DOCUMENT RESUME

ED 261 790 PS 015 346

AUTHOR	Wang, Alvin Y.; Richarde, R. Stephen
TITLE	Generalized Metacognitive Training in Children.
PUB DATE	Mar 85
NOTE	12p.; Paper presented at the Annual Meeting of the Eastern Psychological Association (Boston, MA, March 21-24, 1985).
PUB TYPE	Reports - Research/Technical (143) -- Speeches/Conference Papers (150)
EDRS PRICE	MF01/PC01 Plus Postage.
DESCRIPTORS	Cognitive Processes; *Elementary School Students; *Learning Processes; *Learning Strategies; *Metacognition; Primary Education; *Training; *Transfer of Training
IDENTIFIERS	Cognitive Research

ABSTRACT

Aiming to show that improved learning can take place when children use self-monitoring and evaluation skills, this study represents a relatively new approach toward helping children "learn to learn." Among 60 second grade students, two questions were explored: (1) Is it possible that with proper training young children who ordinarily do not monitor their cognitive activities can be encouraged to do so? and (2) If metacognitive training is feasible, will these newly acquired self-observing skills enable children to select an effective learning strategy when faced with different learning tasks? Training consisted of "playing games" in several ways, one of which was clearly superior to the others. Throughout the course of game playing, experimental subjects were prompted to monitor their performance and evaluate the effect different ways of playing had on the outcome of the game. Findings indicated that: metacognitive training is a feasible and productive technique for improving learning performance in young children; second graders can readily generalize newly acquired metacognitive skills from a game such as circle drawing to another involving paired associates learning; and second graders may not be able to maintain their newly acquired memory-monitoring abilities for a period of 2 weeks. (Author/RH)

ED261790

GENERALIZED METACOGNITIVE TRAINING IN CHILDREN. ALVIN Y. WANG and R. STEPHEN RICHARDE, Virginia Military Institute.
SPONSOR: XENIA COULTER

The hypothesis that heightened levels of metacognitive awareness would improve learning was tested using sixty second-graders. Subjects encouraged to monitor different ways to play games with task-independent prompts were more likely to choose an effective paired-associate learning strategy compared to a control group. The potential success of metacognitive training as a means for promoting "learning to learn" was discussed in relation to strategy-specific instruction.

PS 015346

Generalized Metacognitive Training in Children

This study represents a relatively new approach towards helping children "learn to learn." Our aim was to show that learning improvement can take place when children are encouraged to employ self-monitoring and evaluation skills as they are learning new material. What sets this approach apart from other learning improvement techniques is the focus upon the ability to monitor one's cognitive performance; a generalizable skill that can be readily transferred from one acquisition task to another. Until now, developmental studies on learning improvement were primarily concerned with teaching young learners effective strategies for acquiring new material. The literature amply reflects the benefit such task-specific strategy instruction can have on learning performance. For instance, instructions to rehearse, use interactive imagery, semantic clustering and other mnemonic aids such as the keyword system all serve to enhance children's ability to learn (Pressley, 1982). However, while knowledge of task-specific strategies may be satisfactory for the conditions of original learning, the ability of young children or disadvantaged learners to apply this knowledge across different situations is questionable. Indeed, it has been pointed out that one should not expect specific strategy instruction to lead to long-term maintenance or generalization across tasks unless it is also accompanied by some insight on the part of the learner concerning cognitive means and ends (Brown, 1975; Butterfield, Wambold & Belmont, 1973; Pressley, Borkowski & O'Sullivan, 1984).

Insert Slide 1 here.

We have taken the view that all successful learning and learning instruction requires an effective and functional level of metacognitive knowledge. Our working model of metacognition and it's relationship to the acquisition process is diagrammed in the first slide. Flavell's review article (1979) presents an explicit description of the components underlying the development of metacognitive knowledge and forms the basis for this flowchart. Metacognitive knowledge, as Flavell defines it, refers to a learner's self-awareness as to what can or cannot be done cognitively. Notice that strategic learning requires an effective level of metacognitive knowledge which itself hinges upon the ability to utilize performance feedback.

The knowledge one possesses concerning his/her own cognitive strengths and weaknesses comes about largely after the development of memory-monitoring. This process of self-initiated monitoring is responsible for the "feeling of knowing" phenomenon which William James (1890) eloquently described as the "tingling and trembling of unrecovered associates which is the penumbra of recognition that may surround any experience..."(p. 441). In a similar vein, Piaget (1976) discussed the concept of "metareflexion" as thinking about thinking or reflections upon reflections. Extensive research by Flavell and his colleagues indicates that young children do not spontaneously monitor their cognitive activities and it is not until the end of the elementary school years that memory-monitoring reaches adult levels. Apparently, children first rely upon adults to provide performance feedback and it is only later that they develop the ability to generate their own performance cues. At this point, children can engage in their own "means-end" analysis of learning (Paris, 1978). Therefore, by monitoring their own memory performance they are no longer dependent upon others to provide external cues regarding learning outcomes.

