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ABSTRACT

This study is an attempt to partially confirm the hypothesis that first grade children, generally lacking the skills and/or capacities for efficiently organizing their memories for verbally-presented information, benefit from illustrations which provide a simple external memory. The sample consisted of 32 first grade (second semester) children, divided into two equal groups, for the first replication of the study and 32 children, divided into two equal groups, for the second replication. Children, run individually, heard four stories. Illustration subjects were asked to illustrate the story immediately after hearing it and then to tell all they could recall about it. (In the second replication, literal questions were added.) Control subjects spent the poststory time coloring in a coloring book before recalling the stories they heard. Results showed that the illustration condition produced better recall for long and short passages, and for simple and complex passages. (JM)

Pictures and Young Children's Prose Learning: A Supplementary Report

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Lesgold, Levin, Shimron, and Guttmann (1975) have demonstrated that first graders remember more of a story they have heard when they are exposed to an illustration of the story. The effect was the same whether the child constructed the illustration (using a background scene and cutout objects) or whether the experimenter constructed it for them. However if the child has to select the particular cutouts he needs from a larger pool that includes irrelevant material, illustration has either no effect or else inhibits performance.

There are two relatively obvious, possible hypotheses that explain some or all of these results. First, it may be that exposure to the illustrations is an extra chance to study the same information as was just heard. Thus, it should be facilitative, as long as the picture materials are obviously and completely related to the story. If some of the picture materials are related to the story but others are not, then the picture condition might have the effect of an interpolated list in a retroactive inhibition experiment. Levin, Bender and Lesgold (Note 1) have refuted this extra-study-time hypothesis by showing that, given prose that is relatively long and complex, the illustration condition produces better recall of a story by first graders than any of a series of control conditions that provide extra chances to hear or repeat the story instead of illustrating it.

The present study is an attempt to partially confirm an alternative hypothesis. Specifically, we argue that first grade children generally lack the skills and/or capacities for efficiently organizing their memories for a body of information presented verbally. The effect of illustrations, we claim, is to provide an external memory representation of enough story information at one time so that the child can encode memories that link together the memories he has previously encoded from individual sentences (or other small segments) of the text.

There are several sources of evidence that six-year-old children do not adequately organize their memory for a story they hear. First, it is generally the case that young children do not adjust their processing of information to reflect the type of recall task they will later face (Flavell, 1970; etc.). Second, recent work (Guttmann, Note 2) suggests that over the period from kindergarten through the primary grades, children are gradually developing the ability to mentally organize (elaborate) information derived from text with progressively less external pictorial aids. If the illustrations are merely extra exposure to information, and not a peculiarly useful external memory aid during learning, then one wonders why first graders actually need the illustration to benefit while third graders can (Guttmann, Note 2) do as well when asked to construct a mental image without pictorial prompts. Related work in the domain of paired-associate learning (Rohwer 19) is perhaps more completely developed.

None of this should be taken to mean that young children cannot integrate related ideas at all. Indeed, Paris (1975) has shown that even young children can integrate some of the ideas in prose, although they certainly improve with age on both memory for facts and integration

of facts in memory. There is also evidence that mental-imagery instructions to five-to-eight-year-old mildly retarded children promote integration of related ideas, as measured by the false recognition paradigm (Paris, Mahoney, & Buckhalt, 1974).

The facilitative effects of mental imagery instructions in five-to-eight-year-olds who are retarded (Paris, et al., 1974) has not been found with six-year-olds who are normal (Guttmann, Note 2). There were two differences of importance in the experiments. First, Paris used false recognitions of inferences as his measure of integrative semantic processing while Guttmann used short-answer responses to questions, a form of recall. Second, while Paris used relatively small sets of related ideas, Guttmann used relatively complex stories, about ten sentences multiproposition sentences in length.

