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ABSTRACT

Sixty-eight undergraduate college students served as subjects in a study that examined the effects of reader-generated map-like representations (spatial organizers) on subjects' delayed recall of a narrative. Of interest were the possible interactions between individual difference measures (verbal and spatial ability) and map generation on comprehension and the relationship between information produced on individual maps and comprehension. Subjects were randomly assigned to one of two groups: the "Map group" (who constructed a map while reading) or the "Nomap" group (a read-only condition). All subjects read a 773-word passage describing a mythical tribe's pilgrimage. Comprehension was assessed using an 18-item multiple-choice test containing literal, inferential, and reconstruction items. Results demonstrated the differential effects of map construction on comprehension. Low verbal ability subjects were negatively influenced by map construction, particularly at the detail level, whereas for the high verbal ability subjects, comprehension was enhanced. The reconstruction and inferential results suggested different emphases in comprehension. Map construction enhanced performance on reconstruction questions but failed to facilitate text integration types of comprehension. (HOD)

THE EFFECTS OF SPATIAL ORGANIZERS ON TEXT COMPREHENSION

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ABSTRACT

Examines the effects of reader-generated spatial organizers on college subjects' comprehension of a narrative text, and the interactions between spatial organizer generation and specific mental abilities. Subjects were randomly assigned to one of two groups: The Map group constructed a map while reading) or the Nomap group. (a read-only condition). Comprehension was tested after a 12 minute delay using a multiple choice format containing literal, inferential and "reconstruction" items. Verbal and spatial ability measures were also obtained. Results indicated Map subjects scored significantly higher on reconstruction questions, but significantly lower on inferential questions. A significant Treatment X Verbal Ability interaction for literal and total scores indicated that the organizer facilitated High Verbal subjects' but hindered the Low Verbal subjects' performance. Subjects' maps were scored for the amount of correctly located featural information and for the amount of event related information. Featural information correlations were positively related to literal and reconstruction scores while event-related information was negatively related to all types of comprehension. The results indicate that the value of self-generated spatial organizers depends upon the ability level of the subjects, the relationship between the organizer and the text material, and the nature of the posttest questions. Discussion will focus upon the implications of these findings for instructional design.

THE EFFECTS OF SPATIAL ORGANIZERS ON TEXT COMPREHENSION

This paper reports a study of the effects of reader generated spatial organizers on college subjects' comprehension of a narrative text.

Recent research has demonstrated that spatial organizers of various types can influence comprehension (Holley and Dansereau, 1984; see Levie and Lentz, 1982 for review). For instance, the literature cites the effectiveness of "text-mapping" (Armbruster and Anderson, 1984), "networking" (Holley and Dansereau, 1984), and "schematization" (Mirande, 1984). The theoretical explanation for such effects is that spatial organizers provide a structure for the integration and subsequent recall of information. The spatially organized information could be viewed as reducing the possibility of overloading the verbal processing system.

Essentially spatial organizers are re-representations of texts, or aspects of texts, in a spatially oriented manner which are either provided by the instructor (as in Structured Overviews, Barron, 1969) or generated by the learner. This study is concerned with the latter category and investigates the effects of reader-generated map-like representations on comprehension. Dean and Kulhavy (1981) and Dean and Enemoh (1983) have shown that such representations and forced processing of map-like features facilitates college subjects' comprehension. In a slightly different manner, Schwartz and Kulhavy (1981) reported superior comprehension performance by college subjects who had studied a map-like representation when compared to a group exposed only to a list of features found on the map-like representation.

Left unanswered though by this research is the question of the durability of the effect, particularly once memory for surface details

of the text have decayed. The Dean and colleague studies examined for effects immediately after, or one minute after reading.

Another question posed by current research is whether all subjects benefit equally from spatial organizers. Individual differences have received limited attention, though Dean and Kulhavy's data suggest that low verbal ability subjects' comprehension was enhanced by forced processing of a spatial organizer. Indeed, Dean and Kulhavy's low verbal ability college subjects, with map processing, performed more like high verbal ability non-map subjects on free recall of idea units. Such findings require replication, particularly in the context of delayed recall. Spatial abilities could also be envisaged to influence learning of spatially oriented texts. For example, subjects with low spatial abilities might be expected to gain from the provision of such organizers.

