The selective displaced rehearsal hypothesis and failure to obtain the generation effect

JOLENA A. SUTHERLAND, DAMON KRUG, and JOHN A. GLOVER
Ball State University, Muncie, Indiana

Following a series of four experiments in which the generation effect was not obtained, a selective displaced rehearsal hypothesis, as described by Slamecka and Katsaiti (1987), was tested. The results of the experiments based on this hypothesis agreed with Slamecka and Katsaiti's predictions; that is, the generation effect appeared only in within-group designs that did not control subjects' displacement of rehearsal.

The *generation effect* refers to the phenomenon that self-generated verbal material is better remembered than material that is merely read (Slamecka & Graf, 1978; Slamecka & Katsaiti, 1987). Since its delineation (Slamecka & Graf, 1978), the generation effect has been observed in subjects' memory for word pairs (Donaldson & Bass, 1980; Jacoby, 1978; Slamecka & Graf, 1978), words from anomalous sentences (Graf, 1980), individual words (Glisky & Rabinowitz, 1985), and meaningful sentences (Graf, 1980; Kane & Anderson, 1978). In addition, the generation effect has been observed in both intentional and incidental encoding situations and in free recall, cued recall, and recognition. Furthermore, over the years at least eight distinct theoretical perspectives have been offered to account for the effect (see Slamecka & Katsaiti, 1987, pp. 605-606).

Reports of the generation effect have been ubiquitous and robust. To our knowledge, however, there had not been an investigation of developmental differences in the generation effect. Consequently, we began preliminary work in this arena. We predicted that developmental differences in the generation effect would exist primarily because some metamemory functions would be required for the act of generation and because clear developmental differences in metamemory functions have been observed. We also were interested in beginning to examine potential instructional implications of the generation effect.

Our general questions led us to begin a small-scale examination of the effect. Because it was unclear to us whether a generation effect could be obtained if subjects could not read, but instead would have to encode words via listening only versus verbally generating aspects of the stimulus material, we chose second graders as subjects for our first experiment. These children could read, but they were considerably younger than subjects normally employed in generation effect research. Furthermore, children of about 7 or 8 years of age possess limited metamemory skills. Consequently, although we expected

to observe the generation effect, we hypothesized that in later contrasts with older subjects, we would observe differences in the strength of the effect. As will be seen below, however, no generation effect was observed across a series of four experiments employing between-groups designs. These results seemed strongly counterintuitive, and led us to begin working with older children. Although the data are not reported here, we also found no generation effect in those experiments.

Finally, Slamecka and Katsaiti's (1987) paper shed theoretical light on our problem. Following their lead, we replicated our first experiments employing within-group designs. Slamecka and Katsaiti avouched that the generation effect occurs because subjects selectively displace their attention from read items to generate items on to-be-learned lists, even when the presentation of list items is carefully controlled. If this hypothesis were correct, the generation effect should appear only in within-group–design experiments, because only such designs provide subjects with the opportunity to bias results by shifting their attention to a subset of the stimulus materials. Furthermore, the generation effect should fail to occur even in within-group designs when selective displaced rehearsal is greatly reduced or eliminated. The second set of experiments reported here focused on Slamecka and Katsaiti's hypothesis concerning within-group designs and the reduction of selectively displaced rehearsal within such designs.

EXPERIMENTS 1-4

Experiment 1 originally was planned as a pilot study, designed to familiarize ourselves with potential problems associated with our very young subjects and nonstandard stimulus materials. Our continued failure to obtain the generation effect led to the four replications.

Method

Subjects and Setting. The subjects were 25 second graders (mean age = 7 years, 5 months) enrolled at a laboratory school. All data were collected in a room adjacent to the children's normal classroom.

Materials. Experiments 1 and 2 employed spelling words drawn from the children's curriculum (10 per list). Experiment 3 used 10 vocabulary

413

words drawn from a unit on weather, and Experiment 4 used 10 basic mathematics facts (e.g., $8+9=17$).

Procedure. In each experiment, the children were randomly assigned to conditions. Children in the read-only conditions were seated at a desk, given the stimulus items, and allowed from 10 sec (Experiment 1) to 20 sec (Experiment 3) to read and study each item. Children in the generate conditions generated a portion of each stimulus from memory (e.g., $7+8=X$) during the study period allocated for each item. In both read-only and generate conditions, free recall tests immediately followed encoding.

Results and Discussion

No significant differences were observed between the conditions in any of the experiments ($t < 1$ for each). Indeed, the means and standard deviations were highly similar in the read-only and generate conditions within each experiment (see Table 1). After four failures to obtain the generation effect, we examined the paradigm with older children and also failed to obtain the effect. Finally, we stopped our work to look for methodological and logical errors in our approach. Slamecka and Katsaiti's (1987) paper provided an answer. They, too, were unable to obtain the generation effect in between-groups designs. From their perspective, this was because the generation effect is an artifact of within-group designs that do not control for selectively displaced attention. To test their explanation, we decided to perform an additional series of experiments.

EXPERIMENTS 5-7

Method

The purpose of Experiments 5-7 simply was to determine whether the generation effect would appear in within-group experiments with the materials, method, and age-level subjects used in Experiments 1-4. Experiments 5-7 were highly similar to Experiments 1-4 except that two different groups of second-grade children (mean ages = 7 years, 8 months and 7 years, 6 months) participated. In addition, within-group designs were employed with 20 spelling words in Experiments 5 and 6, and 20 mathematics facts in Experiment 7. The order of read-only items and generate items on the lists used in each experiment was randomized.

