Syntactical Analysis of Written Advance Organizers

Stephen F. Olejnik and John M. Newell

University of Florida

Extensive research has been conducted on the effects of advance organizers on the learning and retention of difficult learning material. Recently, 135 empirical studies were reviewed (Luiten, Ames & Ackerson, 1980) using meta-analytic techniques (Glass, 1979). The results of this analysis indicated that advance organizers have a small but consistent facilitative effect on both learning and retention. The theoretical explanation of how and why advance organizers aid learning and retention has been provided by Ausubel (1960, 1968, 1978) and Mayer (1979). Some confusion however remains regarding the definition and practical procedures to follow in constructing an advance organizer.

Ausubel (1978) has defined advance organizers as "introductory material at a higher level of abstraction, generality and inclusiveness than the learning passage itself" (p. 252). Critics have charged that this definition is vague and Barnes and Clawson (1975) suggest that Ausubel's definition is non-operational. Responding to these critics Ausubel has argued for a distinction between operational and procedural definitions. Procedurally Ausubel suggests that advance organizers can be identified by comparing the organizer material with the learning material. Or using a more sophisticated methodology judges could be asked to examine the materials and determine whether the organizer material meets "its purported criteria in relation to the learning passage itself" (Ausubel, 1978, p. 252). Researchers examining the

effects of these instructional aids however have not made an effort to study in any detail the relationship between the syntactical structure of advance organizer material and the learning passage itself. Nor have there been efforts to determine whether higher levels of abstraction, generality and inclusiveness are the important characteristics of advance organizer material which distinguish it from the learning passage itself. Rather these descriptors are generally assumed to be relevant and accepted as key features of advance organizer material. In his early work with introductory material Ausubel (Ausubel, 1960; Ausubel and Youssef, 1963) suggested that his materials meet his operational definition but provided no empirical evidence of support.

The purpose of the present investigation was to examine the relationship between an advance organizer and a learning passage in terms of levels of abstraction, generality and inclusiveness.

Subjects

A sample of 42 graduate and undergraduate students enrolled in classes in the college of education at the University of Florida participated in the investigation. These students were volunteers who had agreed to participate in the study after they had been given a brief description of the nature of the activities that were being requested. The volunteers were not aware of the true nature of the project. The specific procedures followed are described in a later section. Participation was not mandatory and students received no extra credit for their assistance in the study.

Prose Passages

Three prose passages which had been previously used in an advance organizer study (Kuhn & Novak, 1971) were obtained for the present

investigation. In the earlier study the researchers randomly distributed to a group of undergraduate students either an historical or advance organizer passage and a difficult learning passage. All three passages discussed the process of homeostasis and each consisted of approximately 800 words. The authors had described the advance organizer as "an introductory passage which supplied background material for the learning passage which was presented at a higher level of abstraction, generality and inclusiveness than the learning passage itself" (Kuhn & Novak, 1971, p. 312). Evidence supporting the statement was not provided. The results of that study indicated that the advance organizer material had significantly increased learning and retention of the learning passage when compared with the historical passage.

Instrument

A twenty item semantic differential scale which had been previously developed (Voss & Newell, 1977) for the purpose of rating prose passages along the abstraction, generality and inclusiveness dimensions was used in the investigation. Each item on the scale consisted of a single pair of adjectives which were opposite ends of a continuum. The continuum itself was divided into seven segments. Directionality of the adjective pairs was randomly varied throughout the scale. Newell and Olejnik (in press) had previously used the scale to evaluate the ratings of three different prose passages by three independent samples of raters. The response patterns of each group was factor analyzed using a principal components solution. Each of the three solutions resulted in the identification of three significant factors. The factor solutions were then rotated using both the equimax and varimax rotation procedures with the

results indicating very little difference from the unrotated solution. The unrotated factor solutions were then compared between the three groups. As a result of the analysis it was concluded that the instrument provided a relatively stable factor structure across the different prose passages.

