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ABSTRACT

Second- and fifth-grade students were videotaped as they carried out two different free recall tasks that were designed so that several strategies could be used in coordination to produce optimal performance. In an interview immediately following recall performance, each child was asked to describe his or her study activities. The interview included metamemory questions and a "stimulated recall" procedure in which each child watched a videotape of his or her study behavior. As in previous research, children in the younger group showed limited use of organization and self-testing, the most helpful strategies. Older children not only employed those strategies, but also reported appropriate sequencing and relatively complex coordinations of these and other study activities. Among the older children only, organization of items into groups was supplemented by organization or study of items within groups in a task in which items could be grouped conceptually. In recall of relatively unrelated words, older children were more likely than younger to coordinate several organizational cues. In response to feedback gained through self-testing, older children reported changes or elaborations of study, as well as continuation of previously used study activities. It is expected that this description of spontaneously developed study activities will be useful for future educational interventions. (Author/RH)

THE DEVELOPMENT OF COORDINATED AND SEQUENCED STUDY ACTIVITIES

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Abstract

CHILDREN OF TWO GRADE LEVELS (8 SECOND GRADERS AND 10 FIFTH GRADERS) WERE VIDEOTAPED AS THEY CARRIED OUT TWO DIFFERENT FREE RECALL TASKS, DESIGNED SO THAT SEVERAL STRATEGIES COULD BE USED IN COORDINATION TO PRODUCE OPTIMAL PERFORMANCE. IN AN INTERVIEW IMMEDIATELY FOLLOWING RECALL, EACH CHILD WAS ASKED TO DESCRIBE STUDY ACTIVITIES. THE INTERVIEW INCLUDED BOTH GENERAL METAMEMORY QUESTIONS AND A "STIMULATED RECALL" PROCEDURE IN WHICH A VIDEOTAPE OF THE CHILD'S STUDY BEHAVIOR WAS SHOWN WHILE THE CHILD WAS QUERIED ABOUT STUDY. AS IN PREVIOUS RESEARCH, CHILDREN IN THE YOUNGER GROUP SHOWED LIMITED USE OF THE MOST HELPFUL STRATEGIES FOR THESE TASKS, ORGANIZATION AND SELF-TESTING. OLDER CHILDREN NOT ONLY EMPLOYED EACH OF THESE STRATEGIES, BUT ALSO REPORTED APPROPRIATE SEQUENCING AND RELATIVELY COMPLEX COORDINATIONS OF THESE AND OTHER STUDY ACTIVITIES. AMONG THE OLDER CHILDREN ONLY, ORGANIZATION OF ITEMS INTO GROUPS WAS SUPPLEMENTED BY ORGANIZATION OR STUDY OF ITEMS WITHIN GROUPS IN A TASK IN WHICH ITEMS COULD BE GROUPED CONCEPTUALLY. IN RECALL OF RELATIVELY UNRELATED WORDS, OLDER CHILDREN WERE MORE LIKELY THAN YOUNGER TO COORDINATE SEVERAL ORGANIZATIONAL CUES (ALPHABETICAL ORDER, WORD MEANING, RHYMING). IN RESPONSE TO FEEDBACK GAINED THROUGH SELF-TESTING, OLDER CHILDREN REPORTED CHANGES OR ELABORATIONS OF STUDY, AS WELL AS CONTINUATION OF PREVIOUSLY-USED STUDY ACTIVITIES. WE EXPECT THAT THIS DETAILED PICTURE OF SPONTANEOUSLY DEVELOPED STUDY ACTIVITIES WILL BE USEFUL FOR FUTURE EDUCATIONAL INTERVENTIONS.

Purpose and Method

Research on children's strategic performance in memory tasks has generally been concerned with describing or manipulating the use of some single strategy that will facilitate performance in a particular task. Little work has been concerned with children's acquisition of the ability to sequence and coordinate the use of several different strategies over the course of study in preparation for recall. Such activity should be related to developmentally mature metacognitive activities, including both appropriate verbalization of memory concepts and employment of various self-regulatory activities.

