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Teaching active text processing strategies: Some experimental results.

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Abstract

Current theories about comprehending and memorising texts comment on the relevance of active processing during reading. This active processing is necessary to achieve a coherent representation that includes the construction of a macrostructure and a situational model of the text content. This chapter describes an instructional programme that is designed to improve two important strategies: (a) drawing out main ideas from texts, and (b) constructing outlines (structural summaries of texts).

Taking this theoretical perspective, an experiment was performed to evaluate the impact of a training programme on the strategies mentioned above of secondary school students. In a pretest session, subjects were randomly assigned to three experimental conditions: advance outline (where subjects were given a previous outline of the text), outline construction (in which they were required to elaborate the outline by themselves), and no outline (the control condition). They were given a four-session instruction programme. The first two sessions included a brief explanation of what the main ideas of the text meant and practice in drawing them out from different texts. The two final sessions consisted of practice on the elaboration and use of text outlines based on the main ideas. Again, different texts were used for this purpose. Finally, subjects were given a posttest session to test the effects of training, in which the preliminary experimental conditions were reinstated.

This article reports some of the main results from this experiment, as well as a discussion of their implications for an educational framework.

Introduction

Studies carried out during the past 25 years by cognitive psychologists in the field of discourse comprehension, especially text comprehension, have defined the constructive and interactive nature of this process. The final outcome of comprehension is the construction of a semantic representation that includes a mental situational model of the state of affairs described in the text, integrating the contents of the texts with the subject's prior knowledge (Carpenter & Just, 1987; Johnson-Laird, 1983; Kintsch, 1988; Van Dijk & Kintsch, 1983). This constructive nature of discourse comprehension had already been pointed out by Bartlett's pioneering studies and corroborated by Bransford and collaborators (Bransford & McCarrell, 1975) and by schema theory (Rumelhart, 1980). The point is that text comprehension is an exceedingly complex task in which many cognitive processes on diverse levels (word recognition and lexical access, syntactic and semantic analysis) must interact. This issue is computationally approachable and solvable, based on the subjects' prior knowledge. Therefore, in order to resolve the problem of interpreting the linguistic input consistently, the subject must activate his/her knowledge of the material being dealt with, employ his/her strategic knowledge and recognise the rhetorical structure of the text (Garner, 1987; Resnick, 1984).

In addition, text comprehension is the result of a long acquisition process in which the child learns to automatise the more superficial levels freeing cognitive resources that can be applied to the construction of a precisely detailed mental representation. During this developmental process there comes a time when the child evolves from "learning to read" to "reading to learn". At this point comprehension is not just an end in itself but becomes a means of learning new information. From this moment on, the adolescent is faced with the task of understanding expository texts that try to transmit new contents in a complex

organisation that the reader is not yet familiar with. In order to construct an accurate representation of this type of expository text retaining its main ideas, the subject must have a set of strategic skills that enable him/her to construct an adequate macrostructure of the text; he/she must also adapt to its rhetorical structure and follow the text's guidelines. It is not surprising that many subjects faced with a task beyond their capabilities opt for a repetitive kind of learning that sooner or later leads them to academic failure. The conclusions that can be drawn from this panorama are obvious. If we want to overcome the problems that learning from texts pose to a significant number of subjects of all ages, we must improve either the texts themselves by making their structures clearer and introducing different types of aids that facilitate comprehension, or the strategies and abilities that are vital to the subjects' comprehension. As stated earlier (García Madruga & Martín Cordero, 1987; García Madruga & León Cascón, in press) this is not necessarily an either/or proposition. This paper attempts to make progress in the development of simultaneous intervention of both texts and subjects. Before addressing our study, however, let us take a look at some of the salient points of the research in both areas.