Procedure

Since the ratings of the passages could be affected by the order in which they were read, six sets of materials corresponding to all possible order combinations of the passages were developed. These sets were randomly distributed to student volunteers. Participants were asked to read each passage and rate it in relation to the others using the twenty item semantic differential scale. The passages were simply labeled A, B and C without further identification. Students were asked to use these labels to place the passages along each of the continua on the rating scale. Since the amount of time needed to complete the ratings varied, students were allowed to take the materials home but were asked to return the material with their ratings within two days.

Results

Student ratings were scored and analyzed along two dimensions: first in a replication of an earlier study (Newell & Olejnik, in press), the stability of the factor structure associated with the scale was examined; second, the average ratings for the three passages were compared to determine whether the advance organizer was perceived differently from the learning passage.

A principal components factor analysis without rotation was computed for each of the three prose passages using the FACTOR subprogram

of the SAS (1979) computing package. The factor solutions were not rotated because the previous research results with the instrument had indicated that rotated solutions were not significantly different from the unrotated solution (Newell & Olejnik, in press). Furthermore by considering the unrotated solution the results of the present investigation could be compared to the findings of previous research with the scale. Each solution resulted in six factors, three of which appeared meaningful and interpretable. The loadings on each of the three factors for each of the passages are reported in Table 1. The stability of these factor weights across the passages was estimated by calculating the coefficient of congruence. Table 2 reports the coefficients of congruence between factor loadings obtained on the three passages. These results indicate that the first factor weights across the three passages were very similar. For the second factor the weights for the advance organizer and the historical passages were moderately similar, but the loadings for the historical and learning passages as well as the historical and advance organizer passages were similar but having opposite signs. Finally with the third factor only moderate agreement was obtained between the historical and learning passages but almost no agreement among the weights of the other passage combinations. Coefficients of congruence between factor loadings obtained in the present study with those obtained in the previous investigation (Newell & Olejnik, in press) reflected similar results. For the first factor, the coefficients ranged between .79 and .89, a considerable degree of similarity. For the second factor the coefficients ranged between -.59 and .40 and with the third factor the coefficients ranged

Table 1

Factor Coefficients for the First Three Factors of the

Historical, Learning and Advance Organizer Prose Passages

	Factor 1			Factor 2			Factor 3		
	Historical	Learning Passage	Advance Organizer	Historical	Learning Passage	Advance Organizer	Historical	Learning Passage	Advance Organizer
Difficult-Easy	.7117	.5199	.5153	.0885	-.2264	-.2672	.0626	-.3236	-.2454
Abstract-Concrete	.5713	.4150	.6072	.3041	.4961	-.4385	-.3197	-.2096	.0200
Ambiguous-Clear	.5002	.4672	.8070	.0062	-.2856	.1927	.5766	.2734	-.1573
Incoherent-Coherent	.7596	.7187	.8377	-.1017	.0738	-.0736	.0383	-.0138	.1263
Passive-Active	.4775	.6101	.6275	.3213	.3364	.1241	.2382	.2848	-.1577
Semantic-Sensory	.1535	.5256	.3718	.5046	-.3778	.6656	-.4856	-.2483	.2105
Verbal-Nonverbal	.3627	.1295	.1640	.5333	-.3997	.3665	.3287	-.0435	.4545
Dull-Interesting	.6886	.7204	.6467	.0266	-.0554	.1280	.0985	-.2247	-.5443
Conceptual-Descriptive	.3059	.1629	.3654	.1037	.4963	-.6336	-.3952	-.5576	.0344
Rote-Meaningful	-.3820	-.3485	-.0164	.5030	.1693	.4452	.0792	.5440	-.5648
Useless-Useful	.7622	.7197	.7936	-.1461	.1685	-.0797	.1737	.0868	.0230
Linguistic-Perceptual	.0850	.1669	.0461	.7049	-.7157	.7720	.2471	.2852	.2094
Indirect-Direct	.5466	.7166	.7067	-.3543	.0254	.0167	-.3623	.1054	-.0581
Obscure-Vivid	.8097	.6707	.8991	-.1201	.0561	.0396	-.1886	-.2501	-.0389
Subjective-Objective	-.0963	.1693	-.1324	-.4492	.6815	-.0721	.5155	.5430	.6131
Symbolic-Pictorial	.6359	.4667	.3244	.2143	.3407	-.2143	.0669	-.2208	.0090
Wordy-Concise	.7300	.7031	.8070	-.1721	-.1013	-.0109	.1055	.1963	.3880
General-Specific	.4631	.6221	.6441	-.5456	.0902	-.1041	-.0502	.3830	.3335
Hinders-Helps	.8429	.8497	.7980	.0710	-.2050	.2635	-.1019	.1389	-.1268
Confuses-Clarifies	.8629	.8363	.9051	.0423	-.1045	.0060	-.0208	.0491	-.0563
Proportion of variance explained	38.4	34.6	32.8	11.3	11.3	11.4	8.5	7.8	8.7