It is also unclear from the literature whether spatial organizer effects are general or specific. That is, does spatial organizer generation facilitate comprehension in general (as a form of elaboration) or does it act to facilitate comprehension of those details incorporated in the organizer itself (i.e. a specific effect). Kirby, Jurisich and Moore (1984), using high school students, found that map-processing resulted in increased recall of map-related information, at the expense of more important text information, and that this effect was greater for less able readers. Schwartz and Kulhavy also reported superiority of their map group in recalling map related information. Such results suggest that map-like organizers may enhance recall of map-related detail, but could be expected to fade quickly from memory and not assist broader text comprehension.

Finally, the question of the relationship between information contained on the reader-generated maps and subsequent recall of information

at test requires examining. If maps provide both content and structure then it would be expected that the more information contained on the spatial organizer, the better the comprehension of the text.

In summary, this study examined the effects of reader-generated map-like representations on college subjects delayed recall of a narrative. Of interest were the possible interactions between individual difference measures (verbal and spatial ability) and map generation on comprehension and the relationship between information produced on individual maps and comprehension.

METHOD

Subjects

Sixty eight undergraduate college students (mean CA = 21.9 years) provided the sample for the study.

Procedure

Intact class groups (to which subjects had been randomly assigned previously) were randomly allocated to one of two treatment groups: the Map group (N = 30) which was instructed to construct a map while reading, and the Nomap group (N = 38), a read-only condition. Eight minutes were allowed for reading, including map construction for the Map group. Subjects were informed that they would be asked questions on the passage. Verbal and Spatial ability tests were then administered (12 minutes): The Advanced Vocabulary Test 1 (V-4) and Card Rotations Test (S-1) from the Kit of Factor Referenced Cognitive Tests (Ekstrom, French, Harman and Dermen, 1976). Subjects then completed the multiple choice comprehension test.

Materials

All subjects read a 773 word passage describing a mythical tribe's pilgrimage. The passage describes their journey across a variety of terrains (e.g. deserts, mountains), details a series of events throughout the journey and examines the reasons for the pilgrimage. Only the journey to their holy city is described.

Comprehension was assessed using an 18 item multiple-choice test. Six items tested literal comprehension, six tested inferential comprehension and six others tested "reconstruction". In these last questions, subjects were required to construct spatial (geographical) relationships that had not been stated explicitly in the text. For example, one "reconstruction" question asked

> "On the return journey from Alashon the desert would have been crossed"
>
> A) before the forest
> B) after Gutzab
> C) after Dunbar
> D) before the Savannah plains.

For each item a four point confidence scale was included. Scoring combined accuracy and confidence, following Masson and Miller (1983), providing an eight point scale for each item. That is a correct response, rated extremely confidently scored 7, while an incorrect response, rated extremely confidently scored 0.

The maps generated by the Map group were scored for both correctly located featural information (e.g. name of town) and event related information (e.g. some episode occurred). Featural and event information had to preserve the correct interrelationships among adjacent elements for a full score.

RESULTS AND DISCUSSION

The comprehension data were analysed with a series of 2 (Treatment, Map Vs Nomap) X 2 (Verbal Ability, High Vs Low) X 2 (Spatial Ability, High Vs Low) ANOVAs. Ability groups were determined using median splits.

High Verbal subjects scored significantly higher ($p > .05$) than Low Verbal subjects on literal and reconstruction questions and on the total score. High Spatial subjects scored significantly higher than Low Spatial subjects on reconstruction questions and total score.

We were more interested in the possible interactions of specific abilities and map-generation. Significant Treatment x Verbal ability interactions for literal questions and total score indicated that High Verbal subjects' performance was enhanced by map construction whereas the Low Verbal subjects suffered. These interactions are shown in Figures 1 and 2.

Significant Treatment effects for both reconstruction and inferential questions showed superior performance by Map subjects on reconstruction questions (Map mean = 31.57 sd = 6.75; Nomap mean = 23.87 sd = 7.66) but the opposite for inferential questions (Map mean = 24.41, sd = 6.27; Nomap mean = 26.79, sd = 5.51).

Each of the 18 comprehension questions was then examined to ascertain whether it was predominately map-related or not. Eleven items (3 literal, 2 inferential, and 6 reconstruction) were deemed map-related, the remainder non-map related. ANOVA results showed a Treatment x Verbal ability effect ($p = .06$) for map related items due to the superior comprehension of map-related information by High Verbal Map subjects. This interaction is illustrated in Figure 3. In contrast, for the non-map related information, the Map group's performance was reliably lower than the Nomap group (Map mean = 30.87, sd = 7.78; Nomap mean = 35.03, sd = 5.97).