Intervention in the text and the subjects

Studies on text intervention, both of internal improvement (structure, syntactic and lexical complexity) and the introduction of aids (objectives, questions, summaries, advance organisers, signalling) follow a pattern in which the results of these improvements depends on the measures employed (free recall, recognition, problem solving, etc.) along with the subjects' knowledge and skills. Nevertheless, it appears to be possible to facilitate text comprehension by improving them and by introducing certain aids such as advance organisers, which are a representative cognitive technique. Advance organisers seem to be effective in complex texts whose structures are not particularly explicit, and with students lacking special knowledge of the topic and the necessary strategic skills (Ausubel, 1978; Barnes & Clawson, 1975; García Madruga & Martín

Cordero, 1987; Mayer, 1979, 1983). Mayer (1979) has suggested that the function of advance organisers might be to facilitate the availability and to activate the prior knowledge that allows the assimilation of new information presented in the text. However, as has recently been proposed, the efficiency of advance organisers depends on the use the subjects really make of them since simply presenting them could be insufficient (Kloster & Winne, 1989).

We have found similar results (García Madruga, Luque Vilaseca & Martín Cordero, 1989; Martín Cordero, García Madruga, Luque Vilaseca & Santamaría Moreno, 1991) when attempting to test the efficiency of two aids that are clearly different, due both to their functions and to the research tradition from which they stem. These are objectives and structural summaries or outlines. Outlines explicitly provide the macrostructure and the top-level rhetorical structure of the text, and have been shown to be more effective than objectives in structural recall and comprehension measures. They are similar to advance organisers in that they structurally organise the texts' main ideas. However, our earlier studies suggested areas for future research into the type of propositional analysis used, which was molar with rather large idea-units, and into the subjects' actual use of the aids provided. We have tried to address both of these aspects in this study.

In the past fifteen years, numerous studies on the improvement of subjects' strategies and knowledge of the rhetorical structures of expository texts have shown that, despite the difficulties, it is possible to improve subjects' strategies. Before discussing this idea we should clarify the concept of strategy employed. Along with Van Dijk & Kintsch (1983) we believe that strategies imply the optimum use of a series of actions that lead to the achievement of a goal, thus reading comprehension strategies are an organised set of deliberate actions that the reader uses to achieve a specific goal leading to better comprehension. Among the strategies that have been taught we can highlight the identification of main ideas and summarising as having a basic role in the formation of a precisely detailed representation of the text, since they coincide with the construction of its macrostructure. As shown by Brown and collaborators (Brown & Smiley, 1977, 1978) the ability to identify the

different levels of the ideas in a text cannot be taken for granted, but has to be considered as the fruit of an acquisition process throughout adolescence, generally achieved only after age 17 (approximately 12th grade). In accordance with their inefficient identification of main ideas, younger children tend to passively reread instead of underlining or taking notes. Other studies (Brown & Day, 1983; Brown, Day & Jones, 1983) found that subjects between the ages of 10 and 12, faced with the task of summarising, tended to employ a partially incorrect and passive strategy called copy-delete. This basically consists of selecting and copying, more or less verbatim, some ideas. In other words, the subjects neither applied thoroughly Kintsch and Van Dijk's macrorules nor constructed a summary based on a real interaction with the text, but "got the job done" inefficiently. The developmental pattern of these reading comprehension strategy studies can be described following Gardner (1987) who maintains that the progression leads from the absence of strategies to their flexible and efficient use with an intermediate stage in which the subjects are only able to employ the strategy partially, inflexibly and inefficiently.

Bauman's (1984) studies of main idea identification strategies and Hare & Borchard's (1984) studies of summarising are good examples of how both can be taught with positive results. These studies, along with more recent ones, employ the direct instruction method which simply consists of a complete and detailed explanation of the strategy in question (Winograd & Hare, 1988). The use of direct instruction coincides with the need for the subject to commit himself to apply the strategies intelligently. He/she must use them in an active, flexible and controlled manner, adapting them to different contexts and purposes. The teaching of strategies should not be limited to a detailed explanation of the behaviour and activities needed to carry them out along with practice, but should also try to intervene in those metacognitive aspects that lead to internal control and contribute to the subjects' disposition to actively employ them.