In order to investigate developmental changes in these relatively complex learning activities, we observed, videotaped, and interviewed children of two age levels as they carried out two different memory tasks. In these tasks, several strategies could contribute to optimal performance: On each task, children's recall would likely be facilitated if some organization of stimulus items was made, and on each task, children's use of a self-testing strategy would help them determine whether or not they were ready to attempt recall. Other strategies such as looking at or verbalizing stimulus items, anticipating or rehearsing items individually or in groups, etc. could also be employed. One of the tasks involved free recall of items that could be grouped by category; the other task involved free recall of high-frequency words that could be grouped in various ways (alphabetically, in brief semantically meaningful phrases, by initial or final letter sounds, etc.). In order to equate task difficulty, younger children were given less items to learn on each task than older children received (9 vs. 12 items on word task; 15 vs. 20 items on picture task).

WE RELIED UPON CHILDREN'S VERBALIZATIONS ABOUT THEIR OWN TASK PERFORMANCE AS A BASIS FOR INFERENCES ABOUT STRATEGY COORDINATION AND SEQUENCING. THOSE DATA WERE CORROBORATED AS MUCH AS POSSIBLE BY MORE TRADITIONAL MEASURES DERIVED FROM OBSERVATIONS OF STUDY BEHAVIORS OR INDICES OF RECALL PERFORMANCE. FOLLOWING SEVERAL QUESTIONS SIMILAR TO THOSE USED IN PAST RESEARCH TO ASSESS METAMEMORY (PARIS, NEWMAN, & MCVEY, 1984), A "STIMULATED RECALL" TECHNIQUE (MEICHENBAUM & BUTLER, 1980) WAS USED TO FACILITATE CHILDREN'S DESCRIPTIONS OF THEIR STRATEGY USE, METAMEMORY, AND SELF-REGULATORY BEHAVIORS DURING STUDY. THE PROCEDURE INVOLVED PLAYING A VIDEOTAPE RECORD OF THE CHILD'S STUDY AND RECALL, STOPPING IT REPEATEDLY TO QUESTION THE CHILD ABOUT BEHAVIORS AND COGNITIONS DURING TASK PERFORMANCE. THE QUESTIONS USED DURING THESE INTERVIEWS WERE NON-DIRECTIVE AND NON-EVALUATIVE, AND WERE DESIGNED TO OBTAIN A DESCRIPTION OF EACH STUDY ACTIVITY, A RATIONALE FROM THE CHILD FOR THE USE OF THAT STRATEGY, AND A DESCRIPTION OF HOW THE STRATEGY SHOULD AID LEARNING/RECALL. TWO PRELIMINARY TASKS WERE USED TO INTRODUCE CHILDREN TO THE VIDEOTAPING AND INTERVIEW PROCEDURES.

EIGHTEEN CHILDREN, EIGHT AT APPROXIMATELY THE SECOND-GRADE LEVEL (MEAN AGE = 92 MONTHS) AND TEN AT APPROXIMATELY FIFTH-GRADE LEVEL (MEAN AGE = 125 MONTHS) WERE TESTED IN INDIVIDUAL SESSIONS. ALL CHILDREN WERE DESCRIBED BY THEIR PARENTS AS ABOVE-AVERAGE IN SCHOOL ACHIEVEMENT; MOST WERE ATTENDING SCHOOLS WITH SELECTIVE ADMISSIONS PROCEDURES. AGE GROUPS DID NOT DIFFER IN PARENT EDUCATION OR SES LEVEL, PARENTS' RATINGS OF SCHOOL ACHIEVEMENT, OR KIND OF SCHOOL ATTENDED.