We considered two questions when studying the developmental relationship between metacognition and the acquisition process. First, is it possible that with proper training young children who ordinarily do not monitor their cognitive activities can be encouraged to do so? Second, if metacognitive training is feasible will these newly acquired self-observing skills enable children to select an effective learning strategy when faced with different learning tasks? We tested these hypotheses using a modified version of the generalized metacognitive training program devised by Lodico and her colleagues (Lodico, Ghatala, Levin, Pressley & Bell, 1983).

Sixty 2nd graders participated as subjects in our study. They were randomly assigned to one of two conditions: either the experimental (memory-monitoring training) or the control group. Children were tested individually and were treated identically except that experimental subjects received the benefit of generalized metacognitive instruction whereas control subjects did not. Essentially, this training consisted of "playing games" differently in which one way of playing the game was clearly superior to the others. Throughout the course of game playing experimental subjects were prompted to monitor their performance and evaluate the effect different ways of playing had on the outcome of the game. For example, children were asked to draw a circle both freehand and by tracing a circular cookie-cutter. Afterwards they were asked to compare their drawings and choose the better way of playing the game. Metacognitive awareness was further encouraged by asking additional questions such as "if you had to play this game in the future, which way would you choose?" Invariably, children selected the cookie-cutter strategy as the preferable method. Other games were also played. Along with a set of metacognitive questions posed after each game, we hoped to elicit self-monitoring skills in each of the experimental subjects. In contrast, children in the control condition played the same games but were not asked any questions concerning their performance or different ways of playing the games. This game playing constituted the first phase of our study with each child.

After the game playing sessions took place all children were presented with two separate lists of paired associates. Each list consisted of eight concrete noun pairs and was presented using a single study-test trial. Children in both the experimental and control conditions were told that this new game involved remembering which word in a pair went with the other. They were also told that they would learn two ways of playing this new game. Therefore, one paired associate list was learned using an effective strategy, whereas the second list was learned via an ineffective strategy. The effective strategy required that children form their own sentence using both words in a pair. For example, when presented with the paired associate DINOSAUR-MIRROR, many children readily formed the sentence "the dinosaur saw himself in the mirror." The ineffective strategy involved having children remember which word went with the other by saying each pair over and over for a total of five repetitions. These two learning strategies were employed since previous researchers have documented the clear superiority of sentence elaboration over rote repetition for children in this age group (Moynahan, 1978). Our rationale was that since these strategies produce remarkably different learning outcomes we would increase the liklihood that second graders would distinguish between them using their newly acquired self-observing skills. None of the children received any external cues regarding their paired associate learning performance so the ability to discriminate between these two strategies required that children use their own metacognitive skills.

Strategy order was counterbalanced across all subjects. Therefore, one-half of the children studied the first paired associate list using repetition and the second list using sentence elaboration. This sequence was reversed for the remaining subjects.

In the next, critical phase of our study each child was given a third list of paired associates via the study-test method. We called this the "choice" learning task since children were now given the opportunity to acquire the eight new noun pairs using a strategy of their own selection. Rather than providing instructions on how to play the game as in the previous two learning trials, children were now told to play the game the "best way you know how." No prompts or feedback were provided during the course of the choice learning trial.

Finally, in order to determine whether newly acquired metacognitive skills were maintained over a relatively long period of time a delayed-choice paired associate task was given two weeks later. A new list of eight noun pairs was presented for a single study-test trial, and once again children were instructed to play this game the "best way you know how." Only experimental and control subjects who freely chose sentence elaboration on the first choice trial participated in the delayed test.

Insert Slide 2 here.

The mean number of paired associates correctly learned on the first two trials is presented in the second slide. As expected, no differences emerged between experimental and control subjects at this point. An ANOVA comparing the scores obtained for the first and second paired associate tasks also indicated the lack of any significant sequence or item effects. Notice, however, the large increase in learning scores when children used the strategy of sentence elaboration compared to rote repetition. This is in agreement with previous developmental studies comparing the effectiveness of these two study methods. When our subjects were instructed to use the more effective strategy they learned almost seven items, whereas less than two items, on the average, were acquired using the ineffective strategy of repetition.

Insert Slide 3 here.

Of greater interest are the data obtained from the choice paired associate trial. The third slide depicts the number of experimental and control subjects choosing either sentence elaboration or repetition for the choice learning task. A Chi-square indicated that significantly more children in the experimental condition were likely to select the effective strategy compared to control subjects, _ (1) =

BEST COPY AVAILABLE

.06, $p < .01$. This indicates that children receiving generalized metacognitive training develop an enhanced awareness regarding strategies and their effect upon learning outcomes.