We have, to date, tried to emphasise the active nature of the strategies because we believe that this is the key to the difficulties in teaching them. We must draw a distinction between the subjects' knowl-

edge of strategies and their real and effective use of them (Brown *et al.*, 1983). This is precisely where the problems arise. The important role of the subjects' disposition has been noted by several authors, especially Rothkopf (1988) who maintains that academic results are not dependent solely on cognitive competence but also on the disposition to employ them. Resnick (1987) goes even further when she states that the use of strategies, like any other higher thought process, demands effort on the part of the individual, and so it is necessary to cultivate not only the strategies but the disposition to use them.

Experiment

Objectives and hypothesis

Our objectives were the following:

- (a) To design and test an intervention programme focused on developing an active disposition to comprehend and on the direct teaching of main idea identification strategies and outlining (structural summarising).
- b) To test the effectiveness of Advance Outlines on structural recall and the interaction with the intervention on the subjects. To this end, in addition to the Outline group, we added a No Outline group and an Outline Construction group in which the subjects were simply asked to construct their own outlines.
- c) To contrast different propositional analyses and measures of free-recall we used Kintsch's (Bovair & Kieras, 1985), as well as a more molar, less demanding system, employed by us in earlier studies (García Madruga & Martín Cordero, 1987).

In order to describe our study as exactly as possible we have used the tetrahedral model assumed by Brown *et al.* (1983), in which learning processes are decomposed through the interaction of four factors: (1) activities performed by the learner; (2) his/her characteristics, knowledge and skills; (3) the nature and sequence of the material to be learned; and (4) the type of criterial task employed, free recall, cued

recall, recognition, problem solving, etc. Based on these four factors our study attempted to intervene in all of them in the following way. First, the subjects had to be persuaded to commit themselves actively to the task employing their strategies and knowledge to the fullest in order to actively understand the text and construct an adequate macrostructure. Secondly, we tried to improve their knowledge and reading comprehension skills by providing two crucial strategies. Thirdly, we presented them with three types of material and learning tasks (aid conditions). These were texts with Outlines, without Outlines and with the requirement that the subjects construct the Outline themselves. Lastly, we only used free recall as a criterial task but with several different measures of the dependent variable, including rote recall of the text's propositions, recall of the macrostructure and a measure of the structural recall.

Our hypotheses were the following:

- (1) Intervention will produce a general improvement in the subjects' recall that is irrespective of the aids used. This improvement will be more pronounced in the measures of macrostructure and structural recall, and, specifically, in the Outline group.
- (2) Each aid will produce a different effect on each type of measure. Given the characteristics of the subjects (third year high school) and of the experimental texts (relatively brief and simple), the No Outline group will score highest in propositional recall. The Outline group will score highest in the macrostructural and structural recall and the Construction group will score lower than the other two in the propositional rote recall.

Method

Subjects and design

The subjects were 90 third-year students from a lower-middle class high school in Madrid (mean age: 17.15 years). The TEA-3 verbal intelligence test confirmed the absence of special subjects and the homogeneity of the groups. One third of the subjects gave up or were unable to attend some of the sessions. The final number of students was 59 (No Outline: 20; Outline: 20; and Outline Construct: 19).

We employed a three random experimental groups design with pre- and post treatment measures. The levels of the independent variable were determined by the different aid conditions, which were randomly assigned to the subjects in each classroom. All the subjects received the same intervention. Control of the differentials was carried out based on the increase obtained. Since the comparison of the different measures of the dependent variable was an important part of the study, three measures were performed. Two of these measures were based on Kintsch's propositional analysis system. They consisted of the number of propositions and the number of macrostructural propositions recalled. We also performed another measure of the structural recall based on the number of main ideas recalled in the correct scenario plus the number of scenarios adequately recalled.

