Reprinted from

LEARNING AND INSTRUCTION

European Research in an International Context

Volume 3

Edited by

MARIO CARRETERO, MAUREEN POPE,
ROBERT-JAN SIMONS and JUAN I. POZO

A Publication of the European Association for Research on Learning and Instruction

PERGAMON PRESS
OXFORD · NEW YORK · SEOUL · TOKYO

CHAPTER 15

IMPROVING LEARNING AND RECALL FROM TEXT IN DISTANCE EDUCATION: SOME EXPERIMENTAL RESULTS

Jesus MARTIN CORDERO, Juan A. GARCIA MADRUGA,
Jose Luis LUQUE VILASECA and Carlos SANTAMARIA
Distance Education University, Spain

The goal of this chapter is to assess the efficiency of two educational aids, learning objectives and outlines, designed to enhance text comprehension and recall. Before introducing the design and results of our two experiments, we would like to comment briefly on the theoretical context of our research.

Educational Psychology's goal of enhancing learning from written material had met a considerable handicap in the atheoretical attitude, centered on plain experimental results, shown by many studies in the 60's and the early 70's. However, during the last 20 years different models of text organization have been reported in the literature. These models account for two separate traditions. From a cognitive theoretical framework authors like Ausubel (1968), Novak (1977) have shown how new information could be integrated into cognitive structures by the use of advance organizers. From a behavioristic standpoint, Rothkopf (1970; Rothkopf & Kaplan, 1972) studied mathemagenic behaviors (those that foster learning skills) and the effect of learning objectives and questions on learning from written material. In another vein, Gagné (1977) paid particular attention in his model to *"intellectual skills"* and to learning results and hierarchies.

Some of these models already assumed that the learner is an active processor of information who integrates new knowledge into formerly stored cognitive structures, departing from passive models of human learning. Nevertheless, a more recent tradition has highlighted memory processes in learning research, developing a theoretical context in this

domain. Advances in Cognitive Psychology are contributing to the solution of some of the main problems that the atheoretical positions posed. They have also dealt with some important difficulties related to text structure and organization.

In recent years text comprehension has received a great deal of attention. Studies on prose memory have shown that comprehension does not depend only on the text or the subject's stored structures, but on an interaction between the text, with its structural features, and the schemata used by the subject (Rumelhart, 1980; Schank & Abelson, 1977; Thorndyke & Hayes-Roth, 1979). On the other hand, it should be stated that the basic psychological processes that underlie comprehension function in an interactive and coordinated manner. Word recognition, and syntactic and semantic analysis -once they become automatic through practice- work in a parallel mode, activating as soon as information reaches them. Eventually, this process generates a mental representation of discourse that includes, besides the set of propositions that form the text, the construction of a situational model of the text's meaning (Just & Carpenter, 1987: van Dijk & Kintsch, 1983; Johnson-Laird, 1983).

The increasing importance given to constructive processes in text memory and comprehension has been linked to the development of schema theories and to the much needed criticism of linear processing models. Schema theories construe text comprehension as a process of hypothesis testing, in which the subject, starting from the hints that the text provides, constructs a series of schema-hypothesis that are assessed by matching them against successive sentences, till a coherent interpretation is obtained.

Subjects make two substantial contributions while reading a text: inferences and previous knowledge. Inferences have been given a central role in language comprehension. Clark (1977) distinguished between backward inferences, that allow for the formation of a causal chain of conceptualizations by linking the meanings of different sentences, and forward inferences, that allow for the prediction of future events in the text. Furthermore, the subject's knowledge may be classified into three broad categories. The first is his/her specific knowledge of the topic of the text and the second, his/her knowledge of the world, or that knowledge of social relations and/or causes and features common to different domains. Third, there is also knowledge of higher rhetorical structures that are typical of and limit written discourse, described as superstructures of van Dijk & Kintsch (1983).

