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ABSTRACT

Effects of verbal concept formation training and stimulus enhancement on verbal abstracting were studied in 48 delinquent, mentally retarded, adolescent boys (age range 15 to 18 years) who resided in a state institution. Two two-word similarities tests were used to measure verbal abstraction in the pretest session. The first condition of stimulus enhancement consisted of two five-word similarities tasks, and the second stimulus enhancement condition consisted of two two-word similarities tasks. Four tests were used to measure verbal abstraction in the posttest period. Identical instructions were given for pretests and posttests. Research results indicated that apparent verbal abstracting deficit in cultural-familial retarded individuals resulted from a deficit of information input. Verbal abstraction scores were raised by increasing the number of exemplars in a verbal abstraction task. It was found that concept training procedures designed to familiarize the subject with concept names and exemplary words aided future performance on tasks utilizing the same concepts with different exemplars. Results indicated that training did not aid performance on a task with different concepts. Appended were a review of pertinent literature and a listing of the concepts and tests used in the experiment. (CB)

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by

Alexander J. Tymchuk

Department of Psychology

George Peabody College for Teachers

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FOREWORD

Several lines of thought converge in the research reported in this paper. The first of these is that procedures that have proved to be useful in the investigation of behavior in the area of psychopathology should also be useful in behavioral research in mental retardation. The second major set of ideas is that persons who are diagnosed as cultural-familial retarded may have more ability than is readily apparent to perform tasks that require verbal abstracting operations, and that their apparent deficiency in such tasks may be masked by an inefficiency in information-input channels. Previous work in the Peabody laboratory has indicated that stimulus enrichment procedures can help the cultural-familial retarded person to perform at near-normal levels on verbal abstracting tasks under specified conditions. The research reported in this paper extends that concept and investigates another means of improving the performance of mildly retarded persons on tasks that require verbal abstracting ability. This investigation is the fourth in a series from the Peabody laboratory, and we expect the series to continue.

The particular population chosen for this study was institutionalized retarded delinquent boys. Since these subjects were residents of a state correctional facility, their performance on these tasks may lead one to question why some mildly retarded persons are able to live in the community and to attend public schools, while others are required to live in residential institutions for mentally retarded persons, and still others are confined in correctional facilities.

The Peabody group has thought that it is highly important to investigate the parameters of mildly retarded persons' proficiency in verbal abstracting tasks, since such tasks appear to constitute the core of academic curricula and of many problems of adaptive behavior outside the school setting. As the series of studies continues, further research publications will be available in the IMRID Papers and Reports series.

H. Carl Haywood, Director
Institute on Mental Retardation and Intellectual Development

Some developmental theorists (e.g. Luria, Bruner) point to language as the main means for enabling the young child to move from concrete, associational forms of learning and thinking to more complex and abstract forms of thought. In the same vein, the lack of appropriate language in children from a culturally-disadvantaged environment has often been associated with the poor abstracting skills found in these children (Bereiter and Englemann, 1966; Deutsch, 1965). The association between poor language and poor abstracting skills suggests that stimulus deprivation may have its greatest consequences upon verbal language processing (Fowler, 1970). The cognitive deficit frequently observed in socially-disadvantaged populations may have its primary roots in the effects of poor language environments upon the development of abstracting skills. Discovery of this association and identification of the extent of the cognitive deficit is not enough; what is also required is the identification of the conditions under which the cultural-familial retarded child can acquire more efficient learning processes. Particular emphasis should be placed on improving verbal abstracting ability as a means for developing a more general learning strategy.

In the case of the cultural-familial retarded child who has been raised in an unstructured, verbally unstimulating environment, his poor verbal abstraction may not be indicative of a basic cognitive incapacity, but of an inefficient means of processing incoming stimuli. This inefficient processing may be a result of a lack of exposure to activities calling for either categorizing stimuli, especially on a higher level of abstraction as seen on standard intelligence or achievement tests, or to activities calling for the use of appropriate verbal labels not usually used in an intellectually restricted environment. It would be expected then that the cultural-familial retarded person may benefit from concept training procedures that attempt to overcome the language deficit. In this same line, it is apparent that it is difficult to elevate verbal abstracting performance by concept training procedures in retarded children who have demonstrable central nervous system damage. These children probably have a deficit in cognitive capacity as a result of the cerebral insult. Gordon and Haywood (1969), for example, found that whereas the abstraction scores of the cultural-familial group were significantly raised under the enrichment procedure, no difference occurred for the organically retarded group.

With regard to the cultural-familial retarded person, if we take the position that he has an intact cognitive capacity to make verbal abstractions at a higher level than he actually does as a result of an inefficient processing of information, a profitable strategy to improve his ability would be to train him in more efficient ways to process information.

Some of the conditions under which the cultural-familial retarded person can learn and generalize verbal abstractions have already been delineated, usually in studies involving the use of associative clustering, sorting or similarities tasks as measures of verbal abstracting ability. In these studies verbal abstraction is most broadly characterized as being the use of correct verbal categories in the reduction of information.

A complete review of the use of associative clustering, sorting and similarities tasks with retarded persons is attached in Appendix A. It is sufficient here to outline the strategies in each of these areas that have already proven efficacious in improving the poor verbal abstracting performance of retarded persons in general and the culturally retarded person in particular. Two general strategies have been used in these studies. One strategy has been to give the subject practice with either the concept or the concept verbal label to be used to mediate performance on a subsequent similar or dissimilar conceptual task (e.g. associative clustering--Bilsky and Evans, 1970; sorting--Prehm, 1966a). The second strategy has been used primarily with a similarities task by increasing the number of exemplars for each concept (e.g. Gordon and Haywood, 1969).

Several summary statements can be derived from the associative clustering literature regarding the first strategy:

1) Practice with the names of categories and the words within these categories significantly improve retarded person's recall of the same words in random lists (Madsen and Connor, 1968).

2) Retarded persons tend to use clustering just as much as non-retarded persons and material presented in clusters helps to improve recall over that on random lists (Bilsky and Evans, 1970).

3) No transfer of training to a new list with new categories occurred with retarded persons if the time between training and testing is as long as a week (Gerjuoy and Alvarez, 1969).

Several points relevant to the first strategy can also be derived from the sorting literature:

1) Giving cultural-familial retarded persons practice with the verbal labels of categories improves their sorting of perceptual (e.g. size) and human (e.g. size, age) categories, but not of use (e.g. heating) categories (Stephens, 1966b).

2) Pre-training on one sorting task significantly improves performance on a transfer task (Prehm, 1966a).