Materials

In the pre- and posttests the subjects used a Spanish version of the well-known texts, "Railroad" and "Supertankers". In the pretest, half the subjects received one text and the other half the other text. The texts were switched in the posttest. Both texts were signalled and contained 434 and 451 words respectively, with 10 hierarchical levels. Each text had 3 scenarios. In "Railroad" they were a representation of the theme 'groups in favour and opposed', and in "Supertankers" they were a statement of the problem: causes of sinking and possible solutions. As to the rhetorical structure, "Railroad" uses an adversarial, for and against comparison and "Supertankers" has a problem-solution organisation. Both texts are of equivalent difficulty. In each condition subjects received a booklet with instructions to read and assimilate the enclosed text that they would later be asked to recall. The Outline group also received an outline and was encouraged to use it while reading and assimilating the text. The booklet for the Outline Construction group asked the subjects to elaborate their own outline on the page provided. The answer booklets were the same for all subjects and instructed them to write everything they could recall as exactly as possible.

Table 1: The contents of the four sessions of the training programme

The first session consisted of:

- (a) A general explanation based on:
- What do you remember from the text? Main idea recognition skills.
 - What does the subject bring to his/her comprehension? An active process, knowledge and strategies.
 - What we are going to do?
 - Why is it useful?
- (b) Presentation of text 1.
- Suggesting titles for the text, discussion.
 - List main ideas, discussion.
- (c) Modelling text 1. Four rules for active comprehension:
- Notice the signals and rhetorical markers.
 - Try to visualise what is described.
 - Ask the text questions.
 - Reread to improve understanding.

The second session:

- (a) Presentation of text 2.
- Suggesting titles for the text, discussion.
 - Guided practice (active comprehension).
 - Discussion.
 - Feedback. Partial modelling.
- (b) Presentation of text 3 (same as above).

The third session:

- (a) Explanation of outline:
- The structure of the relationships between the main ideas (using as examples texts 1 and 2).
 - Outline: structural summary. Rules for outlining:
 - Eliminate unnecessary details.
 - Group the information.
 - Use topic sentences.
 - Revision: Improve the connections and introduce new elements.
- (b) Apply the above to the list of main ideas from text 3.
- Discussion and modelling.
- (c) Outline of text 4.
- Students construct outline, guided practice.
 - Discussion.
 - Feedback-partial modelling.

The fourth session:

- a) Outline of text 5.
- Students construct outline, guided practice.
 - Discussion.
 - Feedback-partial modelling.
- (b) Explanation of how to use an outline in processing a text. Discussion. Recapitulation.
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The materials used during the intervention consisted of 5 texts (2 brief ones and 3 more complex and longer ones) and 4 booklets in which the subjects were to do their daily tasks. They also included reminders of especially relevant points of the instruction. The texts were "Las Pirámides", "Los Cheyennes", "Los Nómadas", "La Lengua Galesa" and "El Descubrimiento de América". All of them were natural and easy to understand extracts from encyclopaedias and social science publications.

Procedure and training programme

In the pretest session all subjects took the verbal intelligence test and were then given one of the experimental texts. Each subject was randomly assigned to an experimental group. They had 11 minutes to work with the text, afterwards they had 3 minutes of informal, unrelated, conversation with the researchers and were then given their answer booklets and asked to write everything they could remember for 12 minutes.

The training was carried out by two of the researchers in four 50-minute sessions during the normal class schedule. All subjects received the same session on the same day. The contents of the four sessions is shown in Table 1.

The posttest session was carried out 10 days after the pretest and was conducted in exactly the same manner as the pretest, the subjects received the alternate experimental texts, the only difference was the exclusion of the verbal intelligence test.

Results

The results of the three measures of the dependent variable can be seen in Tables 2 and 3 and Figures 1, 2 and 3.

