to have spontaneously discovered the effective category-naming strategy for the WL, and this trend was not found in the grade 3 subjects. This developmental trend in strategy use was also noted by other researchers (e.g., Bjorklund & de Marchena, 1984; Moynahan, 1978; Rohwer, 1980; Waters, 1982). It appeared that grade 5 subjects were more aware of the nature of the task than their younger peers.

Responses on the strategy-choice data indicated that majority of subjects in the EI condition were able to transfer the appropriate strategies according to the task
demand. Only about half and less than one-third subjects in the SI and Control conditions, respectively, were able to transfer the strategies appropriately. When justifying their choice of strategies, most subjects in the EI condition were able to articulate their reasons in regard to enhancing their recall when applying the strategies, as shown in Table 4. Most of the subjects in the SI condition who reported to have employed the suitable strategies did not acknowledge the benefits of utilizing the effective strategies. The majority of subjects in that condition could not give any reason why they selected the strategies and some of them reasoned that those were the strategies that the experimenter taught them to use for the learning task.

The data reported here corroborate other research's finding (e.g., Ghatala et al., 1985) that explicit information and the conceptualization of memory strategies are fundamental in order to produce generalization and durable use of the strategies. In other words, subjects not only need to know which strategies to use under appropriate circumstances but also are required to have a clear understanding of why the strategies are appropriate in those situations. In the present study, subjects in the EI condition had that understanding and were able to articulate the reasons readily when asked. On the contrary, those subjects in
the SI condition apply the appropriate strategies but lack the understanding of why they did it. Consequently, long term maintenance of the strategies would not be as apparent as subjects in the EI condition.

The concept of teaching students to analyze task demands before selecting an effective strategy to help one's learning on a task is still rather novel; more research along this area is recommended. However, a few points are noteworthy for future investigation. First, this study employed two types of the most frequently used strategies for elementary students, sentence-generation and category-naming. In order to generalize the findings and conclusions to a broader population, a wide range of tasks, memory strategies, and age groups are recommended for future research.

Secondly, this study mainly focused on short term recall. The effect on long term recall by instructing the subjects to analyze task demands before selecting an appropriate strategy is not clear. Given the rationale of this general principal, one would expect that it will also facilitate long term transfer of effective memory strategies. However, no conclusive statement can be made without further investigation.

In addition, the two tasks employed in the present study seem to involve two presumably different task processes, sentence structure process (PA) and
categorical process (WL). It appears from the findings that grade 5 subjects in the Control condition were able to spontaneously induce an effective strategy for the WL and yet unable to do so for the PA task during the learning trial. It is suggested that perhaps category strategy is congruent with basic cognitive organization and consequently these subjects were able to perform more effectively with tasks that involve the categorical process. However, specific reasons for this unexpected performance cannot be determined at this time. Future investigation of the effects of the two task processes on memory strategies is recommended.

In summary, results in the present study support the hypothesis that memory strategies are not task-general, rather they are task-specific. Moreover, the more task-specific information subjects receive concerning memory strategies, the more likely they will transfer the strategies appropriately to new learning situations. These findings have practical implications for education. In actuality, students are often confronted with more than one task to learn and it would not be feasible to prompt students what to do in every new situation. On the other hand, if students have been taught the general principle of analyzing the task demands and matching the task with a most appropriate strategy, this information enables them to think first and then act accordingly.
Since the principal is not limited to one specific situation, students can therefore spontaneously transfer it to a variety of new learning situations.
REFERENCES


Lodico, M.G., Ghatala, E., Levin, J.R., Pressley, M., &


<table>
<thead>
<tr>
<th>Control (CONT)</th>
<th>Simple Instruction (SI)</th>
<th>Elaborated Instruction (EI)</th>
</tr>
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<tr>
<td>1. PPVT test</td>
<td>1. PPVT test</td>
<td>1. PPVT test</td>
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<td></td>
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<td>2. General instruction (Appendix F)</td>
<td>2. General instruction (Appendix G)</td>
<td>2. General instruction (Appendix G)</td>
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<td></td>
<td>2a. Special instruction with PA &amp; WL (Appendix C &amp; D)</td>
<td>2a. Special instruction with PA &amp; WL (Appendix C &amp; D)</td>
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<tr>
<td></td>
<td>- Making sentences out of PA list (two examples &amp; two practice items)</td>
<td>- Making sentences out of PA list (two examples &amp; two practice items)</td>
</tr>
<tr>
<td></td>
<td>- Naming category names out of WL list (two examples &amp; two practice items)</td>
<td>- Naming category names out of WL list (two examples &amp; two practice items)</td>
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<td>3. PA &amp; WL task (Appendix A &amp; B)</td>
<td>3. PA &amp; WL task (Appendix A &amp; B)</td>
<td>3. PA &amp; WL task (Appendix A &amp; B)</td>
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<td>4. Transfer task (Appendix E)</td>
<td>4. Transfer task (Appendix E)</td>
<td>4. Transfer task (Appendix E)</td>
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<tr>
<td>5. Probing of strategies used (Appendix I)</td>
<td>5. Probing of strategies used (Appendix I)</td>
<td>5. Probing of strategies used (Appendix I)</td>
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Table 2
Mean Number of Paired-Associate and Word-List Items Correctly Recalled at the Learning and Transfer Phases by Three Conditions and Two Grades (N=108)