3) Pre-training on concept names after testing for chance performance (i.e., setting a floor) also significantly

improves performance on a transfer task. Further, those retarded persons who show negative transfer in their performance have been institutionalized longer than have those who do not (Hamilton, 1966).

From the studies using similarities tasks, several conclusions can be supported:

1) Training on concept formation significantly improves detecting such concepts in a similarities test, but does not aid performance with foil items, i.e., non-trained concepts (Miller and Griffith, 1961).
2) In a three-word similarities test at least two of the words must be adequately defined in terms of a suitable abstraction before the subject will perceive the similarity (Griffith and Spitz, 1958; Griffith, Spitz and Lipman, 1959; Griffith, 1960).

The studies in which the first strategy mentioned above (i.e. familiarization training on concepts and concept names) has been followed, indicate a facilitating effect upon the verbal abstraction performance of retarded people. Those studies in which a stimulus enhancement procedure has been used also offer support for a facilitating effect.

In clustering:

1) Increasing the number of exemplars per list to two improves a retarded person's recall by 50 percent so that his performance does not differ from that of an

equal-MA non-retarded person (Gerjuoy, Winters, Pullen, and Spitz, 1969).

In sorting:

1) Stephens (1966) concluded that retarded persons do have some concepts available to them, but that these concepts are poorly delineated, i.e., not all the exemplars are identified.

In similarities tests:

1) Increasing the number of exemplars per concept in a similarities test significantly improves the performance of the cultural-familial retarded person (Gordon and Haywood, 1969; Foster, 1970).

One or the other or both of these strategies might be beneficial as a training strategy by which the cultural-familial retarded person's poor verbal abstracting performance might be improved. Although the first strategy is not generally termed a stimulus enhancement procedure, it can be seen as such since it gives practice in abstracting. The second strategy is also a stimulus enhancement procedure, but with probably less generalization effect. Concept training (the first strategy) may improve performance on other concept tasks and thus may be more economical and beneficial since it provides the person with a strategy or set with which to attempt similar tasks. Stimulus enhancement procedures (the second strategy) may improve performance on only those concepts in which an increased number of examples is found and may not provide any generalized strategy. However, in the Gordon and Haywood (1969) and Foster (1970) studies in particular, stimulus enhancement was not seen as being within an educational conceptual framework, but rather as being within a conceptual framework that emphasized alleviation of an information input deficit.

The literature cited above offers some alternatives for improving verbal abstracting performance in retarded persons by giving practice with concept names or with the actual concepts. Whether or not this practice transfers to performance on an untrained concept task is equivocal. Increasing the number of exemplars per concept is another alternative, but whether such a strategy will help performance on another concept task is as yet untested. In addition, whether or not the two strategies combined are more effective than each alone is unknown. Finally, concept training procedures have been shown to be effective in raising the levels of performance of retarded people on associative clustering and sorting tasks, but only in one study (Miller and Griffith, 1961) have they been used with a similarities task, and in that study four concepts (small, large, white, and round) were used.

This study was designed to explore these questions. The general strategy was to select institutionalized delinquent boys who were within the intelligence test limits designated as being in the cultural-familial range. These boys were tested on one or another or on both pre-treatment lists of verbal similarities under standard conditions (i.e., two words). They were then trained on one or another of the sets of concepts and were subsequently tested on the post-treatment similarities tasks under enhanced (i.e., five words) or unenhanced (standard two-words) conditions. The experimental design is depicted in Table 1.

The following relationships were expected to emerge from this design:

1) Subjects will have greater gains in verbal abstraction scores (similarities tests) in the stimulus enhanced versus the non-enhanced conditions.
2) Subjects trained on one list of words of one set of concepts will have higher scores on another list of the same concepts than will untrained subjects.
3) Subjects trained on one list of words of one set of concepts will have higher scores on a list of different concepts than will untrained subjects.
4) Subjects receiving training will have higher post-treatment abstracting test scores than pre-treatment test scores.
5) Subjects receiving training on concepts will have higher abstracting test scores than will subjects receiving stimulus enhancement.
6) Subjects receiving both training and stimulus enhance-

Table 1

Experimental Design

Pre-Treatment Test	Treatment	Number of Exemplars	Order of Post-Treatment Tests	Post-Treatment Test	
				Trial A	Trial B
List I (standard 2-word)	Trained on List I concepts	5-word	1	List I	List II
			2	List II	List I
		2-word	1	List I	List II
			2	List II	List I
List II (standard 2-word)	Trained on List II concepts	5-word	1	List I	List II
			2	List II	List I
		2-word	1	List I	List II
			2	List II	List I
List I + List II	No Training	5-word	1	List I	List II
			2	List II	List I
List II + List I		2-word	1	List I	List II
			2	List II	List I

ment in combination will have higher abstracting test scores than will subjects receiving either procedure alone.

7) There was no reason either from the review of the literature or the empirical data to expect that subjects receiving one five-word post-treatment task would have higher scores on a second five-word post-treatment task, but this relationship was to be examined.

Method

Subjects

Forty-eight residents from a state institution for delinquent adolescent boys between the ages of 15 and 18 were selected as subjects. These subjects were selected from a pool of 119 whose test scores on either the Wechsler Intelligence Scale for Children (WISC) or the Wechsler Adult Intelligence Scale (WAIS) were between 60 and 84, that is, within the range of mild and moderate mental retardation. These individual IQ tests had been given recently as part of a research project on retarded adolescent offenders. Because usual residence in this institution is brief, 35 of these boys had already been released since the IQ tests had been administered; in addition, several others were ill, in isolation, or otherwise unavailable, so that the 48 subjects were taken from a final pool of 60. In addition, one boy left the institution and a second boy was placed in isolation during the period of the experiment, and these were unsystematically replaced. Characteristics of the subjects are reported in Table 2. There were no significant differences among the three treatment groups in mean CA, Verbal IQ, Full Scale IQ, or in similarities subtest scaled scores. The List II and NT-C groups differed significantly on mean Vocabulary scaled scores ($t=1.771$, 30 df, $p<.05$, two-tailed) and on Performance IQ ($t=2.51$, 30 df, $p<.01$, two-tailed). The subjects were randomly assigned in equal numbers to one of the three treatment groups with 48 subjects in all.

