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AUTHOR Graber, Richard A.; And Others
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ABSTRACT

One hundred forty-three students enrolled in an undergraduate chemistry class were rank ordered by their performance on a test of organizing ability. The median break technique was used to form two groups--good organizers (GO) and poor organizers (PO). Students within each of these groups were then randomly assigned to three treatments. Treatment I students received an advance organizer followed by a learning passage. Treatment II students received the same organizer preceded by the learning passage. Treatment III students received an historical non organizer and the learning passage. No significant differences were observed on treatment or interaction, but GO students achieved significantly higher learning passage scores than PO students. (Author/TS)

ACHIEVEMENT AS A FUNCTION OF EXTERNAL ORGANIZERS
AND ORGANIZING ABILITY

Richard A. Graber Thomas D. Johnsten Robert S. Means
Illinois College Oklahoma State University Cheyney State College

The recent resurgence of interest in the use of various types of subsumers to facilitate learning of new material has resulted in a number of apparently conflicting reports in the literature. Ausubel (1960) found that learning and retention of unfamiliar material could be generally facilitated by providing the learner with an advance organizer that was more general, inclusive, and abstract than the material to be learned. A recent study by Kuhn and Novak (1970) tends to confirm Ausubel's findings. On the other hand, Proger et al. (1970) concluded that while it can readily be demonstrated that advance organizers provide specific facilitation, general facilitation is much more difficult to achieve.

Rothkopf (1966) reported that test-like questions which are presented after reading the relevant text passage have both specific and general facilitative effects, while test-like questions presented before the relevant text passage produced only question-specific facilitative effects. Recently Pyper (1969) reported similar findings. Gustafson and Toole (1969), however, found that adjunct questions failed to produce general facilitation and suggested that the effects found by others were more germane to sequential reading than to careful study.

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The claims of Rothkopf and Ausubel have prompted other researchers to examine the facilitating effects of post organizers. Bayuk et al. (1970) reported no significant difference between advance and post organizers. On the other hand, Bauman and Glass (1969) reported that post organizers were significantly more effective than advance organizers. They also found, however, that the average score of the two organizer groups was not significantly different from that of a non organizer group.

It has been demonstrated that learners with low verbal ability profit more from the use of advance organizers than do learners with high verbal ability (Ausubel and Fitzgerald, 1962), but it has not been demonstrated that the ability of a learner to organize new material on his own is correlated with ability; nor has it been demonstrated that organizing ability is related to a student's ability to utilize either advance or post organizers.

The central focus of this study was twofold. In addition to determining the effect of advance and post organizers on student achievement, an attempt was made to identify an intervening variable that might confound the effect of either organizer. It was proposed that the S's internal ability to organize learning material interacts with an externally administered organizer. More specifically, the following null hypotheses were tested:

1. Differences in types of subsumers (advance organizer, post organizer, and non organizer) will not differentially influence undergraduate chemistry students' levels of performance on a science achievement test.

2. Differences in organizing ability of undergraduate chemistry students will not differentially influence levels of performance on a science achievement test.
3. The science achievement test scores of undergraduate chemistry students will not be significantly influenced by the interaction of organizing ability and types of subsumers.

METHOD

The initial pool of possible Ss for this study was the entire class of 140 students enrolled in six sections of a beginning chemistry class at a large midwestern university. All experimental work was conducted during two laboratory periods by the two graduate assistants who were normally in charge of the laboratories.

During the first phase of the study the S's organizing ability was determined with an organizing test (OT) designed by the principal author. The test consisted of a 750 word science-oriented reading passage and an outline structure to be completed by each S. The Ss were allowed ten minutes to read the passage and, after handing in the passage, they were given an answer sheet which listed the key concepts covered in the passage and an outline structure. Each S was asked to organize the concepts into their proper sequence on the outline. The scores were determined according to an instruction sheet written by the author.

A perfect score was zero (indicating no deviation from the original outline of the reading passage). The scores ranged from 0 to 78, with a median of 23.