Propositional recall

The ANOVA aid condition by pre- and posttest showed that both factors were significant (Aid Condition: $F=11.10$, $p=0.000$. Pre/posttest: $F=6.11$, $p=0.017$). The interaction between both factors was not significant.

The effect of the aid condition was also tested with two ANOVAs in pre- and posttest that reached significance (Pretest: $F=8.80$, $p=0.0005$; Posttest: $F=7.84$, $p=0.001$). In the pretest the differences between the No Outline group and the others were significant. In the posttest the Outline Construction group proved to be significantly different from the other two (Scheffé tests: $p<0.05$).

Table 2: Pretest and posttest mean results for the three groups

	Propositional recall		Macrostructural recall		Structural recall	
	pre	post	pre	post	pre	post
No Outline (N=20)	55.75	57.50	17.20	20.60	7.85	10.45
Outline (N=20)	39.65	51.90	13.75	26.25	8.15	11.40
Outline Construction (N=19)	36.26	38.84	13.37	18.68	6.84	8.84

Table 3: Percentage of increase between pretest and posttest

	Propositional recall	Macrostructural recall	Structural recall
No Outline	3.14 %	19.77 %	33.12 %
Outline	30.89 %	90.91 %	39.87 %
Outline Construction	7.11 %	39.71 %	29.23 %

Regarding pre- and posttest differences only the increase achieved by the Outline group reached significance (T-test: $t=-3.45$; $p=0.003$). The use of non-parametric tests on the differential pre- and posttest scores in each group closely approached significance (Kruskal-Wallis: $\chi^2=5.95$; $p=0.051$). The Outline group increase was significantly

higher than the No Outline group's (Mann-Whitney: $z = -2.29$; $p = 0.022$), approaching significance in the case of the Construction group (Mann-Whitney: $z = -1.76$; $p = 0.079$).

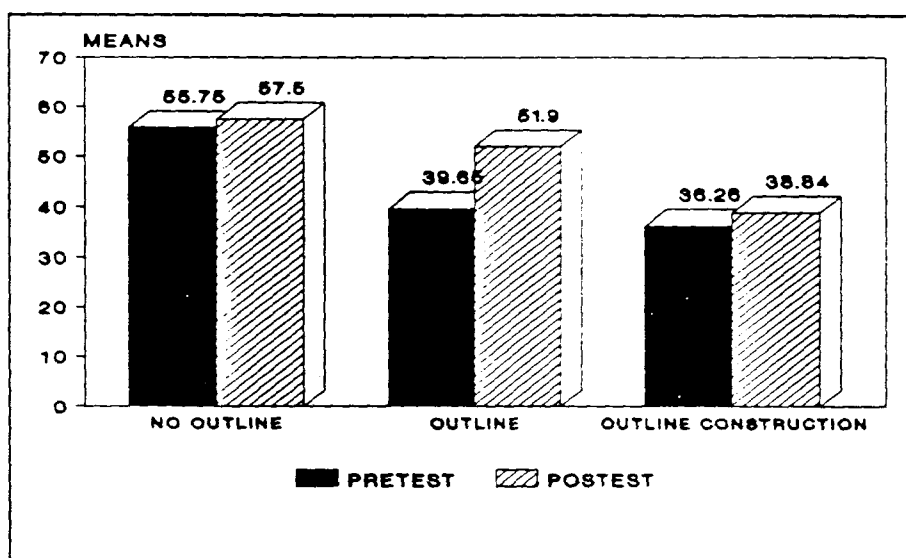


Figure 1: Propositional recall

Macrostructural recall

The ANOVA aid condition by pre- and posttest was only significant in the pre- and posttest factor (Pre/posttest: $F = 15.87$, $p = 0.000$). The ANOVAS performed to test the effects of the aid condition were not significant, with no significant differences between the groups in the pre- or the posttest.

The only difference in the pre- and posttest that achieved significance was the increase reached by the Outline group (T-test: $t = -3.81$; $p = 0.001$), although the Construction group approached significance (T-test: $t = -2.02$; $p = 0.059$). None of the differential scores between the pre- and posttest for any group achieved significance.