Thus, it appears that when either the amount of information to be integrated or the level of integration required (recognition vs. recall), or both, are high, that mental imagery instructions are not enough to produce higher memory performance. This supports the hypothesis advanced above, that young children benefit from the illustrations because they provide a simple external memory for complicated bodies of facts that cannot be held in internal memory together and thus cannot be easily integrated.

If illustration serves to make semantic processing more possible for these young children, then it should benefit them in learning of both simple and complex stories, whether long or short. This would be the case except if the illustration task itself imposed an additional processing load on these children. If that were true, then the utility of illustrations for children learning verbally-presented information would be in questions,

especially for less able children. Unfortunately, the results of Lesgold et al., which showed illustration to be ineffective when the child must choose picture components, leave open the possibility that as stories become longer and/or more complex, the child may not be able to handle even the simpler illustration tasks.

The present study rules out this possible problem by showing that illustration is effective in learning of both simple and complex stories of both long and short length. Such a demonstration would increase our confidence that the illustration procedure can be valuable even for children who find the learning task particularly challenging.

Method

Subjects

Thirty-two first grade (second semester) children from a suburban school served as subjects in the first replication of this study. They were split into two groups of 16 each with roughly equal Stanford Achievement Test scores (mean grade equivalents of 2.35, 2.34 for reading; 2.53, 2.48 for listening). Thirty-two children from an urban Catholic school served in a second replication of the study. They were also split into two groups of 16 each with equivalent mean reading scores on the Wide Range Achievement Test (mean grade equivalent = 2.3 for both groups). The age range of the sample was 6.2 to 7:4 years.

Design and Materials

A partially nested design was used in which Condition (illustration vs. Control), Story Set, and Replication (School) varied between subjects while story complexity (One vs. Two Locations) and Story Length (50 vs. 100 words) varied within subjects. For subjects who received a particular

set of stories, order of presentation was counterbalanced with a Latin Square.

A total of sixteen stories were written, for of each type (50 vs. 100 words; one vs. two locations). All of the stories were of simple wording, treating themes that are regularly found in young children's literature: home life, farm animals, playground events, etc. A one-location story was written so that its entire content could be illustrated with cutouts on a single background scene. A two-location story required two different background scenes to illustrate the entire story. Four Story Sets were created by assigning one story from each condition combination to each story set. Each story had a short (usual two words) title. A set of four literal questions was written for each short story and six were written for each long story. About eight cutouts were made for each story to illustrate the people and objects mentioned in the story. For each one-location story, a single background scene was drawn, and two were made for each two-location story. Scenes and cutouts were ink line drawings colored with artists' felt-tip markers. They were laminated in shiny plastic. Backgrounds were about 30 cm square and cutouts were 5 to 15 cm tall.

Procedure

Subjects were run individually. Each child was first told about the experiment, including the recall task(s). Each child listened to a story (presented via tape recording). After each story, if the subject was in the Illustration condition, he was given the background scene for the story, and the needed cutouts and was told to illustrate the story, taking as long as needed. The illustration was photographed and the illustration time was recorded. To each Illustration subject was yoked a Control subject who spent the same time on a control task after the story.

as the Illustration subject spent making the picture. The control task was coloring simple figures in a coloring book. This task is noninterfering (see arguments in Bender & Levin, Note 3).

After hearing all four stories, the child was given the title of each story in turn and asked to tell all he could remember about the story. Recalls were taped for later scoring. There was no time limit for story recalls. In the second replication, a series of literal questions requiring a very brief answer (one word or a simple clause) was asked about each story after free recall of that story was completed.