<table>
<thead>
<tr>
<th>CONDITION</th>
<th>GRADE</th>
<th>LEARNING</th>
<th>TRANSFER</th>
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<tr>
<td></td>
<td></td>
<td>PA^a</td>
<td>WL</td>
</tr>
<tr>
<td>CONTROL</td>
<td>3</td>
<td>4.44</td>
<td>22.50</td>
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<tr>
<td></td>
<td>5</td>
<td>5.61</td>
<td>25.22</td>
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<tr>
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<td>3</td>
<td>8.44</td>
<td>23.00</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>8.83</td>
<td>23.83</td>
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<tr>
<td>ELABORATED INSTRUCTION</td>
<td>3</td>
<td>8.72</td>
<td>24.00</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>9.06</td>
<td>25.11</td>
</tr>
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</table>

^a. Maximum scores for PA and WL at the learning and transfer phases are 10 and 30, and 5 and 15, respectively.

MS_{error}(102)=3.728 and 10.568, respectively, for the PA and WL at the learning phase.

MS_{error}(102)=2.027 and 7.424, respectively, for the PA and WL at the transfer phase.
Table 3

Proportions of Subjects for Four Categories of Strategies Reported as Employed under the Three Conditions (N=108)

<table>
<thead>
<tr>
<th>STRATEGY-CHOICE</th>
<th>SIMPLE INSTRUCTION</th>
<th>ELABORATED INSTRUCTION</th>
</tr>
</thead>
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<tr>
<td></td>
<td>CONTROL</td>
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<td></td>
<td>PA</td>
<td>WL</td>
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<tr>
<td>APPROPRIATE</td>
<td>22.2</td>
<td>27.8</td>
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<td>INAPPROPRIATE</td>
<td>63.9</td>
<td>55.6</td>
</tr>
<tr>
<td>OWN</td>
<td>8.3</td>
<td>5.6</td>
</tr>
<tr>
<td>INAPPROPRIATE + OWN</td>
<td>5.6</td>
<td>11.0</td>
</tr>
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</table>

a. EXAMPLES OF THE FOUR CATEGORIES:

APPROPRIATE: Sentence-Generation strategy for PA Category-Naming strategy for WL.

INAPPROPRIATE: Rehearsal strategy for both PA and WL.

OWN: Remember the first letter of each word for both PA and WL.

INAPPROPRIATE + OWN: Rehearsal and remember the first letter of each word for both PA and WL.
Table 4

Proportion of Subjects Aware of the Benefits in Using Appropriate Strategies for the Transfer Task as Reported Under the Three Conditions (N=108)

<table>
<thead>
<tr>
<th>CONDITIONS</th>
<th>CONTROL</th>
<th>SIMPLE INSTRUCTION</th>
<th>ELABORATED INSTRUCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PA</td>
<td>WL</td>
<td>PA</td>
</tr>
<tr>
<td>AWARE</td>
<td>24.32</td>
<td>27.03</td>
<td>52.94</td>
</tr>
<tr>
<td>NOT AWARE</td>
<td>75.68</td>
<td>72.97</td>
<td>47.06</td>
</tr>
</tbody>
</table>
Figure 1. Mean No. of Items Correctly Recalled of Paired-Associates at the Learning Phase by Three Conditions and Grades (N=108)
Figure 2. Mean No. of Items Correctly Recalled of Word-lists at the Learning Phase by Three Conditions and Grades (N=108)
Figure 3. Mean No of Items Correctly Recalled of Paired-Associates at the Transfer Phase by Three Conditions and Grades (N=108)
Figure 4. Mean No. of Items Correctly Recalled of Word-lists at the Transfer Phase by Three Conditions and Grades (N=108)
APPENDIX A

PAIRED-ASSOCIATE LIST (TASK 1)

String - Box
Spoon - Egg
Dog - Gate
Stick - Rice
Iron - Candy

Clown - Banana
Needle - Balloon
Swing - Bathtub
Doll - Book
Frog - Cage
APPENDIX B

CATEGORICAL WORD-LIST (TASK 2)

Fruits - Apple, Pear, Grape
Animals - Monkey, Elephant, Lion
Furniture - Sofa, Table, Bed
Jobs - Teacher, Lawyer, Doctor
Vegetables - Carrots, Lettuce, Celery
Vehicles - Car, Bus, Truck
Sports - Hockey, Tennis, Baseball
Instruments - Trumpet, Piano, Guitar
Cities - Montreal, Vancouver, Toronto
Colors - Green, Red, Blue
APPENDIX C