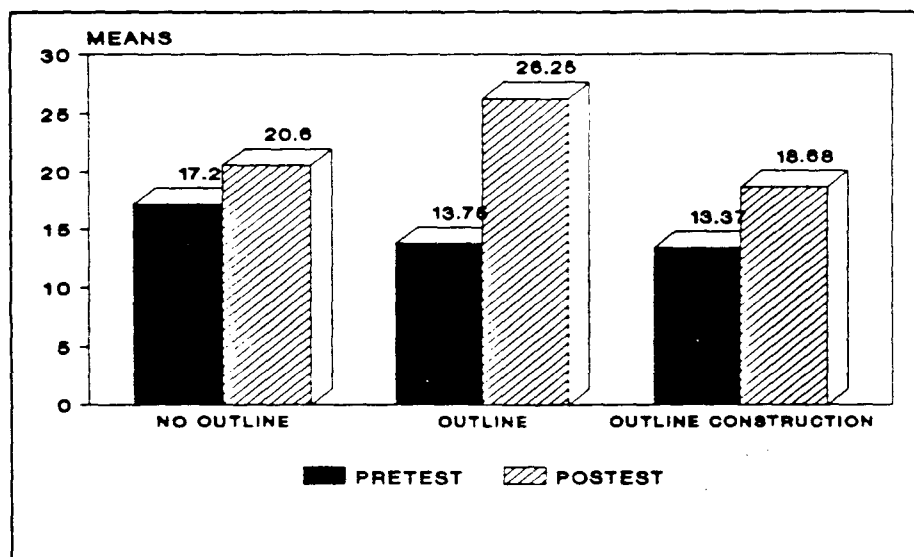


Figure 2: Macrostructural recall

Structural recall

The ANOVA aid condition by pre- and posttest was significant for both factors (Aid condition: $F=4.88$, $p=0.011$; Pre/posttest: $F=22.2$, $p=0.000$). The interaction between the two did not reach significance.

The ANOVAs performed to test the effects of the aid condition were significant only in the posttest ($F=4.54$, $p=0.014$). The difference between the Outline group and the Construction group also reached significance in the posttest (Scheffé test: $p<0.05$).

The increase obtained on the pre- and posttest achieved significance in the Outline group (T-test: $p=0.004$), and in the No Outline group (T-test: $t=-2.96$; $p=0.008$). The Construction group's results did not achieve significance (T-test: $t=-1.99$; $p=0.062$). None of the differential scores between the pre- and posttest for any group achieved significance.