As stated above, educational psychology has researched the effects of different procedures designed to enhance learning from text. Psycholinguistics and constructivist memory theories have researched the effect of certain stimuli and prompts that facilitate text processing. This is why our own work started focusing the manipulation of different text variables as an intervention target. The intervention techniques we used can be classified into two types. Firstly those procedures that manipulate intratextual variables which directly affect the structure of the text. This group includes techniques such as the modification of the general sequence of the text, lexical and syntactical simplifications and the use of connectors or rhetorical formulae. The second category, extratextual aids, is composed of those procedures that do not alter the text itself, and that are expected to exert an influence upon comprehension and recall. This is the largest category and includes advanced organizers, titles and summaries, learning objectives, etc. Of these we have chosen two from different theoretical backgrounds, on which to centre our experiments. These techniques are: learning objectives as developed by Rothkopf (1970; Rothkopf & Kaplan, 1972) from a theoretical position close to behaviourism; and outlines, that in our work are similar to advance organizers. Advance organizers are part of the theoretical conceptions of Ausubel (1968; Ausubel, Novak & Hanesian, 1978), developed from a typically cognitive perspective on significative learning. Outlines are also introductory aids that act on the macrostructure of the text. Both advance organizers and outlines promote the use of deductive strategies, that stress global comprehension. They activate the conceptual structures into which the text's information is incorporated.

Before describing our experimental work, we would like to comment on one of the most important problems posed by educational research on text recall: the need for quantitative comparisons. Many parsing methods have been used, but which would be the most appropriate remains an open question (Schnotz, 1984). The model of propositional analysis that we apply includes units that are hierarchically higher than a proposition. The original text used in our experiments was parsed into 67 propositions which were grouped in 11 scenarios and these, in turn, in 5 blocks. The scenarios and blocks are an attempt to assess the comprehension and memory of levels higher than the propositions in the recall protocols. This enables us to take the two fundamental areas of text memory into account in the results. The first is the recall of the facts and concepts that are lower in the hierarchy or microstructure of the text. These results were obtained by comparing the protocols with the decomposition or table

of propositions or the original text. The second is the macrostructural level, including scenarios and/or blocks. Finally we examined those aspects of the protocol that did not appear in the original text, which may be considered the creative part of reading. These were segments of information that were not actually present in the text, but which nevertheless, appeared in protocols and were relevant to the text's topic.

EXPERIMENT 1

Procedure

Text A (Control) was based on a fragment of a Developmental Psychology Unit then in use in our department. An experimental text was designed, that had the same semantic content as the control text and included two modifications: a) The rearrangement of the text's logical structure through changes in the sequence and organization of the contents. This category included the use of different rhetorical markers, and changes in the page layout that highlighted its logical structure. b) The second modification focused on the macrostructure of the text and consisted of the use of repetition, redundancy and underlining, the placement of key ideas on the left margin of the text and its lexical and syntactical simplification: Short simple propositions replaced complex syntax, without affecting the contents of the text and obscure words were replaced by more familiar terms. This experimental text was preceded by an outline in the case of text B and included 9 interspersed learning objectives in text C.

The experimental design consisted of three groups (Control A, Experimental B, Experimental C) with posttest and one week delayed assessments. In order to quantify the dependent variable we use a free recall test. Verbal Intelligence was used as a covariable, and it was measured by the "different word" and "vocabulary" scales of a standardized verbal test (TEA-3).

In addition to recall scores based on the propositions, scenarios and blocks, two other scores were employed: The scores on the propositions covered by the outline plus those of the propositions covered by the objectives (Ou+Ob); and on those propositions covered by the outline and the objectives (Ou&Ob). The propositions covered by the outline plus the objectives are those propositions highlighted by any of the experimental treatments. Those propositions in the macrostructure which were highlighted in the experimental treatment by repetition, redundancy, underlining and the use of key ideas, as well as by the outline, the

objectives or both. The propositions covered by both the outline and the objectives (Ou&Ob) permitted the effectiveness of both techniques to be compared on the same propositions[1].

The subjects were Spanish Distance Education University students, 57 participated in the first session, in the following random distribution: Group A, n=19 (mean age: 35.1; s.d.=8.6); Group B, n=19 (mean age: 35.3; s.d.=10.1); and Group C, n=19 (mean age: 30.5; s.d.=9). There was an experimental mortality of 12 subjects, remaining 14 subjects in Group A, 15 subjects in Group B and 16 subjects in Group C, at the time of the delayed assessment, a week later.