Insert Slide 4 here.

The next slide (see Slide 4) shows the mean number of noun pairs learned as a function of condition and strategy on the choice learning trial. Notice again that sentence elaboration was clearly superior to rote repetition. Keep in mind that the means depicted here are derived from the different numbers of subjects that we discussed in the previous slide. It therefore seems that while control subjects were not likely to select the effective learning strategy, control subjects that did had very high performance levels.

Insert Slide 5 here.

The next slide (see Slide 5) represents the data obtained from the delayed-choice task given two weeks later. Remember that unequal numbers of subjects from the experimental and control groups participated here depending on whether they elaborated with sentences on the earlier choice task. Whereas all of these children used the effective strategy on the earlier choice-task, many reverted back to the ineffective strategy of rote repeition after two weeks, $\chi^2(1) = 2.40$, $p \sim .20$. This suggests that 2nd graders are still too young to maintain newly acquired metacognitive skills over relatively long periods of time.

What conclusions and remarks can be made when considering our findings in their entirety? First, we may conclude that metacognitive training is a feasible and productive technique for improving learning performance in young children. Since our study was, in part, a replication of an earlier report by Lodico et al. (1983) we also know that this technique is a reliable one. Moreover, it becomes increasingly clear that these findings, considered within the context of existing literature on memory development provide support for Flavell's (1979) model of metacognition and it's relationship to the acquisition process. We therefore accept the notion that memory development is the development of metacognition. To use an analogy proposed by

Ann Brown (1978); just as fever is the symptom or epiphenomenon of an underlying disease, so are elaborative strategies and learning performance the outward manifestations of underlying metacognitions.

Our evidence also suggests that 2nd graders can readily generalize newly acquired metacognitive skills from a game such as circle drawing to another involving paired associate learning. This is a significant departure from earlier work which emphasized the development of strategy specific training since memory monitoring appears to be a skill which can be generalized across different types of tasks. In contrast, knowledge pertaining to particular strategies may only be suitable to a much more limited range of learning conditions. We expect future researchers will more fully explore the extent to which generalization of metacognitive skills can take place when children of different ages are tested using a wide variety of acquisition tasks.

Finally, we obtained some indication that 2nd graders may not be able to maintain their newly acquired memory-monitoring abilities for a period of two weeks. In retrospect, the liklihood of finding long-term retention might have been greater had we spent a longer period of time developing memory-monitoring behaviors. More games or a more comprehensive set of training instructions may be required. On the other hand, perhaps all that was needed was a memory-monitoring prompt during the delayed-choice task. Since no prompts or cues were provided after the two week retention period, we looked for metacognitive generalization using a very stringent test. Additional research is needed to determine the extent to which children in the 2nd grade and younger require cues to engage in memory-monitoring. It may well turn out that whereas young children do relatively poorly on delayed and uncued tests of transfer, older children can readily generalize their newfound metacognitive skills without any prompting to do so.

References

Brown, A. L. Knowing when, where, and how to remember: A problem for metacognition. In R. Glaser (Ed.), Advances in instructional psychology. New Jersey: Lawrence Erlbaum Associates, 1978.

Butterfield, E. C., Wambold, C. & Belmont, J. M. On the theory and practice of improving short-term memory. American Journal of Mental Deficiency. 1973, 77, 654-669.

Flavell, J. H. Metacognition and cognitive monitoring: A new area of cognitive-developmental inquiry. American Psychologist, 1979, 34, 906-911.

Lodico, M. G., Ghatala, E. S., Levin, J. R., Pressley, M. Bell, J. A. The effects of strategy-monitoring training on children's selection of effective memory strategies. Journal of Experimental Child Psychology, 1983, 35, 263-277.