RESULTS

MEMORY PERFORMANCE ON THE TWO TASKS REFLECTED THE USUAL DEVELOPMENTAL DIFFERENCES IN ORGANIZATION OF STIMULUS ITEMS FOR RECALL AND IN THE FREQUENCY WITH WHICH SELF-TESTING WAS SEEN, AS INDICATED IN TABLE 1. ALTHOUGH YOUNGER CHILDREN DID NOT STUDY AS LONG AS OLDER CHILDREN, THEY DID ATTEMPT TO APPLY SOME SIMPLE STRATEGIES IN THE TASKS AND WERE ABLE TO RECALL A SUBSTANTIAL PROPORTION OF THE ITEMS PRESENTED IN EACH TASK. OF GREATER INTEREST IS THE NATURE OF STUDY ACTIVITY DESCRIBED BY THE OLDER CHILDREN. (SEE TABLE 2). ALL TEN OF THE OLDER CHILDREN REPORTED USE OF AN ORGANIZATIONAL SCHEME ON ONE OR BOTH OF THE TASKS, BUT, IN ADDITION TO PRODUCING GROUPS, THESE CHILDREN FOUND METHODS BY WHICH TO ORGANIZE OR RELATE ITEMS WITHIN GROUPS. FOR EXAMPLE, SEVERAL CHILDREN ARRANGED THE WORDS INTO ALPHABETICAL ORDER, AND THEN PRODUCED MORE OR LESS MEANINGFUL SENTENCES TO RELATE ALL OF THE ITEMS THAT BEGAN WITH THE SAME LETTER. ALTERNATIVELY, CHILDREN USED STUDY BEHAVIORS TO PRODUCE INTEGRATED GROUPS: SAYING THE ITEMS REPEATEDLY IN A FIXED ORDER UNTIL THEY WERE LEARNED, USING AN ANTICIPATION STRATEGY WITHIN A CATEGORY GROUP TO LEARN THE ITEMS IN ORDER, OR STUDYING THE ITEMS IN A GROUP UNTIL THEY COULD BE SAID FROM MEMORY IN SEVERAL DIFFERENT ORDERS. NONE OF THE YOUNGER CHILDREN REPORTED ACTIVITIES FOR LEARNING OF ITEMS WITHIN CATEGORIES.

ALL OF THE OLDER CHILDREN ALSO REPORTED THE USE OF SELF-TESTING TO DETERMINE RECALL READINESS ON AT LEAST ONE OF THE TASKS. THEY ALSO REPORTED USING THE FEEDBACK FROM SELF-TESTING EFFORTS TO REDIRECT OR ELABORATE THEIR STUDY ACTIVITIES IN VARIOUS WAYS: AFTER GAINING INFORMATION ABOUT MEMORY, SOME CHILDREN CONTINUED TO STUDY IN THE SAME MANNER AS THEY HAD INITIALLY. ESPECIALLY ON THE PICTURE TASK, SOME OF

THE OLDER CHILDREN, AFTER SELF-TESTING, ATTEMPTED TO REORGANIZE THE STIMULUS ITEMS OR REDIRECT THEIR STUDY EFFORTS IN SOME WAY. SOME CHILDREN, FOR INSTANCE, REPORTED THAT THEY DECIDED TO ORGANIZE ITEMS OR TO CHANGE THE BASIS OF ORGANIZATION AFTER FINDING OUT THROUGH SELF-TESTING THAT RECALL WAS DIFFICULT. THERE WERE ALSO INSTANCES IN WHICH CHILDREN REPORTED COMPLEX COORDINATIONS BETWEEN ORGANIZATION, SPECIFIC STUDY ACTIVITIES, AND SELF-TESTING. FOR EXAMPLE, A CHILD GROUPED ITEMS BY CATEGORY, STUDIED THE FIRST GROUP AND SELF-TESTED TO DETERMINE MEMORY FOR THAT GROUP. WHEN THAT GROUP WAS MASTERED, THE CHILD PROCEEDED TO THE SECOND CATEGORY GROUP AND DID THE SAME. THEN, THE CHILD COMBINED THE TWO CATEGORY SETS, STUDIED AND SELF-TESTED UNTIL THIS LARGER SET WAS MASTERED, AND PROCEEDED IN THIS MANNER UNTIL THE ENTIRE LIST WAS WELL LEARNED. EXAMPLES OF SEVERAL REPORTS BY OLDER CHILDREN OF STUDY ACTIVITIES ARE SHOWN IN TABLE 3.