Results

Cued Recall

Since there were four questions for short stories but six for long stories, the data for cued recall were expressed as percentages correct. A repeated-measures analysis of variance revealed a significant effect of Condition, $F(1,24) = 8.65$, $p = .007$, with the Illustration subjects averaging 69% correct, compared to 47% for the Controls. The interactions of Complexity with Story Set were significant, $F(3,24) = 6.32$, $p = .003$, suggesting some variability of difficulty for specific passages within the four types. Mean percentages for each passage are shown in Table 1. For 14 out of 16 stories, the Picture Condition was higher. Considering that there were only four subjects receiving each story, and considering that the same subjects (Story Set B) were involved in both reversals, this seems a strong result. There was an insignificant trend for one-location stories to be better remembered, regardless of condition, then two-location stories, $F(1,24) = 2.60$, $p = .12$, means = 61% vs. 54%. All other effects were insignificant.

Free Recall

Free recall was scored using the propositional analysis scheme described in Lesgold, et al. There were two graduate student raters, one of whom was blind to the condition assignments of the subjects. That person scored 12 of the 64 protocols. The other rater scored all 64. They agreed on 94% of the individual decisions of whether or not a specific subject recalled a specific proposition. Reliability (tetrachoric correlation) was .98 between scorers. The scorings of the second author were used in all cases.

There was a significant effect of conditions, $F(1,55) = 6.39$, $p = .014$, with Picture group better than the Control, means = 22% vs. 14%. Long stories were not as completely recalled, $F(1,178) = 36.2$, $p<.001$, means = 14% vs. 22%. There was also a marginal effect of Schools $F(1,55) = 3.39$, $p = .071$, with the urban parochial school not doing as well as the suburban public school, means = 15% vs. 20%. There was a Length x Complexity interaction, $F(1,178) = 7.21$, $p = .008$, as depicted in Table 2. There was also a marginal Conditions x Length effect, $F(1,178) = 3.08$, $p = .081$. This was because percentage scores were used. In absolute magnitude the advantage of the picture condition over the control was almost identical for short and long passages, about 1 1/2 extra facts per story. There were significant Condition x Length x Story Set and Complexity x Story Set interactions, again due to both story variability and perhaps small numbers of subjects per story. The means for the stories in the two conditions are shown in Table 3. Eleven out of 16 stories showed the Condition effect in the correct direction. Story Sets B and D accounted for all reversals, again suggesting subject variability as the source of the problem, since stories were

randomly assigned to sets. Taking cued and free recall together, there is no suggestion in the data that some passage types are more likely to be facilitated than others.

Picture Analysis

For each cutout in each picture of each Illustration subject, a decision was made whether the cutout was a) correctly placed on that background; b) placed in a manner inconsistent with the story; or c) omitted from the illustration. Eighty-nine percent of the cutouts were accurately placed; 9% were inaccurately placed, and less than 2% were omitted. There were insufficient misplacements, and too few subjects making more than one or two, to determine whether misplacements varied with passage type.

However, we were able to examine the relationship between picture accuracy and free recall. To do this, we classified each proposition according to whether the objects or people it named were placed correct or incorrectly or were omitted. Propositions which included both a correctly placed and an incorrectly placed referent were excluded from these analyses. We then computed the probability of correct recall for propositions based upon how well they were illustrated. Considering only propositions whose illustration was unambiguously classifiable and which were either perfectly recalled or not recalled at all, 66% of the correctly illustrated propositions were recalled and 37% of the incorrectly illustrated propositions were recalled. Considering only those subjects who had both correct and incorrect placements, this difference is significant, $t(22) = 4.29$, $p<.001$.

It should be noted that these recall figures are higher than the overall recall reported in Figure 3. This is because there were

many propositions which, though in principle illustrable, did not generate unambiguous picture placement criteria. Even though each child heard over 100 propositions in the four stories, only about a third of them on average could be unambiguously classified for correct placement and recall. This, in itself, confirms earlier findings (Lesgold, et al., 1975) that illustration activity facilitates prose learning in first graders only to the extent that there is perfect correspondence between prose content and illustration activity.

We also attempted to compare incorrect placement and omission of cutouts for recall efficiency. Eighteen of the 24 subjects who misplaced some cutouts still recalled some propositions referring to those cutouts. None of the nine children who omitted cutouts recalled any facts referring to those cutouts. This difference is significant, Fisher exact $p<.001$. Thus, even handling a cutout incorrectly produced better recall than ignoring it.