Table 2

Coefficients of Congruence between Factor Weights for the Historical, Learning and Advance Organizer Prose Passages

	Factor 1			Factor 2			Factor 3		
	Historical	Learning	Advance Organizer	Historical	Learning	Advance Organizer	Historical	Learning	Advance Organizer
Historical	1	.97	.96	1	-.40	.53	1	.59	.12
Learning		1	.97		1	-.69		1	.16
Advance Organizer			1			1			1

between -.33 and .26. These results indicate that the weights for the first factor are very stable across both the passages and across users of the scale. The second and third factors however appear to be considerably less than stable.

Student perceptions of the prose passages were obtained by summing the seven point scales across the twenty adjective pairs. A high rating indicated that the student viewed the passage as easy, concrete, clear, coherent, etc., while a low rating indicated that the passage was viewed as difficult, abstract, ambiguous, incoherent, etc. The mean ratings for each passage under each order of presentation are reported in Table 3. A split-plot analysis of variance for repeated measures

Table 3

Means and Standard Deviations of Passage Ratings by the Order of Presentation

	Passage A		Passage B		Passage C	
Order	Historical		Learning Passage		Advance Organizer	
ABC	61.14	(16.05)	96.29	(20.82)	110.42	(8.44)
BCA	98.14	(16.99)	76.43	(15.25)	84.43	(14.74)
CAB	93.14	(19.45)	91.14	(27.95)	87.14	(32.89)
ACB	56.42	(19.67)	94.00	(14.58)	108.71	(8.62)
BAC	64.43	(23.40)	92.00	(20.97)	93.14	(19.67)
CBA	67.14	(19.26)	91.29	(24.06)	88.71	(17.41)
	73.40		90.19		95.43	

was calculated using the P2V subprogram of the BMDP (1977) computing package. Tests for statistical significance were made for differences between passages, the order of presentation and the passage by order interaction. The test for the order effect resulted in an F statistic equaling 1.33 which was not significant at the .05 level. Across all orders the mean rating for the historical passage was 73.4, for the learning passage it equaled 90.19, and for the advance organizer it equaled 95.43. The resulting F statistic equaled 10.5 which was significant at the .0001 level. The test for the interaction resulted in an F ratio equaling 3.03 which was significant at the .003 level. The magnitude of the differences between the ratings of the three passages therefore was dependent on the order of presentation. Figure 1