In the presentation of the experiment to the subjects the importance of their collaboration with the experimenters was emphasized, they were told that their participation would hopefully serve to improve the quality of written material for distance education. Following this, the sequence of tasks was briefly described and the importance of participating in the second session was stressed. Subjects were then given an answer sheet and the verbal intelligence test was administered. Texts were then distributed at random to each group (A, B or C). The instructions for working through the texts were read aloud and subjects questions were answered. In the instructions, the subjects were encouraged to get as much information as possible from the texts, by reading them in depth. The subjects were allowed 12 minutes. to read the texts and, after a 5 min. break, the free recall test was administered; 20 mins. were allotted for this task, in which the subjects were asked to reproduce as accurately as possible the content of the material there had just read. At the end of the session they were again reminded of the importance of participating in the second session. The task they were to perform at that time was not described. At the delayed test session the free recall test was again administered.

Results

Table 1 shows the global results for each group. The posttest scores achieved by Group B were higher than those of Groups A and C. In the delayed test this pattern was again repeated, but to a lesser degree. Table 2 shows the correlation scores between direct recall scores and the verbal

---

[1] For a more detailed description of Experiment 1, its theoretical context, a list of the propositions and the texts used, see Garcia Madruga & Martin Cordero (1987).

intelligence scores for each group. Group A's correlations were all highly significant ($p < 0{,}005$). Group C had lower correlations and no significance was reached in the posttest. Group B's correlations were close to zero and in no case reached significance. This salient correlation pattern will be discussed later, in relation to the possible effects that the different aids may exert on comprehension.

TABLE 1
Free recall results for each group: Totals and Means

		Free recall	
		Postest	Delay*
Group A	Total	203.5	109.5
	Mean	10.71	7.82
Group B	Total	251.0	133.5
	Mean	13.21	8.90
Group C	Total	205.0	105.0
	Mean	10.78	6.76

* Group A, n=14; Group B, n=15; Group C, n=15.

TABLE 2
Correlation between scores free recall tests and verbal intelligence test

	Free recall	
	Postest	Delay
Group A	0.645**	0.641**
Group B	0.056	0.158
Group C	0.223	0.419*

* $p < 0.1$; ** $p < 0.005$.

Two ANOVAs were carried out on direct scores from the free recall posttest and delayed test and none of them reached significance, though the pattern of results is consistently favourable to Group B (outline).

Different text levels were taken into account in calculating the results. In addition to quantitative recall or direct scores, scores for Blocks, Scenarios and Inferences were obtained. Figure 1 shows the results on the free recall posttest. These yield a pattern favorable to group B in all the

levels of text analysis. In order to verify the significance of the results, two more ANOVAs were carried out. The first on the sum of the three scores (Scenarios + Blocks + Inferences), this can be considered a measure of structural memory and comprehension. In the second, only the Inferences were considered, enabling us to obtain an index of comprehension. In the first case the ANOVA was significant ($F=2.55$; $p<0.1$), though the contrast between groups did not reach significance. The second ANOVA was also significant ($F=3.55$; $p<0.005$) and so were the contrasts between groups (Scheffé, FB-A=2.33: FB-C=2.33: $p<0.1$). In the delayed recall the results showed the same pattern but to a lesser degree. The ANOVAs carried out on those results did not reach significance.