The results of the OT were rank ordered and the middle 44 Ss were dropped from the study. The 48 Ss obtaining the lowest scores were classified as good organizers. Correspondingly, the 48 Ss obtaining the highest scores were classified as poor organizers. Each good organizing S was randomly assigned to one of the three treatment groups (advance organizers, post organizers, and non organizers). The assignment was made according to the procedure described by Dayton (1970). In a similar manner each poor organizer was randomly assigned to one of the three groups. This procedure resulted in the formation of six experimental cells of 16 Ss each.

In order to avoid any possible Hawthorne effect, Ss who had been dropped from the study were also assigned to the three treatment groups and participated in all phases of the study. Their scores, however, were not included in the treatment comparisons. Those Ss assigned to the two non organizer cells were arbitrarily assigned to receive the non organizer in either the advance or the post position.

The S's composite ACT scores and GPA's were available and a Pearson r correlation was determined for an aliquot of 40 Ss randomly selected from the entire pool. The r value for OT and ACT was -0.36 , and for OT and GPA the r value was -0.70 . An r value of 0.32 is necessary for significance at the 0.05 level of confidence.

The materials utilized in the second phase of the study were provided by Dr. David Ausubel and were identical to those used in his 1960 study. They included a 500 word advance organizer, a 500 word non organizer, a 2500 word learning passage, and a pool of 45 multiple choice questions. For the present study 32 questions were randomly selected to serve as the criterion measure. The post organizer was identical to the advance organizer except for appropriate grammatical changes in the instructions. Further modifications were made in the timings and instructions to suit local conditions.

The entire second phase of the study was administered during the first half of a regularly scheduled laboratory period approximately one week after the first phase was completed. As a consequence of random assignment approximately one-half of the Ss in each section received the advance organizer sequence (either the advance organizer or the non organizer followed by the learning passage); while the remaining Ss received the post organizer sequence (the learning passage followed by either the post organizer or the non organizer). In order to avoid confusion the materials were color coded. A red cover sheet identified all advance organizer sequence materials, and a green cover sheet identified the post organizer sequence materials. In addition, each S's name was placed on the materials he was to receive.

The red advance organizers and non organizers, and the green learning passages were distributed at the beginning of the laboratory period. Ten minutes later the red materials were collected

and the red learning passages were distributed. After an additional 35 minutes the green learning passages were collected and the post organizers and post non organizers were distributed. Finally, ten minutes later all materials were collected and the criterion measure was distributed. This procedure insured that each S had possession of an organizer for ten minutes and the learning passage for forty-five minutes. The Ss were allowed as much time as they required to complete the criterion measure.

A 3 X 2 multiple analysis of variance design was employed to analyze the results of the learning passage test. Two Ss assigned to experimental groups were absent on the day of the study. The resultant unequal cell frequencies were corrected for by the procedure described by Winer (1962).

To insure that the data would meet the basic assumption of homogeneous variances, Cochran's technique was utilized. The analysis yielded an F ratio of 0.23, a non significant value.

RESULTS

The analysis is summarized in Table I.

 Insert Table I here.

From Table I it is apparent that there were no significant differences among the three types of subsumers. Rejection of the null hypothesis at the 0.05 level of confidence requires an F

ratio of 3.15. Consequently the first null hypothesis was accepted. On the same basis the third null hypothesis was also accepted.

The second null hypothesis was rejected at the 0.005 level of confidence. Good organizers scored significantly higher than poor organizers. The cell means are given in Table II.

Insert Table II here.

CONCLUSIONS

The results of this study indicate that neither advance nor post organizers effectively facilitate the learning of unfamiliar science material by average undergraduate chemistry students. This appears to contradict the findings of Ausubel (1960), who used the same materials to demonstrate that facilitation does occur with senior undergraduates. Several possibilities for this discrepancy exist: (1) The Ss used in Ausubel's study were psychology students and as such were probably less familiar with the contents of the learning passage than were the science students utilized as Ss in the present study. (2) The subject matter of the learning passage was too difficult for the Ss in the present study. (3) The Ss participating in the present study "overlearned" the learning passage and thereby obliterated the facilitating effect of the subsumers. (4) The present findings represent a statistical rarity. (5) The experimental plan

utilized in this study was not sensitive enough to detect experimental differences. (6) The Ss participating in the present study, as students of science, already possessed the appropriate ideational scaffolding and therefore were capable of subsuming the learning passage without the help of external aids. (7) Any effect that the subsumers have on learning is complex and relatively small.