CONCLUSIONS

1. CHILDREN AGES 10 TO 11 YEARS OF AGE DEAL WITH MEMORY TASKS BY COORDINATING STUDY ACTIVITIES INVOLVING ORGANIZATION OF ITEMS, SPECIFIC STRATEGIES (NAMING, LOOKING), AND SELF-MONITORING ACTIVITIES. IN ADDITION TO FORMING AN OVERALL ORGANIZATIONAL STRUCTURE, THESE CHILDREN ENGAGE IN STUDY ACTIVITIES OR DEVISE MEANS OF WITHIN-GROUP ORGANIZATION IN ORDER TO ASSURE RECALL OF ITEMS WITHIN LARGER GROUPS.

2. CHILDREN AGES 7 TO 8 YEARS RARELY SHOW STRATEGIES OF ORGANIZING OR SELF-TESTING, AND THEY RARELY REPORT SUCH STRATEGIES, OR THE COORDINATION OF STRATEGIES, IN RESPONSE TO QUESTIONS ABOUT THEIR PERFORMANCE.

3. USE OF AN INTERVIEW PROCEDURE IN WHICH CHILDREN TALK ABOUT THEIR STUDY WHILE VIEWING A VIDEOTAPE OF THEIR STUDY ACTIVITIES HAS PROVEN USEFUL IN HELPING TO DESCRIBE THE COMPLEXITIES OF THE CHILD'S STUDY.

4. INTERVENTIONS IN THE LABORATORY OR IN EDUCATIONAL SETTINGS THAT ARE INTENDED TO IMPROVE CHILDREN'S MEMORY TASK PERFORMANCE SHOULD BE GEARED TO INCLUDE THE COORDINATION OF STRATEGIES OF VARIOUS LEVELS OF COMPLEXITY. TRADITIONAL TRAINING STUDIES HAVE FOCUSED ON TEACHING A SINGLE STRATEGY, PERHAPS LIMITING THE EFFECTIVENESS OF INTERVENTION. IN LIGHT OF THESE OBSERVATIONS OF CHILDREN'S RECALL, IT IS IMPORTANT TO CONSIDER THE CONTEXT OF STUDY ACTIVITIES WITHIN WHICH A TRAINED STRATEGY MUST BE EMBEDDED IN ORDER TO AFFECT THE CHILD'S ACQUISITION OF INFORMATION.

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TABLE 1

MEAN SCORES FOR SORTING, PROPORTION OF ITEMS, RECALLED, AND RECALL ORGANIZATION INDICES FOR CHILDREN OF TWO AGE LEVELS

VARIABLE	YOUNGER GROUP	OLDER GROUP	P*
PICTURE TASK			
SORTING: CATEGORY	.50	1.00	NS
SORTING: COLOR	.63	.60	NS
TIME SPENT STUDYING	82.5 s	212 s	.044
PROPORTION ITEMS RECALLED	.73	.86	NS
RR CATEGORY	.198	.569	.006
RR COLOR	.318	.127	NS
RR PERCEPTUAL	.350	.311	.029
WORK TASK			
SORTING	.75	2.00	.000
TIME SPENT STUDYING	67.1 s	149.6 s	.009
PROPORTION ITEMS RECALLED	.85	.96	.016
RR PERCEPTUAL	.39	.46	NS

* PROBABILITY LEVELS FOR AGE DIFFERENCE FROM ANALYSES OF VARIANCE FOR EACH MEASURE.