Tests

Two lists were used to measure verbal abstraction in the pre-treatment session. The first was a revised two-word similarities test like that used by Foster (1970) and Gordon and Haywood (1969). This test is comprised of items from the Similarities subtest of the WISC and WAIS. It is a 20-item test which presents pairs of stimulus words for each item requiring different verbal abstractions (e.g. "how are an orange and a banana alike?"). For this study, several items were changed from the test used by Foster (1970) which was also a revision of that used by Gordon and Haywood (1969). These items were changed either because they were not answered by anyone in the Foster (1970) study (e.g. squares)

Table 2

Means and Standard Deviations (SD) of Chronological Age (CA), Verbal IQ (VIQ), Performance IQ (PIQ), Full Scale IQ (FSIQ), Vocabulary Scaled Scores (VOC) and Similarities Scaled Scores (SIM) for the Three Treatment Groups

Treatment Groups	CA (in Months)		VIQ		PIQ		FSIQ		VOC		SIM	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
List I	192.25	9.68	72.75	9.27	78.56	8.28	73.37	7.47	4.06	1.73	5.31	3.20
List II	196.81	8.64	73.31	7.22	80.87	6.78	75.37	5.53	3.44	1.82	4.68	2.70
NT-C	193.86	10.3	74.25	9.32	74.68	7.13	72.37	6.94	4.31	0.73	5.43	2.16

or because the choice of exemplars was too restricted by the nature of the item (e.g. senses). The concepts and the revised test are presented in Appendix B. The instructions for the test are identical to those used in the WAIS, that is, with a correction for the first item (i.e., orange and banana) if the subject mentioned a difference, failed to respond or said that they were alike. Unlike the WAIS where testing is discontinued after four consecutive failures, all items were given to all subjects. This test is referred to as Pre-Treatment Test-List I.

The second test was a two-word similarities test similar to the first one except that this test was comprised of 20 concepts used by other behavioral scientists in the study of verbal abstraction in retarded subjects (e.g. Blount, 1969, 1971). The concepts and the exemplary words used in this test are also presented in Appendix B. This test is referred to as Pre-Treatment Test-List II. The instructions for administering both tests are identical.

Four tests were used to measure verbal abstraction in the post-treatment session. Stimulus enhancement condition one consisted of two five-word similarities tasks. The Five-Word Post-Treatment Test-List I consisted of a list of sets of five words each for the same 20 concepts used in the Pre-Treatment Test-List I with the difference being that these words did not include the two used previously.

As an example, orange and banana were used in the initial session, but peach, apple, cherry, pear, and grape were used in the five-word post-treatment test. The procedure of not including the pre-treatment test words in the post-treatment test differs from that used by Foster (1970) and Gordon and Haywood (1969). This test, along with the other post-treatment tests, is presented in Appendix B. The Five-Word Post-Treatment Test-List II consisted of a similar list of 5 word sets for each of the 20 concepts used in the List II group's initial session, i.e., with Pre-Treatment Test-List II. The words chosen to serve as exemplars of each concept were selected as being those on which there was total agreement among four graduate students.

Stimulus enhancement condition two consisted of two two-word similarities tasks.

The Two-Word Post-Treatment Test-List I consisted of a list of words containing two different stimulus words for each of the 20 concepts used in the List I group's initial session. These words included the first two words of the five used in the first part of stimulus enhancement condition one. The Two-Word Post-Treatment Test-List II consisted of a list of two different stimulus words for each of the 20 concepts used in the List II group's initial session. These words included the first two words of the five used in the second part of stimulus enhancement condition one.

Instructions for each of the post-treatment tests were identical to those for the pre-treatment tests.

Procedure

The experimental procedures were carried out by the same experimenter in a quiet office in the counselling and guidance center at the institution. There were two individual experimental sessions for each subject, the first lasting approximately 35 minutes and the second, 30 hours after the first, lasting about 20 minutes.

Pre-Treatment Test. Two non-experimental boys served as runners. Both were uninformed as to the purpose of the study. The experimental subjects were brought in to the center in groups of two. While one boy took part in the experiment, the other remained in a vacant office which was devoid of furniture. As each subject completed his session, he was returned to his job or class so that no communication would occur between the tested and as-yet-untested subjects. Possible communication in the dormitories during the evening was uncontrolled except that each boy was asked not to talk about the session with anyone. They were not told that there would be a second session. As each boy was brought in, he was asked if he wished to participate in the study which was explained as a study of learning. No boy indicated that he did not wish to participate; the author's impression was that many of the boys felt that participation in the study would in some way expedite their release and, therefore, they seemed motivated to participate. This feeling, when expressed, was refuted.

Subjects in the List I group received Pre-Treatment Test-List I, while subjects in the List II group received Pre-Treatment Test-List II. Subjects in the third treatment group, the Not Trained-Contrast group (NT-C) received both pre-treatment tests, systematically varying order so that one-half of the subjects received Pre-Treatment Test-List I first and one-half received Pre-Treatment Test-List II first. The NT-C subjects received the same instructions as did those of the List I and List II groups. Subjects of the NT-C groups did not receive any further training whereas the others did. Individual item responses in all tests were recorded verbatim.

Training Session. Immediately following administration of one and/or the other pre-tests, each subject in both the List I and List II groups received the training procedure designed to familiarize the subject with the highest-order verbal abstraction for each pair of words. The training procedure involved asking the subject to give a sentence combining the two stimulus words for each item. For example, for the first item in Pre-Treatment Test-List I, the subject was asked to use the words orange and banana in a sentence so that the sentence would contain a similarity between the two words. The subject then responded, usually with a similarity given in the pre-test. If the subject said that we eat an orange and a banana, his record sheet would be marked that he had given an incorrect response even though "eating" is a correct response for this item. The response "eating" is only given a score of 1 on the WISC and WAIS Similarities subtests whereas the abstractions considered superordinate, or of the highest order, are given scores of 2. In the training session only abstractions that could be scored 2 were accepted as being correct. The subject did not see his record sheet, but, as in the case of the response of "eating" to orange and banana, he was told "yes, we eat oranges and bananas, but they are also fruit." (None of the subjects in the List I and List II groups were unfamiliar with any of the verbal labels for the higher order concepts being trained). This correction procedure is similar to that used on the first item on the WAIS except that here only a higher-order abstraction is being given whereas in the instructions to the WAIS, the correction involves saying that "we eat them, they have peelings, they are both fruit" which offers two lower-order abstractions (eat and peelings) in addition to the higher-order one (fruit), and thus does not prepare a suitable set for giving superordinate abstractions. Following the correction on item one, the same procedure was followed with items two through twenty. In the case of a correct response (e.g. "oranges and bananas are fruit" to item one), the experimenter said "that is a good answer" and proceeded to item two. In this way the subject received the set to give the best possible abstraction. For the second treatment group, the same procedure was followed with the words of List II. Once all 20 items were completed, i.e., trial one, trial two began. In this trial and on subsequent trials, the instructions were the same as for trial one. If the subject did not spontaneously give the higher order abstraction for an item, he was corrected. The criterion for learning for both List I and List II was one trial in which all of the correct higher order abstractions were spontaneously given for all items.