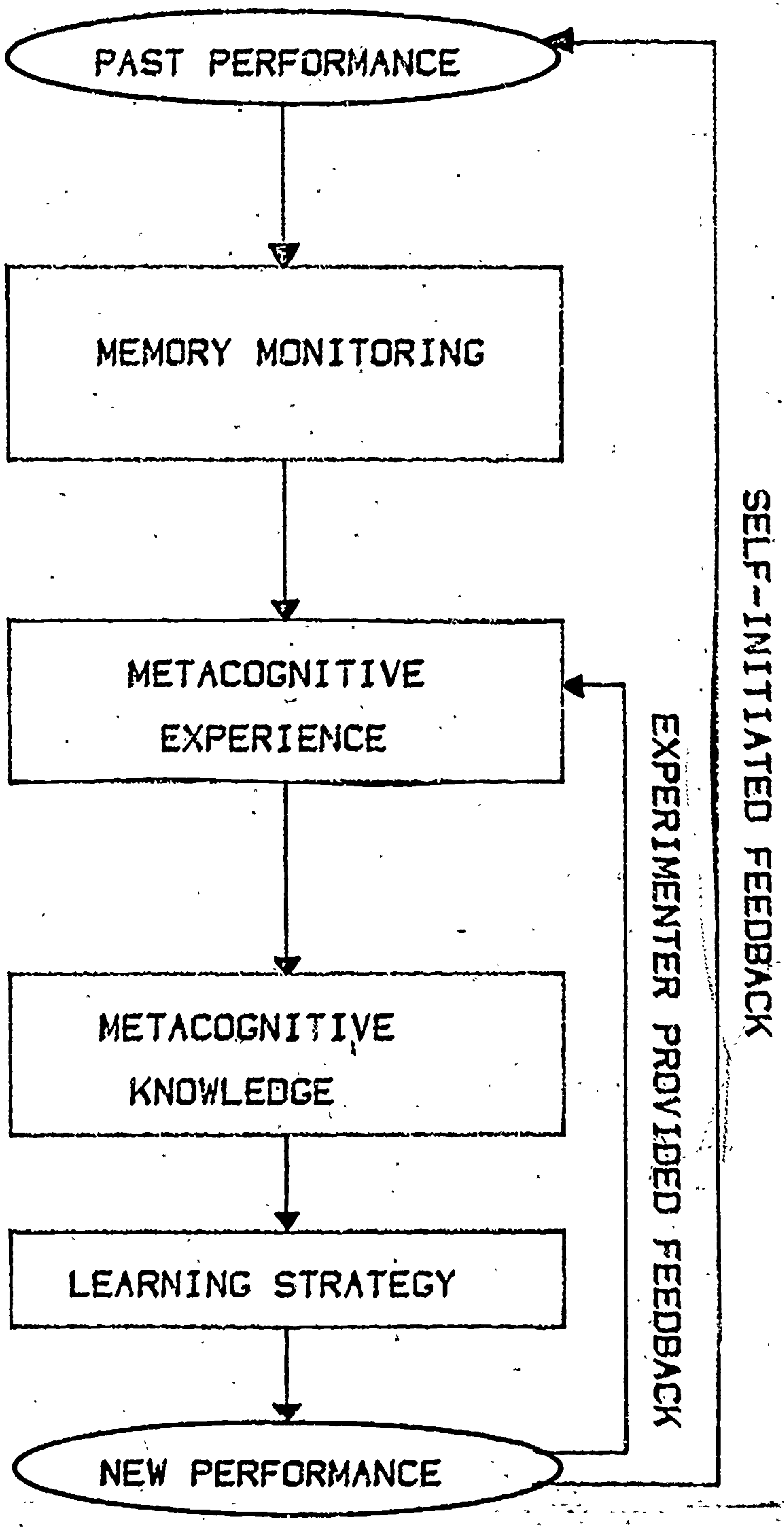
Moynahan, E. D. Assessment and selection of paired associate strategies: A developmental study. Journal of Experimental Child Psychology, 1978, 26, 257-266.

Paris, S. G. Coordination of means and goals in the development of mnemonic skills. In P.A. Ornstein (Ed.), Memory development in children. Hillsdale, New Jersey: Erlbaum, 1978.

Piaget, J. The grasp of consciousness: Action and concept in the young child. Cambridge: Harvard University Press, 1976.

Pressley, M. Elaboration and memory development. Child Development, 1982, 53, 296-309.

Pressley, M., Borkowski, J. R. & O'Sullivan, J. T. Memory strategy instruction is made of this: Metamemory and durable strategy use. Educational Psychologist, 1984, In Press.


PAST PERFORMANCE
MEMORY MONITORING
METACOGNITIVE EXPERIENCE
METACOGNITIVE KNOWLEDGE
LEARNING STRATEGY
NEW PERFORMANCE
EXPERIMENTER PROVIDED FEEDBACK
SELF-INITIATED FEEDBACK

Slide 2

Mean Numbers of Correct Paired Associates Recalled With Rote Repetition and Elaboration Instructions

Trial	Group Exp.	Group Control
PAL 1		
Rote	1.9	2.1
Elab.	6.9	6.7
PAL 2		
Rote	1.7	1.3
Elab.	6.9	6.9

Slide 3

Number of Experimental and Control Children Selecting Elaboration or Repetition Strategy on Choice PAL Trial

Strategy	Group Exp.	Group Control
Rote	8	13
Elab.	22	17

Slide 4

Mean number of correct paired-associates recalled on Choice-PAL trial.

Strategy	Group Exp.	Group Control
Rote	1.5	1.8
Elab.	7.0	6.9

Slide 5

Number of Exp. and Control children selecting rote repetition and elaboration on Delayed-Choice trial.

Strategy	Group Exp.	Group Control
Rote	13	9
Elab.	9	8