These results demonstrate the differential effects of map construction on comprehension. Low verbal subjects seem to have been negatively influenced by map construction, particularly at the detail level, whereas for the high ability subjects, comprehension is enhanced. The reconstruction and inferential results suggest different emphases in comprehension. Map construction enhanced performance on reconstruction questions but failed to facilitate text integration types of comprehension. The analyses of map-related and non-map related information also support the proposition of different emphases in comprehension.

These data would suggest little support for a theory that stresses reader-generated maps as general facilitators of comprehension. The effects are more consistent with a theory that specifies that maps of the type used in this study direct readers' attention to map related information, particularly if readers are of high verbal ability.

Analyses of the maps generated by the Map group showed that correct spatial location of featural information was positively correlated with literal (0.30), reconstruction (0.49) and total (0.28) comprehension scores. These correlations support Schwartz and Kulhavy's findings in that subjects who drew more accurate maps benefited on the comprehension test. Examination of correctly located event information provided an unexpected finding. For all types of comprehension, and total score, the event scores were negatively correlated with comprehension (ranging from -0.21 for inferential to -0.35 for total score). Inclusion of event related information while reading seemed to have impaired all levels of comprehension. An indication of the types of information included on individual maps can be gleaned from Figure 4, a composite map constructed using information included on over 50 percent of the reader-generated maps.

Overall, this study indicates that reader generation of a spatial organizer during reader enhances particular types of comprehension and that verbal ability interacts with map generation. The study, however, was conducted with a highly selective group of proficient readers (college undergraduates) and utilized only one narrative. While it would be premature to draw firm conclusions regarding educational implications, the results do provide some guidance for instruction.

If instructors use spatial organizers of the type used in this study, they should be mindful of the possible differential effects on comprehension and the interaction of specific abilities and spatial organizer use. The findings suggest that teachers should be clear as to the purposes for using spatial organizers.