Members of the NT-C group did not receive any training, but spent about the same amount of time with the experimenter as did those in the List I and List II groups. The time spent taking both of the Pre-Treatment tests was comparable to that spent taking one or the other plus the time spent in training.

Post-Treatment Test. The post-treatment test session began approximately 30 hours after the initial pre-treatment test and training session. The subjects were tested in approximately the same order as they had been for the previous session. The subjects in the List I and List II groups were randomly assigned to one of two stimulus enhancement conditions, i.e., either the five-word or the two-word tests, and, within each stimulus enhancement condition, to one of two orders of post-treatment test presentation according to the experimental design depicted in Table 1.

Subjects in the NT-C or contrast group were also assigned randomly to one of the two stimulus enhancement conditions and to one of the two orders of post-test presentation within each stimulus enhancement condition, making certain that an equal number of subjects within each cell had received each of the tests first in the initial session.

Each subject then received either the five or the two word post-treatment test for both List I and for List II with order of list presentation systematically varied.

Scoring. Scoring for all tests was done according to the general criteria of the standard Wechsler procedure by two independent trained psychometrists without benefit of knowledge of group membership of the subjects. Inter-scorer reliability coefficients were determined between the stimulus enhanced and stimulus nonenhanced versions of both List I and List II. Gordon and Haywood (1969), had previously reported inter-scorer reliabilities of + .98 for their two-word test and + .92 for their five-word test.

In the Wechsler procedure the maximum score per item is 2 for a higher-order abstraction, with a score of 1 given for a lower-order abstraction and 0 for a clearly incorrect response. The total possible score per test was 40. The scoring criteria for the items used from Foster's (1970) and

Gordon and Haywood's (1969) task were used here. The scoring criteria for the other new items and for the items included in the List II tests were derived in part from the responses received and were completed by a trained psychometrist. The scoring criteria for all of the List I and List II tests (pre- and post-treatment, five-word and two-word) are presented in Appendix C.

Results

Inter-scorer reliability. The correlation of the independently scored similarities tests yielded a product-moment coefficient of + .97 for Pre-Treatment Test-List I, + .95 for the Five-Word Post-Treatment Test-List I, and + .96 for the Two-Word Post-Treatment Test-List I. For the List II similarities tests, the respective coefficients were + .95, + .96, and + .95. Consequently the scores of only one rater were used in the analysis.

Initial learning. Trials to a criterion of one correct trial were recorded for the two treatment groups who were trained on either the Pre-Treatment Test-List I (List I) or on the Pre-Treatment Test-List II (List II). The subjects in the former group took a mean of 3.94 trials (SD=1.77) with a range of 2 to 10 trials while the latter group took a mean of 3.50 trials (SD=0.82) with a range of 2 to 5 trials to reach criterion. The difference in mean number of trials was nonsignificant, indicating no difference in the number of trials required to learn to criterion. The small number of trials needed to learn all 20 concepts was comparable to the two and three trials required for Miller and Griffith's (1961) subjects to acquire their trained abstractions.

Analysis of variance--one. Four analyses of the results were undertaken. A 3 X 2 X 2 X 2 mixed analysis of variance with repeated measurements on one variable was the principle analysis. The factors were Treatment Group (trained on the Pre-Treatment Test-List I, trained on the Pre-Treatment Test-List II, and not trained groups), Level of Stimulus Enhancement (two or five stimulus words), Order of Presentation of Post-Treatment Test (order one=Post-Treatment Test-List I + Post-Treatment Test-List II; order two=Post-Treatment Test-List II + Post-Treatment Test-List I) and Tests (the Post-Treatment Test-List I and the Post-Treatment Test-List II). The repeated measures were the two tests. This analysis ignored pre-treatment test scores.

The means and standard deviations of the individual cell blocks are summarized in Table 3 and are presented graphically in Figures 1 and 2 with means summed across order. The first analysis of variance is summarized in Table 4.

There were significant main effects for Training (F=5.39, 2/36 df, $p < .009$) and for List (F=20.10, 1/36 df, $p < .001$). More importantly, there was a significant Training by List

Table 3

Means and Standard Deviations (SD) for Treatment Groups on

Pre-Treatment Test and on Post-Treatment Test

Treatment Group	Number of Exemplars	Order of Post-Treatment Tests	Pre-Treatment Test-List I		Pre-Treatment Test-List II		Post-Treatment Test-List I		Post-Treatment Test-List II	
			Mean	SD	Mean	SD	Mean	SD	Mean	SD
Trained on Pre-Treatment Test-List I Concepts (List I)	5	1	24.75	3.87	-	-	31.00	4.83	28.50	4.72
		2	21.75	2.51	-	-	34.75	1.527	31.50	2.64
	2	1	22.0	2.94	-	-	31.50	4.20	27.25	5.80
		2	18.50	9.46	-	-	30.25	2.51	22.75	3.10
Trained on Pre-Treatment Test-List II Concepts (List II)	5	1	-	-	28.75	3.10	28.25	4.20	35.50	1.71
		2	-	-	24.25	1.00	27.00	5.35	34.75	5.00
	2	1	-	-	27.00	5.59	24.00	2.94	33.00	4.69
		2	-	-	26.50	3.78	26.50	3.69	34.25	2.88

Table 3 (continued)

Treatment Group	Number of Exemplars	Order of Post-Treatment Tests	Pre-Treatment Test-List I		Pre-Treatment Test-List II		Post-Treatment Test-List I		Post-Treatment Test-List II	
			Mean	SD	Mean	SD	Mean	SD	Mean	SD
Not Trained-Contrast Group (NT-C)	5	1	18.50	5.25	25.75	7.41	27.00	5.74	25.50	6.58
		2	20.25	6.60	23.25	7.63	23.00	7.02	27.00	5.22
	2	1	14.00	9.05	19.0	11.97	17.25	10.72	20.50	12.15
		2	25.75	1.73	32.00	3.36	28.00	1.71	34.25	1.52