Discussion

The Illustration condition produced better recall for long passages and short ones, for simple passages and complex ones. This suggests that the task of producing a picture that is directly related to a story one has heard involves very little extra cognitive load over the activities the child would otherwise engage in while learning. As we constituted the task, it can only help, not hurt. This suggests that previous work (see Samuels, 19), which suggested that illustration was of questionable help for children learning from prose, is not completely correct. Helpful effects can be achieved.

It is important to note that children did their illustrations for us only after the whole passage was completed. Better effects of

illustration may be found when illustration occurs after each sentence. This would most likely be the case for long passage, part of which may be forgotten before the illustration activity commences. Thus, we have probably underestimated the illustration effect that is possible for long passages. On the other hand, the use of illustrations more frequently than every 100 words (the size of our longer stories) is likely to be impractical, so it is reassuring to note that even our procedure works.

Looking at our results and those of Lesgold et al. (1975) we can extract several principles for effective illustration. First, the child need not construct the illustration himself, though it may be necessary for him to see it constructed or otherwise have his attention drawn to all its components (Lesgold et al., 1975). Second, illustrations must be more effective for facts that they clearly represent than for related facts that are not very specifically illustrated (facts that were incorrectly illustrated were still better recalled than facts that did not correspond to a specific cutout placement). Third, illustrations are effective to the extent that the child has constructed them correctly. Overall, illustrations are effective in young children's prose learning only to the extent that they specifically and accurately represent facts that are to be learned, and it is probably necessary to control the child's attention to parts of the picture.

These findings of the importance of specific relationship between story and picture and of a guaranteed attention to salient picture aspects may help us understand why earlier research on picture efficacy (see Samuels, 19) has been so unproductive. The standard criteria for children's book illustrations are aesthetic. The emphasis is on quality artwork and perhaps secondarily motivating or arousing the child. In

experiments on the effects of illustration, there is closer correspondence between picture and story content, but generally there has been little effort to direct the child's attention to aspects of the picture the way that syntax, stress, and pitch direct attention to aspects of an auditory message. Thus, it is not surprising, from the standpoint of behavior theory, that illustrations have not appeared to be effective.

Finally, it should be noted that older children can often do mentally what younger children need pictures for (Guttmann, Note 2; Rohwer, 197) and that better readers need pictures less than poor ones (Levin, 1973). Thus, with maturity of the comprehension skills, pictures may have a more specialized function. They may, in this latter case, be suited best to presenting spatial information (as in a book on bicycle repair). Or, they may function as external memories for complex bodies of prose, such as those occurring in multi-term series problesm ("John is taller than Bill, . . ."). Finally, they may be a form of footnote or digression from the main text argument.

Table 1

Percentage of Correct Responses to Questions

Condition	Passage Type	Story Set A	B	C	D
Illustration	short, 1 location	75	56	88	81
	short, 2 locations	69	75	50	88
	long, 1 location	87	54	79	50
	long, 2 locations	54	54	58	79
Control	short, location	44	62	75	38
	short, 2 locations	25	56	38	56
	long, 1 location	42	58	58	33
	long, 2 locations	33	42	37	58

Table 2

Free Recall: Length x Complexity

	Length	
Complexity	Short	Long
One location	24%	14%
Two locations	19%	15%

Table 3

Free Recall: Detailed Cell Mean Percentages

Condition	Passage Type	Story Set A	B	C	D
Illustration	short, 1 location	25	35	36	18
	short, 2 locations	30	22	24	18
	long, 1 location	15	13	25	12
	long, 2 locations	17	13	18	19
Control	short, 1 location	14	23	18	25
	short, 2 locations	10	11	12	23
	long, 1 locations	6	17	6	15
	long, 2 locations	8	16	7	19