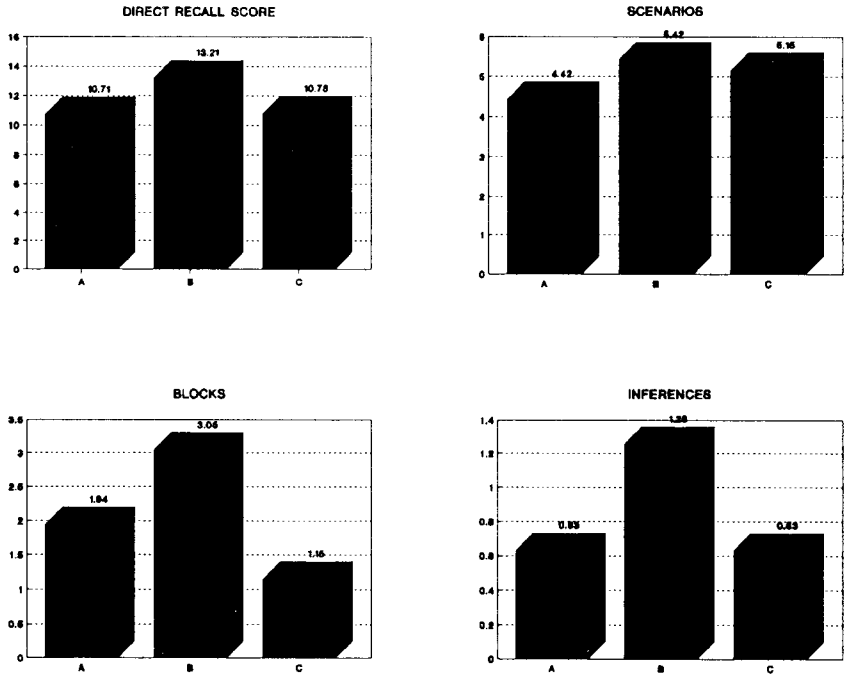

FIGURE 1
Experiment 1 mean scores for the three groups on free recall posttest.

As to the results on intentional learning, that is, those propositions directly affected by the experimental treatment, the two types of analysis

described above were carried out in order to verify the validity of the aids.

Table 3 shows the summary of the significant means contrasts of intentional and incidental learning. The results on the propositions covered by the outline plus the objectives (Ou+Ob) are favorable to Group B, in the posttest as well as in the delayed test, followed by Groups C and A. The differences B-A ($p < 0.05$), in the posttest and B-C ($p < 0.1$) in the delayed recall were significant.

The results on incidental learning show an unfavourable pattern for Group C (A-C, posttest, $p < 0.1$; A-C, delayed, $p < 0.025$; B-C, posttest, $p < 0.05$) and the differences between A and B were virtually nonexistent. These results show that the experimental treatment produced an improvement in intentional learning in Group B, without diminishing incidental learning, at least in the posttest.

TABLE 3

Means comparison of intentional and incidental learning

			B - A	C - A	B - C
Intentional Learning	Ou+Ob	Posttest	<0.05		
		Delay	<0.15		<0.1
	Ou&Ob	Posttest	<0.1	<0.15	
		Delay	<0.1		<0.1
Incidental Learning	Ou+Ob	Posttest		<0.1	<0.05
		Delay		<0.025	
	Ou&Ob	Posttest		<0.15	<0.025
		Delay		<0.05	<0.1

The propositions covered by both outlines and objectives (Ou&Ob) permit the comparison of their efficiency, as shown by the higher scores achieved by Group B over Group C, this can also be seen by Group C's low scores in incidental learning and Groups B's decrease from posttest to delay. The highest scores on incidental learning on the posttest were reached by Group B although the differences from Group C were very small. Group B's scores on the delay are clearly higher than those of the other two groups. The means contrast B-A reached significance on the posttest and the delay ($p < 0.1$) and the means contrast B-C also reached significance ($p < 0.1$).

Group B achieved the highest incidental learning scores on the posttest, followed by Group A and lastly C. Only the means contrast between B-C reached significance ($p < 0.025$). In the delay the order was as follows: Group A, Group B, Group C; although the differences between A-B are minimal and only the contrasts between A-C ($p < 0.05$) and B-C ($p < 0.1$) achieved significance.

Discussion

The results have not confirmed the hypothesis that there would be an improvement in Groups B and C's scores, in the posttest and the delay, over Group A's. Nevertheless, two aspects of the results stand out and appear to be of interest to the overall conclusions.