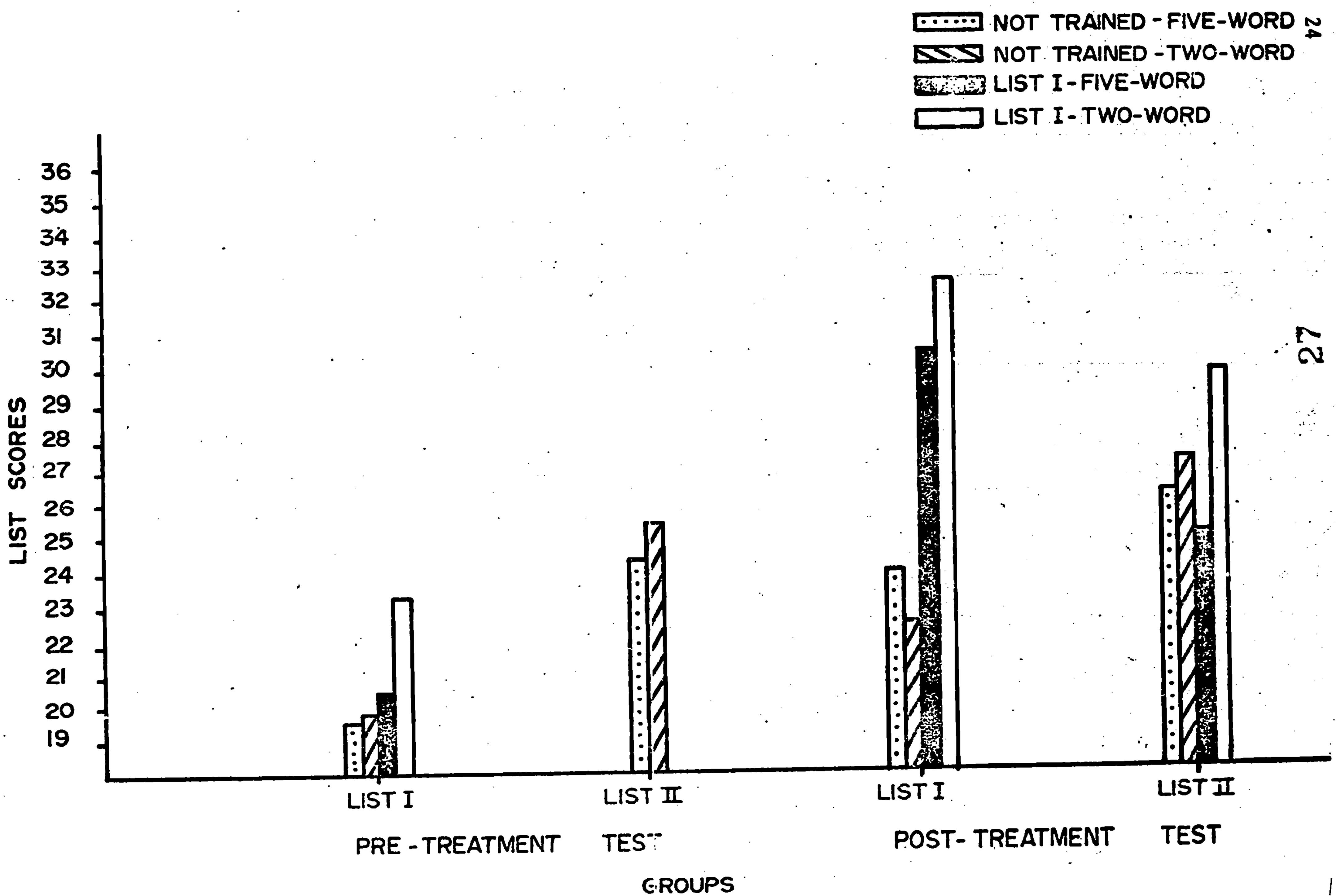

FIGURE I - DEPICTION OF MEAN SCORES FOR THE LIST I TREATMENT GROUP

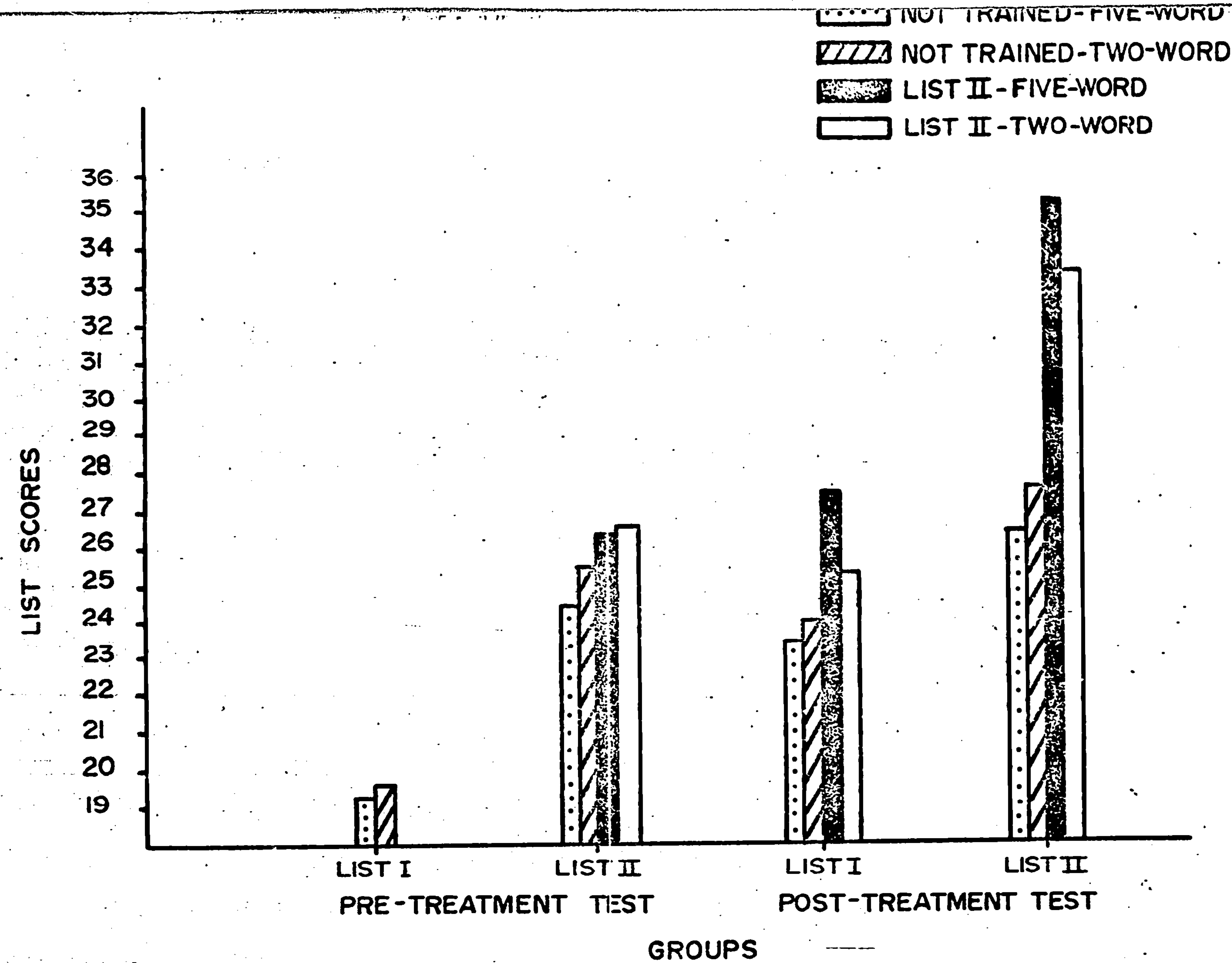

FIGURE 2 - DEPICTION OF MEAN SCORES FOR THE LIST II TREATMENT GROUP

Table 4

Analysis of Variance Summary Table for the Comparison Between Three Levels of Treatment, Two Levels of Number of Exemplars, Two Orders of Post-Test List Presentation and Two Post-Treatment Tests

Source	df	MS	F
Between Subjects			
Training (T)	2	265.82	5.39**
Exemplars (E)	1	92.04	1.86
Order (O)	1	108.37	2.19
T X E	2	18.76	
T X O	2	76.21	1.54
E X O	1	57.04	1.15
T X E X O	2	178.19	3.61*
Subjects within groups (Error between)	36	49.31	
Within Subjects			
List (L)	1	130.66	20.10**
T X L	2	310.51	47.77**
E X L	1	.06	
O X L	1	1.50	
T X E X L	2	19.19	2.95
T X O X L	2	18.40	2.83
E X O X L	1	4.16	
T X E X O X L	2	.38	
L X Subjects within groups (Error within)	36	6.50	

* $p < .05$
** $p < .01$

interaction (F=47.77, 2/36 df, $p<.001$). There were no significant main effects for either Level of Stimulus Enhancement or for Order of Post-Test Presentation. There was also a significant Training by Enrichment by Order interaction (F=3.613, 2/36 df, $p<.036$) while the Training by Enrichment by List interaction was not significant (F=2.954, 2/36 df, $p<.063$).