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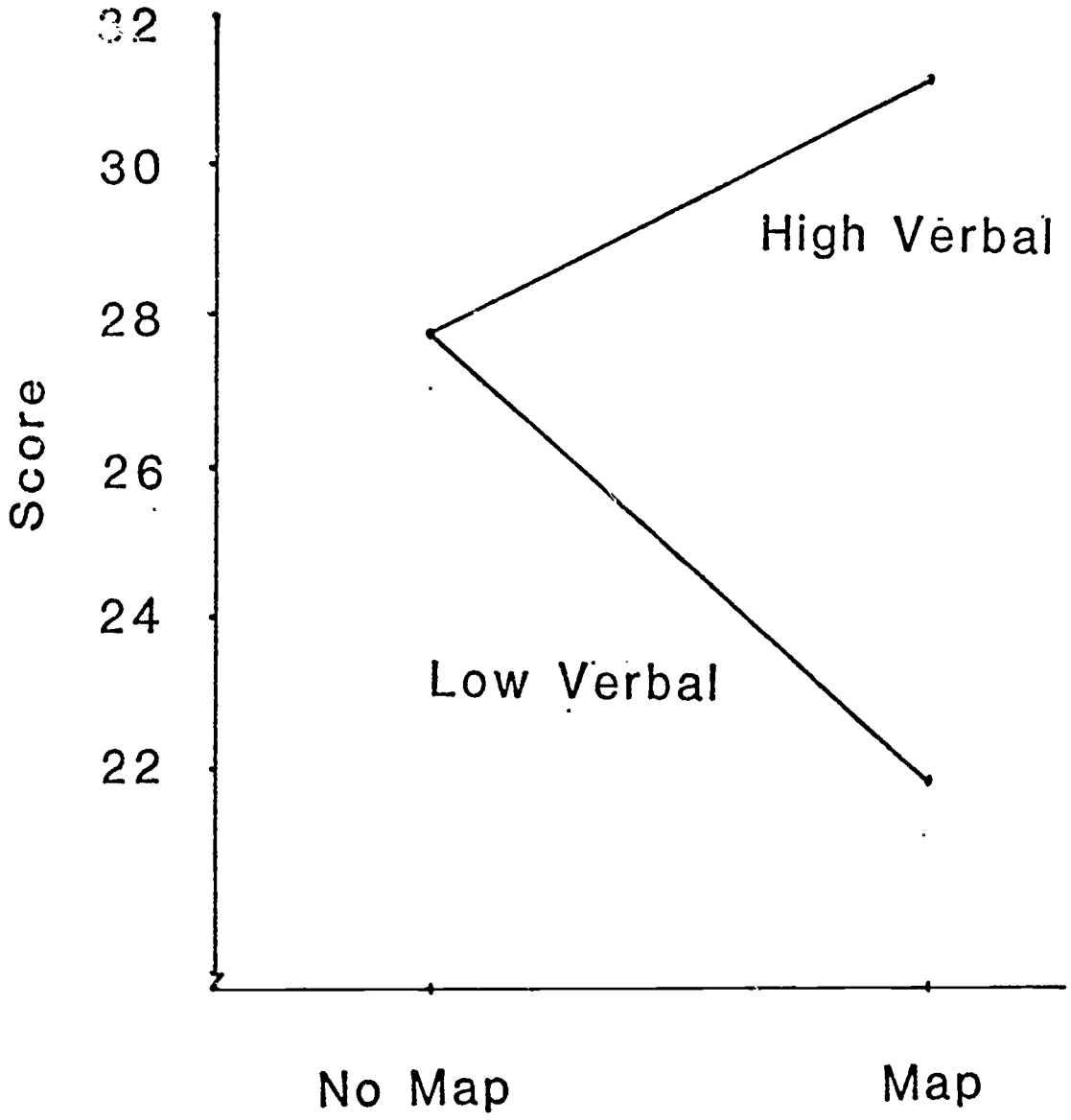
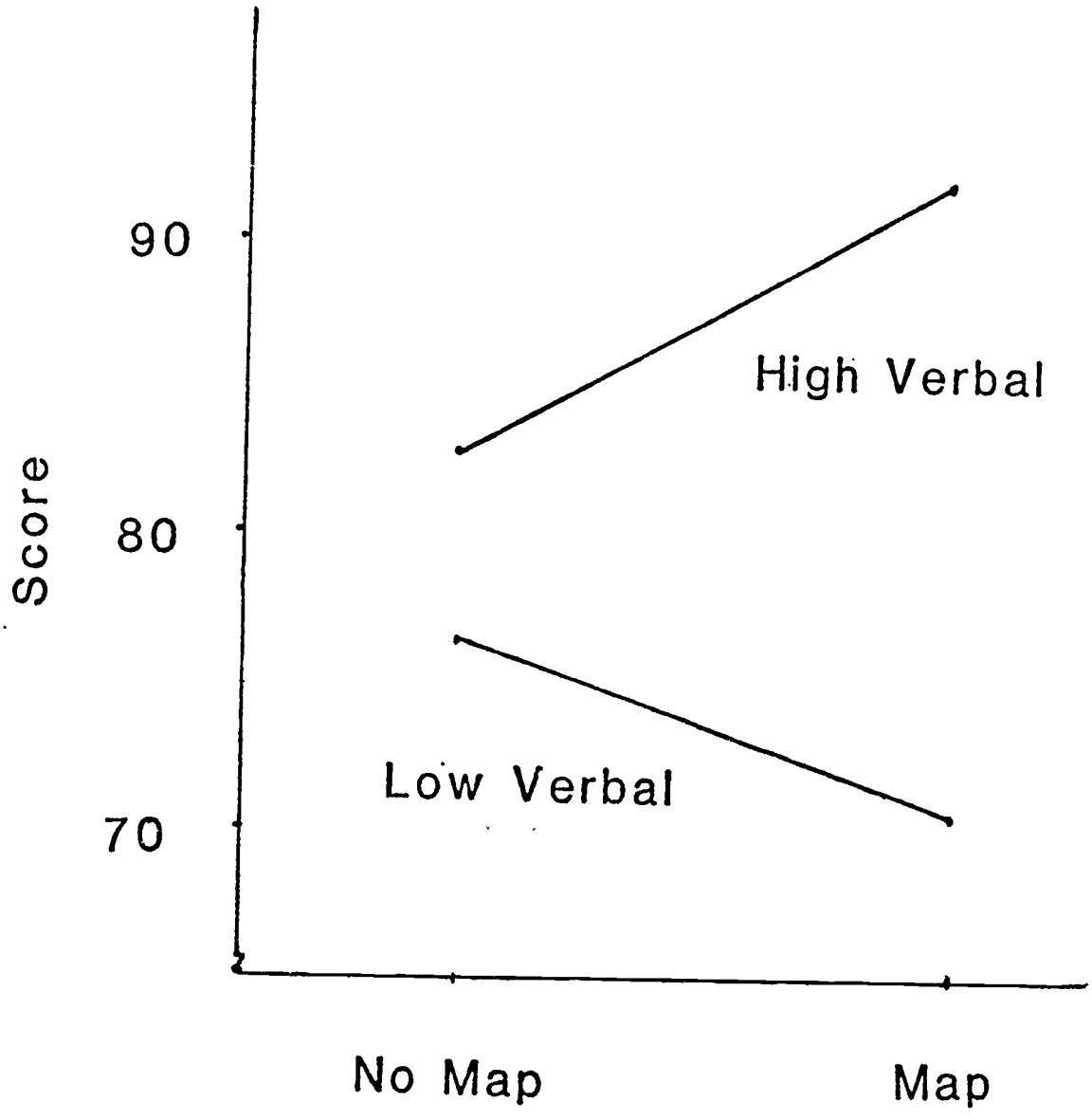
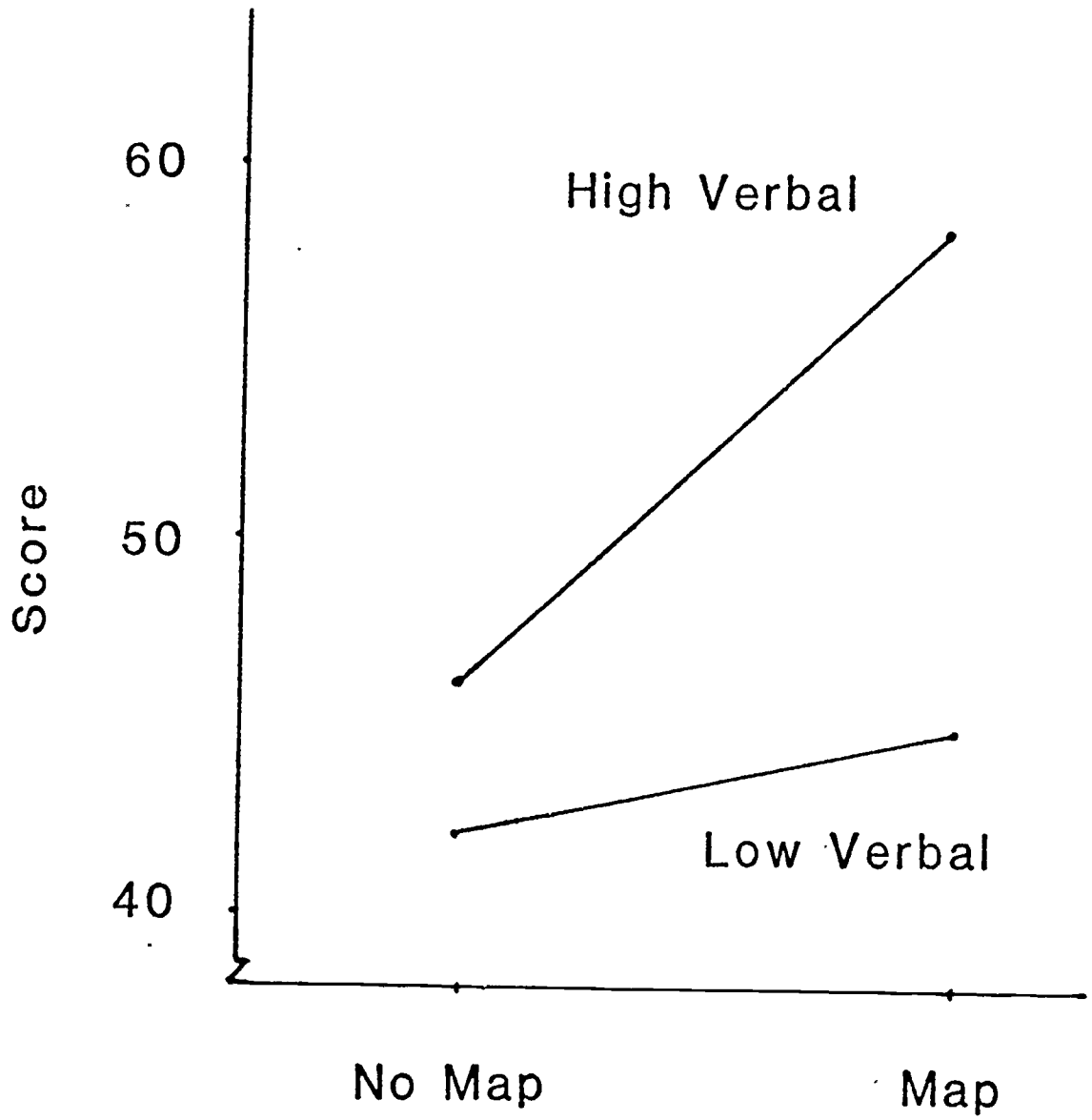


Treatment X Verbal Ability: Literal



Treatment X Verbal Ability:

Total Comprehension



Treatment X Verbal Ability:

Map Related (P=.06)