Firstly, Group B's results present a pattern that in spite of not achieving statistical significance, is consistently higher than that of the other two groups. This difference is also evident when the correlations between verbal intelligence and recall scores for the three groups are compared (Table 2). In Group A and, to a lesser degree, in Group C, the correlations that reach significance suggest that an important part of the variance might be explained by the verbal intelligence of the subjects. On the other hand, in Group B the lack of correlation seems to demonstrate that the recall scores were not particularly affected by verbal intelligence. This lack of correlation into Group B is coherent with the notion that the improvement in this group's scores is due to the experimental treatment. The poor results of experimental Group C in the posttest and in the delay, which were even lower than those of Control Group A, should be noted. The analysis of the correlations between the recall scores and verbal intelligence does not shed any new light on these results.

A second prediction supposed that Experimental Group B would achieve the highest total scores and that the same would happen in

intentional learning. As has been shown, Group B's pattern of results appears to confirm this hypothesis, since the structural memory and comprehension scores are also significantly higher. Subjects in Group B seem to show better structural memory (Scenarios + Blocks + Inferences) in the posttest and especially greater comprehension an measured by the inferences. These results confirm our predictions regarding the function of the outline in structuring the text and aiding in the construction of its overall representation. The same pattern of results, although diminished, holds for the delay.

As to intentional learning, the general pattern of results seems to confirm the predictions of our second hypothesis. In the case of the propositions covered by the outline plus the objectives (Ou+Ob) which, as indicated above, include those propositions highlighted by the common experimental treatment, the results clearly show the superiority of Group B compared with the two other groups. These results reached statistical significance on the comparison with Control Group A in the posttest ($p < 0.05$) and with Experimental Group C in the delay ($p < 0.1$). The results in incidental learning confirm the efficiency of the experimental treatment of Group B, since there are no differences from Group A but they are present in relation to Experimental Group C in the posttest. In other words, the improvement in intentional learning of Group B does not suppose a reduction on the propositions not covered by the treatment. Improvement is not achieved at the expense of incidental learning. It should be noted that the propositions covered by Ou+Ob coincide with the text's macrostructure. This fact underlines the importance of Group B's results in contrast to those of Group C.

Our analysis of the propositions covered by the outline and the objectives (Ou&Ob) facilitates the comparison of the two treatments due to the overlap in the treatment of some propositions. The results show a great similarity between both experimental groups in the posttest, although Group B scores significantly higher than the other two groups. The results on incidental learning show that Group B maintained similar or even higher levels than Control Group A both in the posttest and in the delay. Group C shows once again, a loss in incidental learning, with significantly lower scores on the postest than Group B and lower scores on the delay than both Groups A and B. Again, the comparison is quite favourable to experimental Group B, on which the outline technique was used.

EXPERIMENT 2

Procedure

Our main target in this second experiment was to replicate some of the most relevant results from Experiment 1. We were also interested in devising a more complete design with a different subject sample. Our purpose was to refine our former conclusions and avoid some of the problems introduced by the wide variety of ages, topic knowledge and study skills present in our previous experiment's sample.

Materials in this experiment did not differ from the ones used in Experiment 1. The design was a factorial 2x2; the first factor being the type of aid and the second type of text. The following were the groups in this experiment:

- Group A: Control text plus advanced outline.
- Group B: Experimental text plus advance outline.
- Group C: Experimental text plus learning objectives.
- Group D: Control text plus learning objectives.

Given our aims we eliminated delayed assessment in this experiment, thus subjects only answered the free recall test once. However, we did keep the two different measures to evaluate the efficiency of the aids type: Those propositions covered by the outline plus the objectives (Ou+Ob), and those covered by the outline and the objectives (Ou&Ob) in which there was an overlap in the treatment.

Subjects were students from a middle class neighbourhood secondary school in Madrid. A total of 105 subjects were randomly assigned to the four experimental conditions: Group A, n=27: Group B, n=26; Group C, n=28; Group D, n=24, Mean age was 16.9 with no significant difference between groups.

The procedure was the same as in Experiment 1. Instructions were read aloud, subject's doubts were answered and they were told to read the text carefully and to try and remember as much from it as they could. Before they answered the free recall test they were instructed to write down everything they could recall from the text they had read, and to try to reproduce the original text as accurately as possible. They were allotted 20 minutes to perform this task.