The Training by List interaction is depicted in Figure 3. It can be seen that training on one set of stimulus words for List I concepts significantly improved performance on a second set of different stimulus words for the same concepts relative to the not-trained contrast group, but did not improve performance when tested on different concepts (i.e., when post-treatment tested on the List II concepts). It can also be seen that training on one set of stimulus words for the List II concepts improved performance on a second set of different stimulus words for the same concepts relative to the not trained contrast group. Training on the List II concepts did not generalize to the List I concepts. This difference of means, 26.81 and 23.25 for the trained and not-trained groups on the Post-Treatment Test-List I respectively, generated a two-tailed t of 1.687 (30 df, $p<.20$). In either case training on one set of concepts did not generalize to performance on a second set of concepts. The Training by Enrichment by List interaction, although not significant, was judged to

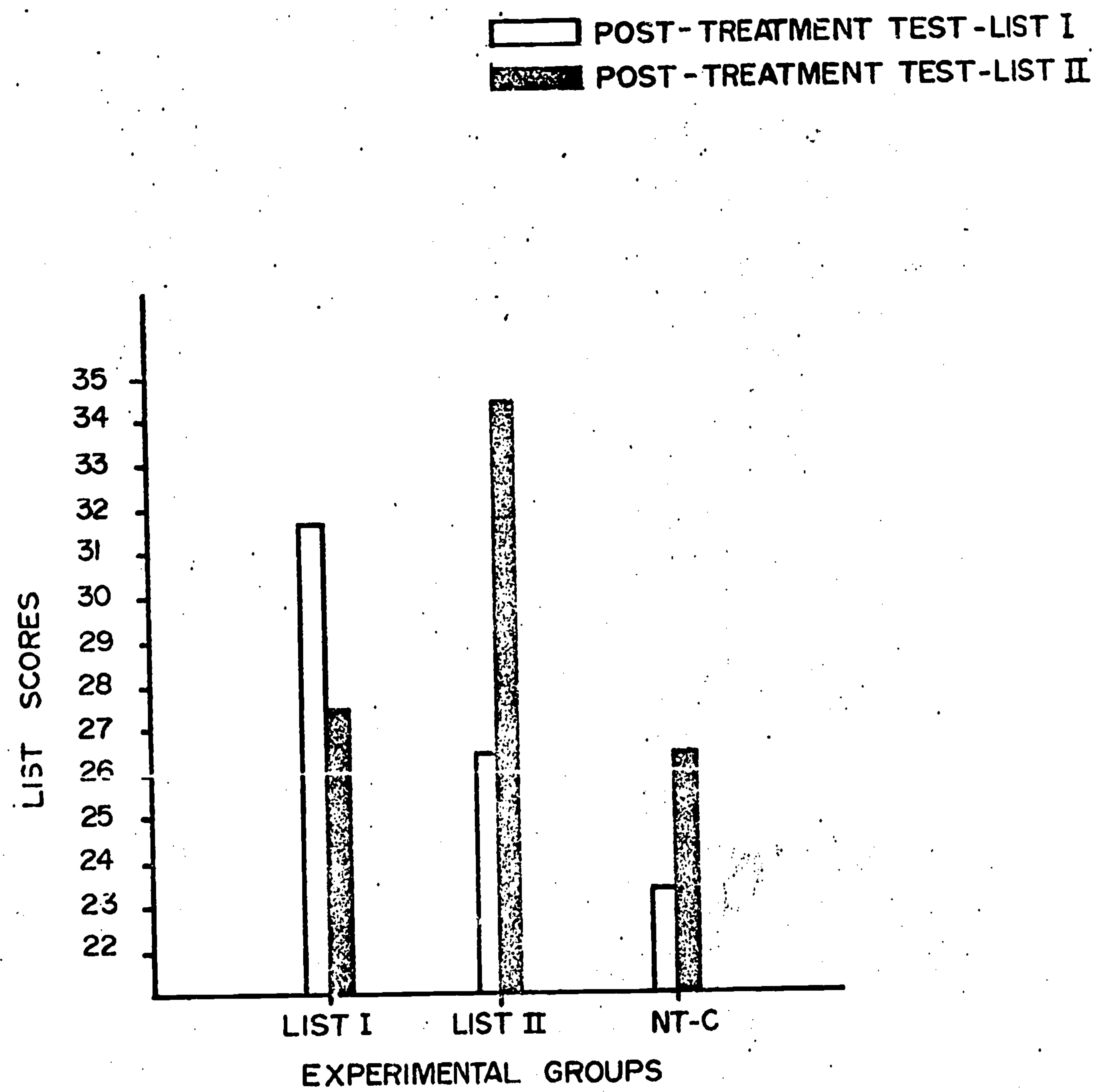

FIGURE 3 - DEPICTION OF TRAINING X LIST INTERACTION

be the most appropriate to present here. The Training by List interaction for the five-word condition is depicted graphically in Figure 4. The Training by List interaction for the two-word condition is depicted graphically in Figure 5.