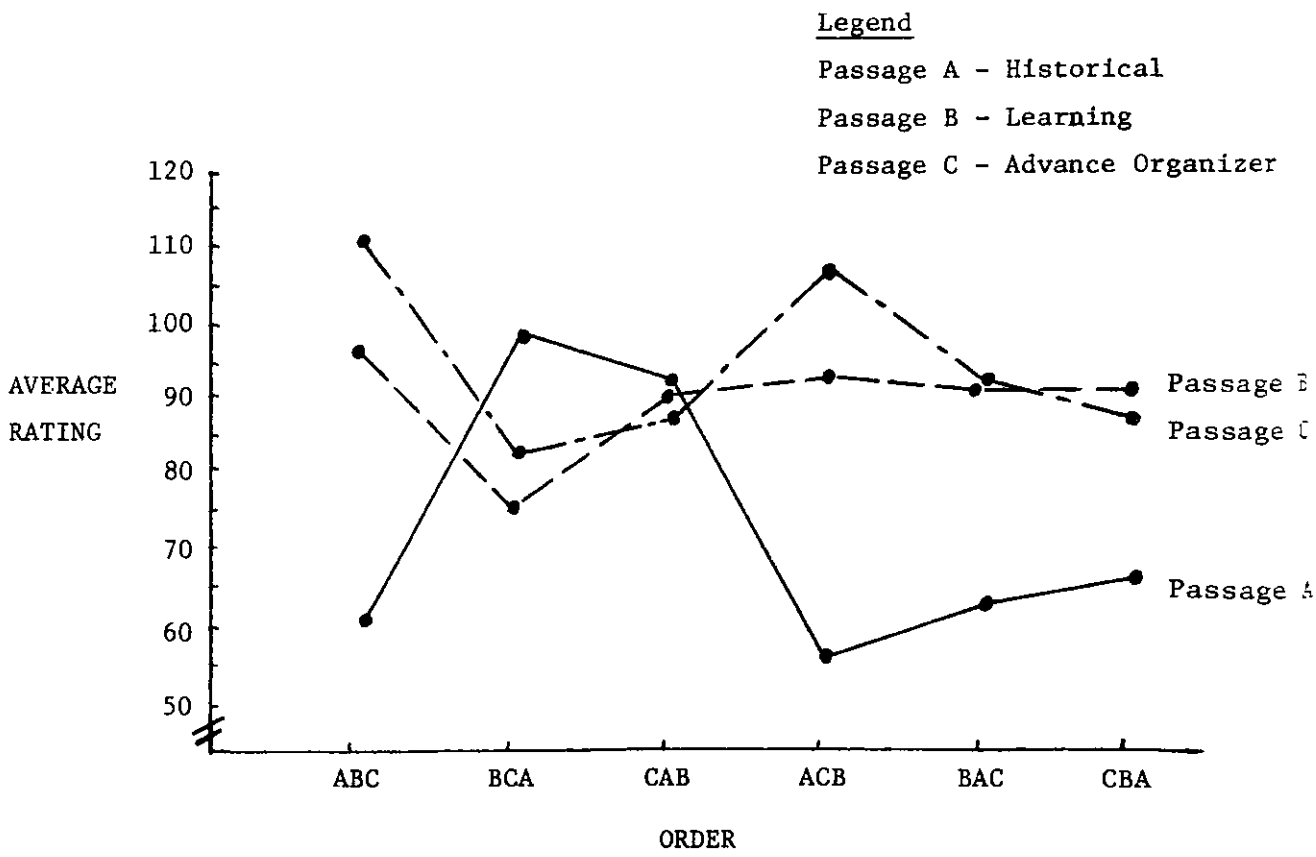

Figure 1 - Plot of cell means for the passage by order interaction

pictorially represents the differences between the ratings of the three passages for each of the six orders of presentation. These results show that regardless of the order of presentation the advance organizer and the learning passage were perceived similarly. The degree of similarity however varied depending on the order of presentation. With the exception of two orders (BCA and CAB) the historical passage always received a lower rating than either the learning or the advance organizer passage.

Since the order of presentation has some effect on the rating passage, three further analyses taking order into consideration were conducted. The ratings of the three passages were compared when they were presented first, second and third using a one way analysis of variance strategy. The GLM subprogram of the SAS (1979) computing package was used to calculate the F statistic and the corresponding probability level for each of the analyses. The results of these analyses are reported in Table 4. When presented first (ABC, ACB) the historical passage received an average rating of 58.79 while the learning passage (BCA, BAC) had a mean rating of 84.21 and the advance organizer (CAB, CBA) had an average rating of 87.93. The resulting F ratio equaled 8.01 which was significant at the .001 level. When presented first the learning and advance organizer materials were rated very similarly and significantly higher than the historical passage. A similar analysis was conducted comparing the ratings of the passages when the three passages were presented second or third. In neither of these analyses were the differences significant at the .05 level, thus indicating that all three passages were perceived similarly. In all three analyses however the advance organizer

material did receive higher ratings than the other passages but the difference was never very large compared to the learning passage.