Results

Figure 2 shows direct recall, scenarios, blocks and *"strucmem"* (structural memory) mean scores. This last score is a compound measure that combines scenarios and blocks and is aimed to assess the subject's structural memory and comprehension. The results profile favours outline Groups (A and B) and broadly matches the results from Experiment 1. Also these results show the efficacy of the experimental text vs. control.

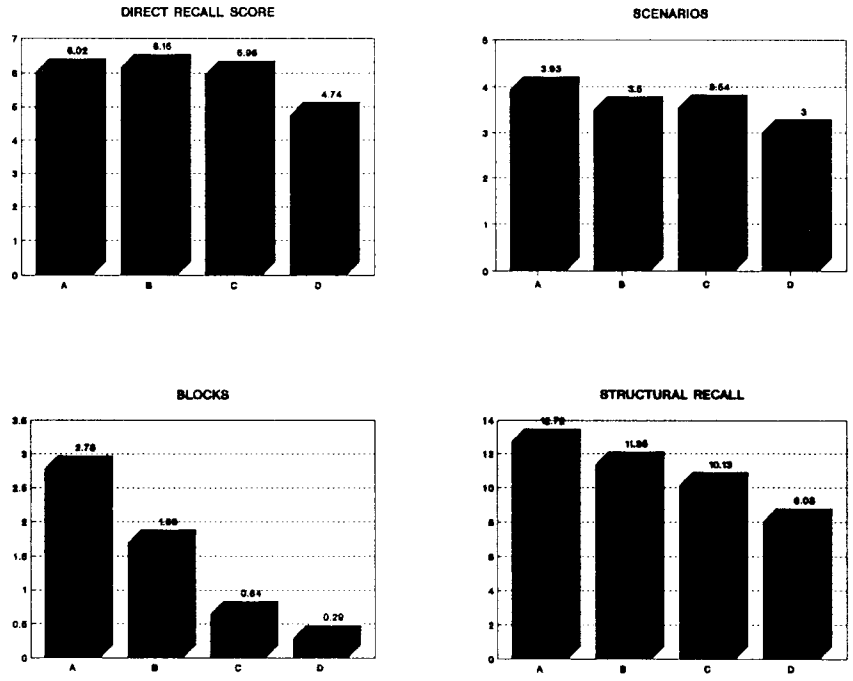

FIGURE 2
Experiment 2 mean scores for the four groups on free recall postest.

Although the ANOVA (2x2) performed on direct recall scores was nonsignificant, results from both groups using the outline were higher than those of the objective groups, the order being B, A, C, D.

For scenarios, the ANOVA (2x2) was not significant either. The order of the groups again favoured those using an outline (A, B, C, D).

Blocks produced a non homoscedastic distribution so we used a nonparametrical test to contrast both factors. The Chi-square test was

only significant for the aid factor (Chi-square=28.380, d.f.=5, $p<0.00001$), and the influence of the text factor did not reach significance. The order (A, B, C) favoured still once more the outline Groups and all contrasts between them (Mann-Whitney V test) were highly significant except for the contrast between Groups C and D.

The *"strucmem"* score also yielded significant differences (ANOVA 2x2; main effect $F=8.588$, $p<0.0001$). The aid factor was significant ($F=16.527$, $p<0.0001$), and the text condition (experimental vs. control) did not seem to exert any effect on the results. The order was the same as in the last analysis and, in this case, the only significant difference was between groups A and D ($p<0.05$).

In Experiment 1 part of our explanation for the high variability of the results was based on the wide differences in study skills and knowledge of the topic assumed for our sample. The need for a more homogenous sample in Experiment 2 also had some effect on the results. The mean number of recalled propositions was nearly half that of our first experiment. Furthermore, correlations between the amount of recalled propositions and the diverse scores of intentional and incidental learning were high and significant (outline intentional, 0.71; outline incidental, 0.79; objectives intentional, 0.61; objectives incidental, 0.82; Ou+Ob intentional, 0.70; Ou+Ob incidental, 0.79; $p<0.001$ for all correlations). As a result we considered it advisable to perform two types of statistical analysis. The variation consisted of introducing the covariable of the amount of recalled propositions as a statistical control. The results confirmed previously observed patterns and some of the contrasts reached statistical significance.