One-tailed *t*'s were computed in order to test the differences between individual pairs of means. In both the five-word and two-word conditions the training on the Pre-Treatment Test-List I significantly improved post-test performance on the Post-Treatment Test-List I relative to the second training group (five-word condition, $t=2.302$, 14 *df*, $p<.05$; two-word condition, $t=3.388$, 14 *df*, $p<.01$) and to the contrast group (five-word, $t=4.306$, 14 *df*, $p<.001$; two-word, $t=2.516$, 14 *df*, $p<.05$). The difference between performance on the Five-Word and the Two-Word Post-Treatment Test-Lists was nonsignificant. In both the five-word and two-word conditions the training on the Pre-Treatment Test-List II significantly improved performance on the Post-Treatment Test-List II relative to the List I group (five-word condition, $t=2.7824$, 14 *df*, $p<.02$; two-word condition, $t=3.9724$, 14 *df*, $p<.01$). In relation to the contrast group, the group trained on the Pre-Treatment Test-List II made higher scores in the five-word condition ($t=3.3704$, 14 *df*, $p<.01$), but not in the two-word condition. The difference between performance on the five-word and the two-word Post-Treatment Test-List II was nonsignificant.

In terms of the expectations mentioned in the introduc-

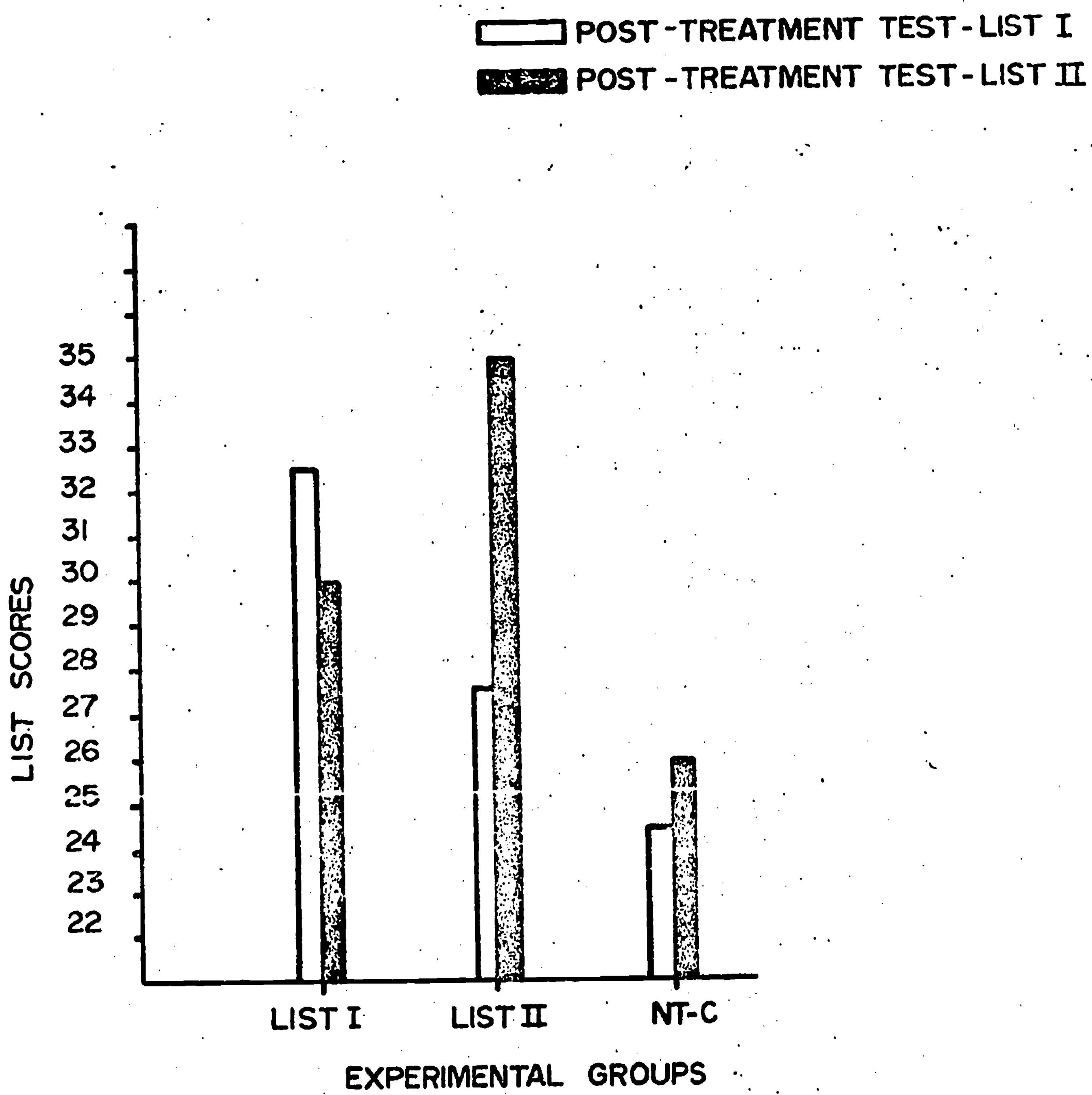

FIGURE 4 - DEPICTION OF TRAINING X LIST INTERACTION FOR THE FIVE-WORD CONDITION

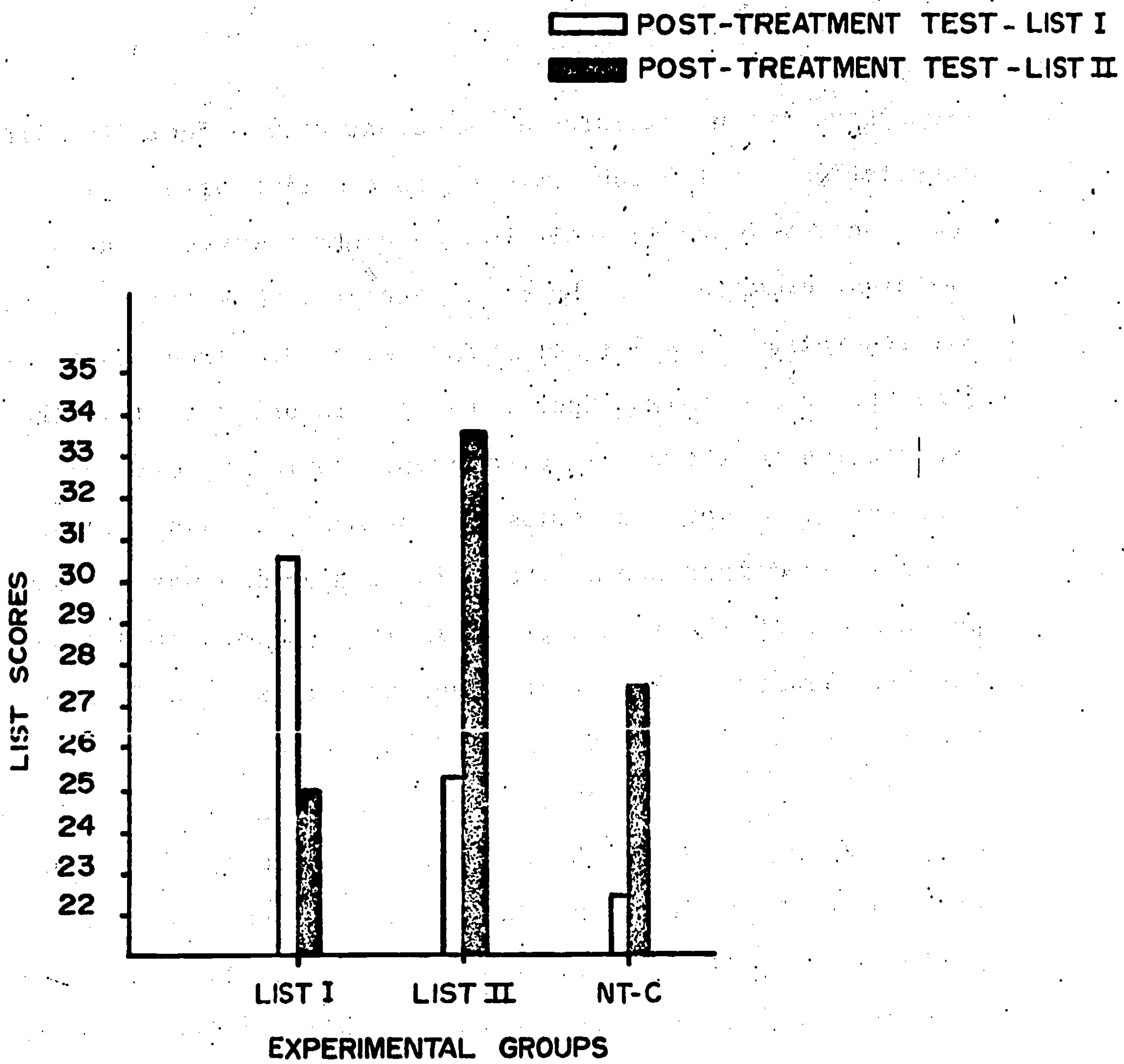

FIGURE 5- DEPICTION OF TRAINING X LIST INTERACTION FOR THE TWO-WORD CONDITION

tion there was no stimulus enhancement main effect (the first expectation). Although training on one list of exemplars of some concepts significantly improved performance on a list of different exemplars of the same concepts, this training did not generalize to a list of exemplars of different concepts (the second and third expectations). In order to test the expectation that training on concepts would improve performance more than would stimulus enhancement, it was necessary to make two comparisons. The first comparison was of mean performance of the List I group in the two-word condition on the Post-Treatment Test-List I versus the mean performance of the NT-C group on the same list. This comparison yielded a t of 2.777 (30 df, $p < .02$). The second comparison was of the mean performance of the List II group in the two-word condition on the Post-Treatment Test-List II versus the mean performance of the NT-C group on the same list. This comparison yielded a t of 3.036 (30 df, $p < .01$). In both comparisons the fifth expectation was supported.