PAIRED-ASSOCIATE ILLUSTRATION & PRACTICE LIST

Marble - Thumb
Carrot - Barrel
Towel - Plate
Shovel - Popcorn
CATEGORICAL WORD-LIST ILLUSTRATION & PRACTICE LIST

Flowers - Rose, Tulip, Lily
Clothing - Shirt, Dress, Pants
Body Parts - Arm, Leg, Head
Meat - Pork, Beef, Lamb
APPENDIX E

TRANSFER TASK

Milk, Cheese, Yogurt
Ontario, Alberta, British Columbia
Telephone, Radio, Television
Spoon, Fork, Knife
Hot, Cold, Warm

Cow - Tent
Hair - Pipe
Hand - Hat
Pork - Cake
Celery - Stairs
APPENDIX F

CONTROL CONDITION

You are going to play a memory game. The objective of this game is to remember and recall as many words as you can.

For the first task, the words are paired together and you should remember them as pairs. At the end of the list, you will be given the first word of the pair and you have to recall the second word. For example, here are two pairs:

    Tractor - Mask
    Rope - Eye

I want you to learn them (subjects are given 15 seconds to learn each pair). Now, if I give you this word, Tractor - (Rope - ), what was the other word of the pair?

Let's try another two pairs. I want you to do the same thing as you did before.

    Marble - Thumb
    Carrot - Barrel

For the second task, you should remember the words on the card as a group. At the end of the task, you will be given the category name, and you tell me what are the words on the category. For example, here are two lists of words:

    Flowers - Rose, Tulip, Lily
    Clothing - Shirt, Dress, Pants

If I give you the category name Flowers (Clothing), what are the words in the category?

Now, here are two more lists of words for you to practice, I want you to do the same thing as you did before.

    Body Parts - Arm, Leg, Head
    Meat - Pork, Beef, Lamb
APPENDIX G

SIMPLE INSTRUCTION CONDITION

You are going to play a memory game. The objective of this game is to remember and recall as many words as you can.

For the first task, the words are paired together and you should remember them as pairs. At the end of the list, you will be given the first word on the pair and you tell me what is the second word of the pair.

One "trick" you can use to help you remember which two words go together is to make a sentence to connect the words. For example, here are two pairs:

Tractor - Mask
Rope - Eye

The sentences I will make for these pairs are:

The TRACTOR ran over the MASK.
The ROPE moved over the EYE.

When you are given the first word on the pair, Tractor (Rope), you recall the sentence and the sentence helps you to remember the second word on the pair.

Now, here are two more pairs of words for you to practice. I want you to use the same "trick" I just taught you and use it to help you to learn these words.

Marble - Thumb
Carrot - Barrel

For the second task, you should remember the words on the card as a group. At the end of the task, you will be given the category name, and you tell me what are the words on that category. One "trick" you can use to help you remember the words on the card is to connect the category name with the words on the card. For example, here are two lists of words:

Flowers - Rose, Tulip, Lily
Clothing - Shirt, Dress, Pants
What you can do is to say these words to yourself: "Here are three kinds of Flowers - Rose, Tulip, Lily; here are three types of Clothing - Shirt, Dress, Pants". When you are given the category name Flowers (Clothing), it gives you a clue of the words that belong to the category.

Now, here are two more lists of words for you to practice, I want you to use the same "trick" that I just taught you and use it to help you to learn the words.

Body Parts - Arm, Leg, Head
Meat - Pork, Beef, Lamb
APPENDIX H

ELABORATED INSTRUCTION CONDITION

Not all memory "tricks" are helpful for the same task. Some "tricks" are better or more helpful for one type of task than is the other. Therefore, when you are given a task to learn, you should first look at what the task is and then select the "trick" that would help you the most.

For example, the sentence "trick" works well when you have to remember two words that are paired together, like these pairs:

Hammer - Bell  The HAMMER hit the BELL.
Arm - Bread    The ARM picked up the BREAD.

On the other hand, when you are given a task to learn that involves with a long list of words such as this:

Rock, Bottle, Wheel, Fish
then the sentence "trick" would not be of a help to you because it is very difficult to connect so many words into a sentence.

For the category-naming "trick", it works well only when the words all have one thing in common, that is, they fall under the same category such as this list:

Appliances - Toaster, Refrigerator, Dishwasher, Oven

However, the category-naming "trick" is not useful when the words are not connected with one another like this list:

Vocabularies - Prevent, Brave, Join, Hazardous, Contagious
Since this task requires you to define these vocabularies, give a category name to these words would not be able to help you to define the meaning of these words.

Therefore, when you are given a task to learn, examine the task first, determine which "trick" would be most suitable for that specific task and then use that "trick" to help you for better recall.
APPENDIX I

QUESTIONNAIRE ON STRATEGY USED DURING TRANSFER TASK

1. What strategy(ies) did you used for the transfer task?

2. Why did you select this/these strategy(ies) to help you?

3. How did the strategy(ies) help you to learn the words?

4. Please give an example of the strategy(ies) you used.