Results and Discussion

The results are presented in Table 1. Analyses of the data from Experiment 5 [$t(25) = 7.57, p < .01$], Experiment 6 [$t(25) = 8.77, p < .01$], and Experiment 7 [$t(27) = 7.15, p < .01$] indicated that significantly more generate items were recalled than read-only items. These results agree with the position taken by Slamecka and Katsaiti (1987). Furthermore, an informal contrast of the data obtained in Experiments 5-7 with those gathered in Experiments 1-4 seems to show a similarity in pattern to the results reported by Slamecka and Katsaiti. It appears that not only was children's recall of generate items increased, but their recall of read-only items was depressed. In other words, the within-group designs may have had the effect of allowing selective displaced attention to increase the processing of the generate words at the expense of the read-only words, a finding noted by Slamecka and Katsaiti (1987). However, a complete test of their selective

Table 1
Results of Experiments 1-8

	Condition					
	Read-Only Items			Generate Items		
	N	M	SD	N	M	SD
Between-Groups Designs						
Experiment 1	12	5.61	1.21	13	6.02	1.35
Experiment 2	11	6.07	2.13	12	5.96	2.22
Experiment 3	13	5.02	2.09	12	5.11	2.31
Experiment 4	12	7.07	3.11	12	7.90	2.56
Within-Group Designs						
Experiment 5	(13)	4.46	1.60		9.15	1.03
Experiment 6	(13)	4.23	1.67		9.23	.97
Experiment 7	(14)	5.93	1.91		9.71	.45
Experiment 8						
Free Rehearsal	(15)	4.46	1.72		9.31	1.65
Controlled Rehearsal	(15)	5.53	1.28		5.48	1.27

Note—The data for Experiments 1-3, 5-6, and 8 are based on words recalled. The data for Experiments 4 and 7 are based on math facts recalled. For Experiments 1-4, which used between-groups designs, the Ns are given for each condition. The Ns vary due to absences and one failure to follow directions. For Experiments 5-8, which used within-group designs, the Ns are given once in parentheses.

displaced attention hypothesis requires more than obtaining the generation effect in a within-group design. It also requires a demonstration that the generation effect does not occur in within-group designs when adequate controls for selective displaced attention are used. To attempt such a demonstration, we conducted a final experiment.

EXPERIMENT 8

A mixed model design was employed in which generate/read was the within-group factor and free/controlled rehearsal of items was the between-group factor. Thirty second graders (mean age = 7 years, 9 months) who had not participated previously were drawn from two classrooms. The children were randomly assigned to either a controlled rehearsal condition or a free rehearsal condition. Unlike previous experiments, the materials were presented via a microcomputer to allow for better control of rehearsal. In the controlled rehearsal condition, the children had to repeat aloud, over and over, each word from the time of its appearance (whether it was read or required generation) on the screen until it was replaced with the next word on the list 10 sec later. In the free rehearsal condition, no such verbalization was required. From Slamecka and Katsaiti's (1987) perspective, requiring the children in the controlled rehearsal condition to repeat aloud each word for the full 10 sec of its exposure should dramatically limit the possibility of selective displaced rehearsal. Other than the changes in design and mode of material presentation, the general procedures previously described were followed.

The results indicated a significant difference by both the between-groups [$F(1,28) = 24.16, p < .01$] and the within-group factors [$F(1,56) = 28.82, p < .01$]. In addition, the interaction term was significant [$F(1,28) =$

17.77, $p < .01$] (see Table 1). An examination of the means clearly shows that the generation effect appeared only in the free rehearsal condition. No generation effect appeared in the controlled rehearsal condition. In addition, recall of read-only words by the free rehearsal condition was substantially, but not significantly, lower than children's recall of read-only words in the controlled rehearsal condition.

GENERAL DISCUSSION

The results of the present experiments offer confirmation of those reported by Slamecka and Katsaiti (1987). After failing to obtain the generation effect in four experiments, we began to cast about for some explanation. Slamecka and Katsaiti's (1987) selective displaced rehearsal hypothesis suggested that the generation effect essentially was an artifact brought about through the use of within-group designs. Initial confirmation of this hypothesis was obtained in our Experiments 5-7. One such experiment would have been sufficient, but the repeated failure to obtain a generation effect in Experiments 1-4 seemed to require some balance of replications that did identify the effect in within-group designs. Finally, the results of Experiment 8 confirmed Slamecka and Katsaiti's (1987) findings that the generation effect would occur in within-group designs only when rehearsal was not controlled. When we introduced a means of controlling rehearsal (repeating the words aloud), no generation effect was observed. Presumably, this lack of effect was due to the inability of subjects to shift their processing away from read-only words to generate words.

REFERENCES

DONALDSON, W., & BASS, M. (1980). Relational information and memory for problem solutions. *Journal of Verbal Learning & Verbal Behavior*, **19**, 26-35.

GLISKY, E. L., & RABINOWITZ, J. C. (1985). Enhancing the generation effect through repetition of operations. *Journal of Experimental Psychology: Learning, Memory & Cognition*, **11**, 193-205.

GRAF, P. (1980). Two consequences of generating: Increased inter- and intraword organization of sentences. *Journal of Verbal Learning & Verbal Behavior*, **19**, 316-327.

JACOBY, L. L. (1978). On interpreting the effects of repetition: Solving a problem versus remembering a solution. *Journal of Verbal Learning & Verbal Behavior*, **17**, 649-667.

KANE, J. H., & ANDERSON, R. C. (1978). Depth of processing and interference effects in the learning and remembering of sentences. *Journal of Educational Psychology*, **70**, 626-635.

SLAMECKA, N. J., & GRAF, P. (1978). The generation effect: Delineation of a phenomenon. *Journal of Experimental Psychology: Human Learning & Memory*, **4**, 592-604.

SLAMECKA, N. J., & KATSAITI, L. T. (1987). The generation effect as an artifact of selective displaced rehearsal. *Journal of Memory & Language*, **26**, 589-607.