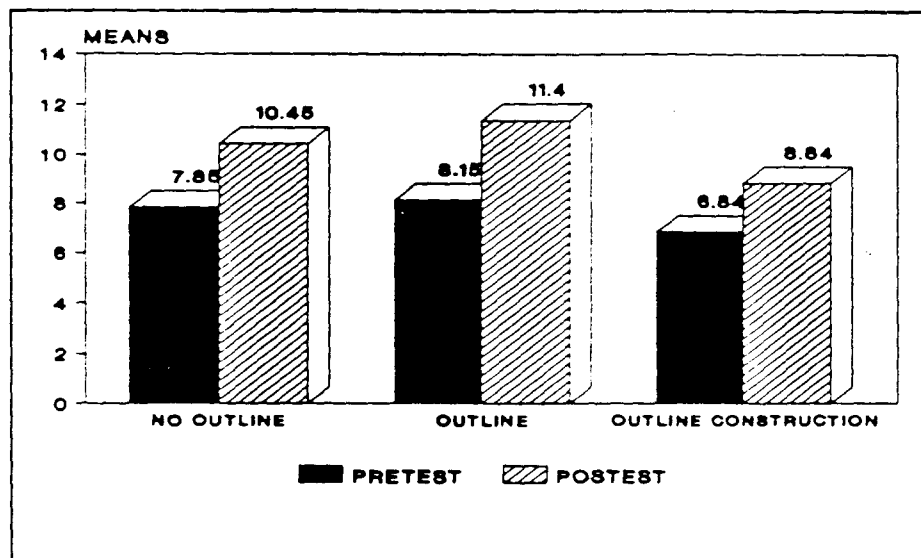


Figure 3: Structural recall

Discussion

In general the results seem to confirm our hypotheses. The Training Programme, in spite of its brevity, appears to have caused an improvement in the subjects' recall according to all three measures. Nonetheless, the differences between the pre- and posttest on the Propositions Recall achieved significance only in the Outline group. On Macrostructure Recall besides achieving significance in the Outline group, the Construction group approached it. The influence of the intervention seems to have been more general in the Structural Recall, reaching significance in both the Outline and No Outline groups, and also approaching it in the Construction group. It should be noted that the training produced some improvements in all three groups as shown in Table 3. Given the characteristics of the design, intrasubject control and the lack of a control group, the results must be confirmed by new studies that do not suffer from this limitation. Furthermore, it is imperative to consider basic issues related to possible long-term effects of the treatment and its transferability to other types of texts and situations.

The No Outline group's superiority in the "repetitive" propositional recall confirms our second hypothesis. As was to be expected, this superiority disappears in the posttest when compared to the Outline group. The results are less clear in the case of the Macrostructure: there were no significant differences between groups to be found, in spite of the expectation that there would be a difference in the Outline group's favour. The cause of this last effect could be twofold. Besides the experimental texts being brief, signalled and relatively simple, this could be due to the fact that the measure of the macrostructure is a subset of the measure of the total number of propositions recalled. In other words, the No Outline group may have, in the worst case, learned large portions of the texts, including the macrostructure, repetitively. No differences can be observed in the Structural Recall of the pretest, although the data point in the foreseen direction. In the posttest the results are as expected, save for the fact that the Construction group scored significantly lower than the Outline group. This was not expected. The poor results of the Construction group in this last measure, in the posttest, could lead us to ask ourselves whether the training has really been effective for this group. We, are convinced, however, that these data can be explained by the fact that the Construction group's task should not be expected to result in an increase on free recall measures. On the other hand, this group's scores improved between the pretest and the posttest on all the measures, though never reaching significance.

The results appear to show, just as we expected, the complex interaction of the aids, the training and the diverse measures of the dependent variable. The effectiveness of our training in active strategies seems to have been especially useful to the Outline group. This can be explained on two levels. The use of advance outlines, as well as the training, spring from the same cognitive theoretical frame of comprehension processes and the central role of the subject's prior knowledge and strategies. It is therefore not surprising to find a convergence between both types of intervention. A second, less optimistic analysis, would highlight the fact that the training includes, precisely, teaching the subjects to use outlines correctly. In any case, as stated earlier (Martin

Cordero, García Madruga, Luque Vilaseca & Santamaría Moreno, 1991) we believe that only with an adequate understanding of the cognitive processes involved in comprehension and of the active role that subjects must take it is possible to design effective aids and intervention programmes.

The results of the different measures bring several aspects to the fore that we would like to highlight. In the first place, we have shown that the aids, and to a lesser extent, the training, produce different effects on the diverse measures of recall. This fact underlines the need to take this into account in future studies by making qualitative as well as quantitative predictions (Mayer, 1988). This is being done to an increasing extent (see, for example, Cook & Mayer, 1989; Mannes & Kintsch, 1987). In the second place it enables us to evaluate the diverse types of measurement and propositional analysis employed, leading to a positive assessment of molar scoring systems, as well as the need to take into account the organisation of recall. Finally, the absence of results in the Construction group underscores the interest of including in future studies measures that go beyond mere free recall, since as Kintsch (1986) has stated, reading a text and learning from a text are two different things.

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