TABLE 2

AGE DIFFERENCES IN DESCRIPTIONS OF
STUDY ACTIVITIES GIVEN IN VIDEOTAPE INTERVIEWS

ACTIVITY REPORTED	YOUNGER GROUP	OLDER GROUP	P*
USE OF A CATEGORIZATION SYSTEM	.75	1.85	.002
PICTURE TASK: WITHIN-CATEGORY ORGANIZATION	00	.60	.082
PICTURE TASK: WITHIN-CATEGORY STUDY ACTIVITY	00	1.20	.007
WORD TASK: COORDINATION OF ORGANIZATIONAL CUES	00	.40	.045
USE OF LOWER-LEVEL STUDY BEHAVIORS	1.88	1.70	NS
USE OF SELF-TESTING DURING STUDY	.38	1.70	.000
COORDINATION OF STUDY ACTIVITIES	.44	1.55	.000

*PROBABILITY LEVELS FOR AGE DIFFERENCE FROM ANALYSES OF VARIANCE FOR EACH MEASURE.

TABLE 3

EXAMPLE 1 (OLDER BOY ON WORD TASK):

(ORGANIZED WORDS ALPHABETICALLY INTO ROWS; MADE NONSENSE SENTENCES OUT OF WORDS WITHIN EACH ROW; REHEARSED ROWS CUMULATIVELY; USED AN ANTICIPATION METHOD TO SELF-TEST.)

"I'M TRYING TO PUT THEM IN ALPHABETICAL ORDER . . . MAYBE I THOUGHT IT'D BE EASIER BECAUSE I WOULD KNOW THAT A'S AND B'S AND C'S AND D'S . . . IF I COULD REMEMBER THEM LIKE THAT, I COULD FIRST THINK IF THERE ARE ANY ONES IN THAT LETTER AND THEN I WOULD KEEP ON THINKING . . . TRYING TO MEMORIZE THEM LIKE IN ONE SENTENCE, LIKE TRY TO MAKE THEM LIKE AWAY, BOY, BALL -- TRY TO MAKE THEM IN SORT OF A NONSENSE SENTENCE . . . A SENTENCE THAT DIDN'T MAKE SENSE BUT JUST REMEMBER IT. [NOW I'M] . . . TRYING TO REMEMBER THE FIRST LINE, THEN I CLOSED MY EYES A COUPLE OF TIMES TO TRY TO REMEMBER IT, SAY IT IN MY HEAD AND THEN I COULD SEE IT OUT THERE AND IF I WAS CORRECT, I REALLY WOULDN'T DO TOO MUCH MORE WORK ON IT AND CONCENTRATE A LITTLE HARDER ON THE SECOND ROW . . . WHEN I WAS A LITTLE SURE . . . THAT I'D MEMORIZED THE FIRST ROW, I WENT ON TO THE SECOND ROW. WHEN I WAS SURE OF . . . BOTH OF THOSE, I'D GO ON TO THE THIRD ROW FROM THERE . . . I WOULD SAY THEM IN MY MIND AND THEN AFTER I SAID IT, I LOOKED AND IF IT SOUNDED LIKE WHAT IT WAS, IT WOULD BE CORRECT . . . -- SIT AND CLOSED MY EYES AND SAW IF WHAT I SAID WAS ALL THOSE WORDS AND THEN I'D GO TO THE THIRD ROW, AND THEN AFTER I WAS SURE OF THE THIRD ROW, I'D GO OVER IT ALL . . . AT THE SAME TIME."

EXAMPLE 2 (OLDER GIRL ON WORD TASK):

(USED FIRST LETTERS OF EACH WORD TO FORM A NEW WORD; THEN TRIED TO FORM WORD PAIRS; THEN RELATED ALL WORDS INTO A LONG SENTENCE/STORY; SELF-TESTED.)