Table 4

Mean, Standard Deviations, F-ratios and Probability Levels for the Three Passages When Presented First, Second and Third

	Historical	Learning Passage	Advance Organizer
Presented First	58.79	84.21	87.93
	(17.42)	(19.48)	(25.40)
	F = 8.01	PR > F .0012	
	Historical	Learning Passage	Advance Organizer
Presented Second	78.79	93.79	96.57
	(25.48)	(21.78)	(17.13)
	F = 2.71	PR > F .079	
	Historical	Learning Passage	Advance Organizer
Presented Third	82.64	92.57	101.78
	(23.73)	(21.47)	(17.08)
	F = 2.92	PR > F = .065	

Discussion

The present investigation examined the relationship between an advance organizer and a learning passage in terms of their levels of abstraction, generality and inclusiveness. Materials which had been previously used in an advance organizer study were obtained and

distributed to a sample of students who judged the prose passages along the abstraction, generality and inclusiveness dimensions. In the earlier study the researchers had found that the advance organizer had facilitated the learning and retention of the learning passage to a greater extent than the historical passage. The results of the present study indicated that when the judges were asked to compare the passages along Ausubel's operational definition of an advance organizer, they perceived very small differences between the advance organizer and the learning passage. There were however significant differences in the perceptions of the historical and the other two prose passages. These results can be interpreted as having two important implications for both past and future research on the effects of advance organizers.

First the results indicate that if Ausubel's operational definition is appropriate, greater care must be given to the development of advance organizer material. The results also raise some question on the interpretation of previous research efforts on the effects of advance organizer material. The effects that have been observed in the past attributed to advance organizer material as defined by Ausubel should in fact be attributed to the effects of prose overview material. In distinguishing between advance organizer material and overviews Ausubel suggested that the overview was written at the same level of abstraction, generality and inclusiveness as the learning material. The results of the present study indicate that the learning and advance organizer materials were perceived as similar thus suggesting that what was called an advance organizer may be better thought of as an overview.

A second implication of the results of the study is that Ausubel's operational definition of an advance organizer as being at a higher level of abstraction, generality and inclusiveness is not very useful. These descriptors may not reflect on the important dimensions which distinguish the advance organizer material from the passage to be learned. The important dimensions need to be identified in order to consistently develop helpful instructional aids.

References

Ausubel, D. P. The use of advance organizers in the learning and retention of meaningful verbal material. Journal of Educational Psychology, 1960, 51, 267-272.

Ausubel, D. P. Educational psychology: A cognitive view. New York: Holt, Rinehart and Winston, Inc., 1968.

Ausubel, D. P. In defense of advance organizers: A reply to the critics. Review of Educational Research, 1978, 48, 251-257.

Ausubel, D. P., & Youssef, M. The role of discriminability in meaningful parallel learning. Journal of Educational Psychology, 1963, 54, 331-336.

Barnes, B. R., & Clawson, E. U. Do advance organizers facilitate learning? Recommendations for further research based on an analysis of 32 studies. Review of Educational Research, 1975, 45, 637-659.

BMDP. Biomedical computer programs: P-series. Los Angeles: University of California Press, 1977.

Glass, G. V. Integrating findings: The meta-analysis of research. In L. S. Shulman (Ed.), Review of research in education (Vol. 5). Itasca: Peacock, 1978.

Kuhn, D. J., & Novak, J. D. A study of cognitive subsumption in the life sciences. Science Education, 1971, 55, 309-320.

Luiten, J., Ames, W., & Ackerson, G. A meta-analysis of the effects of advance organizers on learning and retention. American Educational Research Journal, 1980, 17, 211-218.

Mayer, R. E. Can advance organizers influence meaningful learning? Review of Educational Research, 1979, 49, 371-383.

Newell, J. M., & Olejnik, S. F. Imagery/concreteness attributes of advance organizers. Journal of Experimental Education, in press.

SAS. Statistical analysis system: User's guide. Raleigh, North Carolina: SAS Institute, 1979.

Voss, B. X., & Newell, J. M. An attempt at measuring sensory and imagistic qualities of written passages. Paper presented at the Florida Educational Research Association meeting, St. Petersburg, Florida, 1977.