Regarding the intentional and incidental learning, the same types of tests as in Experiment 1 were carried out. The results described below take into account the covariable amount of recalled propositions. In those propositions covered by any of the experimental treatments (Ou+Ob; outline, objectives or common experimental treatment) the main effects approached significance (ANCOVA, $F=3.031$: $p=0.053$), and the text factor was significant (ANCOVA, $F=5.926$; $p=0.017$). Neither the aids nor the interaction between factors reached significance. It seems that the fact that the common experimental treatment overlapped with the outline or with the objectives could have affected the contrast between aid factors and the interaction. In this case, as in the following ones, a floor effect (as to the amount of recalled propositions) impeded an accurate contrast between the different types of aids.

Those propositions covered by both treatments, outlines and objectives (Ou&Ob) permit the efficiency of both techniques on the same propositions to be compared. If the differences in the main effect are significant ($F=4.149$, $p=0.019$) it is due to the marked contrast in the text factor ($F=8.193$; $p=0.005$). In other words, hardly any propositions appear which permit the aid factor to be compared, since on most of them there is a coincidence of experimental treatments. As to incidental learning, none of the contrasts reached significance.

Discussion

In general, as a replication experiment, we may state that, although the results do not always achieve the desired levels of significance, they are consistent with those of Experiment 1.

As indicated before, the subject's prior low level of knowledge of the text topic seems to have diminished intergroup differences which otherwise might have emerged. Note should be taken that the analysis of inference scores in Experiment 2 does not appear because the subjects were simply incapable of producing any, due to their meager knowledge of the text's topic. Similarly, it is remarkable that significant differences have appeared only on the highest level measure of recall (Blocks). These differences are significant for the contrasts between all groups, except for those carried out between groups using objectives. The recall of the text's macrostructure has been adequately covered in the outline groups. None the less, and in spite of this, the outline did not activate prior knowledge which would have facilitated the assimilation of new concepts in greater detail, increasing the recall of a higher number of proposition. It seems that the subject's lack of knowledge in this field impeded a richer interaction between prior knowledge and new concepts.

A floor effect also appears to have intervened in the contrasts carried out on intentional and incidental learning. As in Experiment 1, the results are consistently favourable to the outline groups. On the other hand, the use of a factorial design has permitted some of the results to be examined in greater detail. The Experimental Groups B and C consistently achieved better results on intentional learning. The Experimental Group using outline scored higher than the experimental group using objectives on both intentional learning measures, and the control-outline group always scored higher than the control-objectives group. Although there are no significant differences in incidental learning, the results clearly favour the outline groups. Thus, the pattern of results coincides with that of the first

experiment and our hypothesis that outlines are more effective is, once again, strengthened.

CONCLUSIONS

Our goal was to assess two types learning aids -outlines vs. objectives- as to their ability to optimize the storage and recall of information from expository texts. Before discussing any conclusions it is necessary to underline the range of complexity and nuances that converge in these tasks.

From the results of our two experiments it may be concluded that the pattern is favourable to the use of outlines, although not all the contrasts reached the desired significance. Our explanation of how the outline functions under its different conditions is as follows. An outline can provide the subjects with the structure of the text and help them to focus on its most relevant aspects, which constitute the macrostructure of the text. In fact, the outline seems to have acted mainly on the structural memory and comprehension and through them on the qualitative recall, albeit without reaching significance. This interpretation of the data is reinforced by the results that outline groups obtained showing that there is no loss of incidental learning. From this we may deduce that the effect of the outline is general and not specific. Furthermore, in Experiment 1, in which we introduced a delayed recall measure, Group B's loss is minimal. This contrasts with the losses suffered by Group C.

The objectives' inefficiency also needs to be explained. One possible explanation could be that our objectives conveyed too much information and were too general. This resulted in the loss of efficiency in intentional learning and, in spite of their generality, no improvement in comprehension or direct recall appeared. Another possible explanation is that objective's results could be due to interference by the common experimental treatment. There are some other results that support this interpretation (Brooks et al., 1983). However, in Experiment 2, in spite of the limitations above mentioned, the objectives groups scored systematically lower. Group D (control/objectives) always scored lower than the other groups. In Experiment 1 the decrease on delayed measures may be explained in terms of long term memory access difficulties.