" . . . FIRST I READ THEM ALL OVER--AND I READ THEM IN PAIRS AND I TRIED TO FIND OUT HOW THE PAIRS WERE LIKE EACH OTHER . . . THEN I READ THEM THROUGH A SECOND TIME AND THEN I TRIED TO THINK IN MY HEAD, WHILE I WAS LOOKING AT THEM, WHAT WAS GOING TO COME NEXT -- . . . . I WAS TRYING TO KIND OF MAKE A STORY OUT OF THEM LIKE, 'A BALL WAS FAR AWAY, THE DOG RAN AFTER IT; THE THE BOY WALKED BEHIND IT; AWAY WENT THE CAR AFTER BOTH OF THEM. . . . I WOULD THINK, 'WHAT WENT AWAY? A CAR.' AND THEN AFTER I HAD GOTTEN THE STORY TOGETHER I PICKED OUT THE PAIRS OF WORDS . . . IN THE ORDER THEY WERE LAYING DOWN. . . . I WAS LOOKING AT THE WALL . . . TRYING TO PICTURE THE STORY IN MY HEAD . . . AND I WAS TRYING TO REMEMBER THE WORDS. . . . WHEN I LOOKED AT THE WALL AND I OULD SAY THEM THEN I'D FEEL LIKE I COULD DO IT WITH A COVER OVER THE WORDS."

EXAMPLE 3 (OLDER GIRL ON PICTURE TASK)

(FIRST, TRIED REHEARSAL BY ROWS AND DISMISSED IT AS INEFFECTIVE; THEN TRIED ORGANIZATION BY COLOR, THEN BY OBJECT CATEGORY; COUNTED CATEGORIES AND NUMBER OF OBJECTS IN EACH AND USED THAT TO REMEMBER; SELF-TESTED.)

"FIRST THING I DID WAS THINK ABOUT MEMORIZING IT . . . LIKE ALL THE THINGS IN THE FIRST ROW . . . BUT I COULDN'T REMEMBER THE FIRST ONE. . . . THEN I REMEMBERED . . . THAT I COULD SWITCH THEM AROUND SO I TRIED TO PUT THEM IN GROUPS OR CATEGORIES. . . . FIRST, I STARTED THINKING ABOUT THE COLORS, THEN I STARTED THINKING ABOUT HOW THEY WERE RELATED SO I MOVED THEM . . . SO THERE WERE A DOG, AN ALLIGATOR, A CAT, AND THE BUTTERFLY TOGETHER. SO I REMEMBERED ANIMALS, FRUITS, TRANSPORTATION, PARTS OF YOUR BODY AND CLOTHES. AND I REMEMBERED THERE WERE FOUR IN EACH ONE (CATEGORY). . . . I LOOKED AT THE PICTURES SO OFTEN THAT I THOUGHT I COULD REMEMBER THEM. AFTER I HAD SAID EACH CATEGORY NOT REALLY LOOKING, I THOUGHT THAT IF I LOOKED AT THE WALL AND COULD SAY THE CATEGORIES TOO, THEN I COULD JUST PROBABLY SAY WHAT WAS IN THEM."

EXAMPLE 4 (OLDER BOY, GIVING RATIONALE FOR SELF-TESTING)

(HE LAYED WORDS OUT ROW BY ROW; HE STUDIED EACH ROW BY LOOKING AT IT, THEN COVERING IT UP AND TRYING TO SAY THE WORDS; AFTER DOING THE SECOND ROW, HE TRIED TO DO THE FIRST ONE AGAIN TO SEE IF HE REMEMBERED.)

"WHEN YOU DO IT ROW BY ROW YOU USUALLY FORGET, SO I WENT BACK TO SEE IF I COULD REMEMBER THE FIRST ROW AGAIN. . . . I TRIED TO MEMORIZE SOMETHING ONCE AND KEPT WORKING AND WORKING AND WORKING ON IT. AND LATER, WHEN I THOUGHT OF IT, I COULDN'T DO IT; SO I DECIDED, 'I'M NOT GONNA DO THIS AGAIN!' SO I WENT BACK AND I DID IT, AFTER I'D BEEN THINKING ABOUT SOMETHING ELSE. THE ONLY WAY YOU REALLY KNOW IT IS IF YOU CAN THINK OF IT, EVEN WHEN YOU'VE JUST BEEN THINKING OF SOMETHING ELSE."