Of these possibilities, only the latter two withstand close scrutiny. The first possibility is rejected because a pilot study with comparable science students who received only the criterion measure yielded a mean score of 7.0 (a mean score of 6.4 would be expected by chance). Evidence that the learning passage was not too difficult is available in the means tables. Ausubel's study produced a grand mean of 15.4. The grand mean for the present study was 17.7. The maximum possible score for Ausubel's study was 36; for the present study the maximum was 32. The third and fourth possibilities are rejected because two replicating studies utilizing identical techniques except for study times produced results consistent with those of the present study. The fifth possibility is unlikely since both a homogeneous population and a relatively powerful design were utilized.

In his study with Fitzgerald (1961), Ausubel states that "organizers appear to be effective only in those instances where existing discriminability between the two sets of ideas is inadequate as a consequence of the instability or ambiguity of the established concepts." It is assumed that this observation applies to post organizers as well as to advance organizers.

In the present study the organismic variable examined was organizing ability rather than either general ability or achievement. It was demonstrated, however, that organizing ability correlates with both ACT and GPA. It was also demonstrated that poor organizers were not differentially benefited by either advance or post organizers. This was the result expected in view of the above discussion. Whether a S were a good or poor organizer would not affect his performance on an organizer-assisted task when, in fact, the organizer provided no ideational scaffolding for him. However, a good organizer would be expected to perform better than a poor organizer on any task, whether organizer-assisted or not, because of the high correlation between organizing ability and other abilities.

The results of this and similar studies completed recently seem to indicate that the general facilitating effect of subsumers is easily confounded by extraneous variables. While specific facilitation has been reported a number of times, general facilitation by a subsumer has been much more elusive. Bayuk et al. (1970), in evaluating their own study as well as others reported in the literature, stated, "When the discussion refers to the incidental or general facilitative effects of organizers, there are usually no positive results." They concluded by observing, "If one adheres to Ausubel's precise definition of the term 'organizer' then much of the work in this area must be reinterpreted."

The composite results of recently completed research seems to indicate that organizers might be expected to facilitate learning under the following circumstances: (1) When the organizer contains information that was not previously part of the learner's cognitive background, but is of such a nature that it can either be learned and then transferred to the learning passage as a principle, or it can mobilize other information in the learner's cognitive background to transferable-principle status. (2) When the learning passage is completely unfamiliar to the learner. (3) When the difficulty level of the learning passage approaches but does not exceed the upper limit of the learner's capability. (4) When the circumstances are such that the learning passage cannot be studied thoroughly. Since it is difficult to meet all of these conditions concurrently, it is quite possible that the facilitating effect of a single subsumer will be obliterated.

A further problem is associated with the fact that an organizer is a very personal thing. By definition, an organizer is an organizer when it facilitates learning. If it does not facilitate learning, it is a non organizer. It is quite possible and very probable that what serves as an organizer for one individual may be a non organizer for another individual.

In the light of the evidence presented here and in other recent studies, it appears that the effects of subsumers on learning are complex and relatively small when compared to other environmental and organismic variables. It is suggested, however, that continued research in this area should be undertaken to determine

the extent of the effect of advance and post organizers on learning, the conditions under which organizers facilitate the learning process, and the nature of any organismic variables that might interact with external organizers.

Table I

Source	SS	df	MS	F
Treatments	12.53	2	6.26	0.30
Levels	230.99	1	230.99	10.97 ***
Interaction	111.89	2	55.94	2.66
Error	1853.71	88	21.06	
Total	2209.11	93		

*** $p < 0.005$

Table II

	Advance	Post	Non	Sum
Good	19.93	18.13	19.80	19.26
Poor	14.56	17.94	15.88	16.23
Sum	17.16	18.03	17.77	17.66

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