Thus, two general conclusions might be drawn. The first is that outlines are more efficient than objectives, especially with regard to comprehension, global recall and recall of the text's macrostructure. The second refers to the action of the aids. Outlines seem to promote a deductive strategy, activating, at least in Experiment 1, the prior

knowledge structures necessary for the processing of the text. In both experiments the ability of the outline to transmit the macrostructure of the text can be observed. In the objectives groups the subject's performance seems to indicate that the density of the objectives impeded the expected improvement in intentional learning, and produced a fragmented, punctual processing that favoured neither comprehension, nor the recall of the text.

In summary, our general conclusion, pending further experiments that would permit greater accuracy, postulates that the outline acts by enhancing the subject's normal processing of the text, in a way that is consistent with what is already know about text comprehension. Objectives at this point appear to be of limited use, and lack an adequate theoretical base in processing and text comprehension (Resnick, 1984).

REFERENCES

Ausubel, D. P. (1968). *Educational Psychology: A Cognitive View*. New York: Holt, Rinehart & Winston.

Ausubel, D. P., Novak, J. D., & Hanesian, H. (1978). *Educational Psychology: A Cognitive View*. New York: Holt, Rinehart & Winston.

Brooks, L. W., Danserau, D.F., Spurlin, J.E., & Holley, Ch.D. (1983). Effects of headings on text processing. *Journal of Educational Psychology*, 75, 2, 292-302.

Clark, H. H. (1977). Bridging. P. N. Johnson-Laird, & P. C. Wason (Eds.), *Thinking. Readings in cognitive science*. Cambridge: Cambridge University Press.

Gagné, R. M. (1977). *The conditions of Learning*. New York: Holt, Rinehart & Winston.

García Madruga, J. A., & Martín Cordero (1987). *Aprendizaje, Comprensión y Retención de Textos*. [Text learning, comprehension and recall]. Madrid: UNED.

Johnson-Laird, P. N. (1983). *Mental models. Towards a Cognitive Science on Language, Inference, and Consciousness*. Cambridge: Cambridge University Press.

Just, M. A., & Carpenter, P. A. (1987). *The Psychology of Reading and Language Comprehension*. Newton, Mass.: Allyn & Bacon.

Novak, J. D. (1977). *A Theory of Education*. Cornell: Cornell University Press.

Resnick, L. B. (1984). Comprehending and learning: implications for a cognitive theory of instruction. In H. Mandl, N. L. Stein, & T. Trabasso (Eds.), *Learning and Comprehension of Text*. Hillsdale, N. J.: Erlbaum.

Rothkopf, E. Z. (1970). The concepts of mathemagenic activities. *Review of Educational Research*, 40, 325-336.

Rothkopf, E. Z., & Kaplan, R. (1972). Exploration of the effects of density and specificity of instructional objective on learning from text. *Journal of Educational Psychology*, 63, 4, 295-302.

Rumelhart, D. E. (1980). Schemata: The buildings blocks of cognition.In R. J. Spiro (Ed.), *Theoretical Issues in Reading Comprehension*. Hillsdale, N.J.: Erlbaum.

Schank, R. C., & Abelson, R. P. (1977). *Scripts, Plans, Goals and Understanding: An Enquiry into Human Knowledge Structure*. Hillsdale, N.J.: Erlbaum.

Schnotz, W. (1984). Comparative instructional text organization. In H. Mandl, N. L. Stein, & T. Trabasso (Eds.), *Learning and Comprehension of Text*. Hillsdale, N.J.: Erlbaum.

Thorndyke, P. W., & Hayes-Roth, B. (1979). The use of schemata in the acquisition and transfer of knowledge. *Cognitive Psychology*, 11, 82-106.

van Dijk, T. A., & Kintsch, W. (1983). *Strategies of Discourse Comprehension*. New York: Academic Press.