The sixth expectation, that is, that training and stimulus enhancement in combination would significantly improve performance more than either procedure alone was tested by making four individual comparisons. The first comparison was of the mean performance of the List I group under the five-word condition on the Post-Treatment Test-List I versus that of the NT-C group under the five-word condition which yielded a *t* of 3.2698 (14 *df*, $p < .01$). The second comparison was of the mean performance of the List II group under the five-word condition on the Post-Treatment Test-List II versus that of the NT-C group which yielded a *t* of 3.734 (14 *df*, $p < .01$). These two comparisons indicated that training and stimulus enhancement improved performance significantly more than did stimulus enhancement alone. The third comparison was of the mean performance of the List I group under the five-word condition versus that of the List I group under the two-word condition on the Post-Treatment Test-List I, which yielded a nonsignificant difference. The fourth comparison was of the mean performance of the List II group under the five-word condition versus that of the List II group under the two-word condition on the Post-Treatment Test-List II, which also yielded nonsignificant differences. The results of the third and fourth comparisons indicated that training and stimulus enhancement did not significantly improve performance more than did training alone. Finally, the lack of a significant Enrichment by Order effect indicated that subjects who received one five-word post-treatment task did not have higher scores on another five-word task than did those subjects who did not.

Analysis of variance--two. A second analysis was performed to look at the possible differential training effects. For this analysis, the List I and List II groups alone were compared on post-treatment test performance. This partial partitioning of the two degrees of freedom for the training main effect from the previous analysis left a 2 X 2 X 2 X 2 mixed analysis of variance with repeated measures on one variable. There were two Training groups (List I and List II), two levels of Stimulus Enhancement (two or five stimulus words), two Orders of Post-Treatment Test Presentation and two Post-Treatment Tests (List I and List II). The repeated measures were on the last variable, Post-Treatment Tests.

There was no significant differential Training main effect nor was there a significant Order main effect. There were significant main effects for Stimulus Enrichment ($\underline{F}=5.292$, 1/24 df, $p<.029$) and for List ($\underline{F}=5.805$, 1/24 df, $p<.023$). There was also a significant Training by List interaction ($\underline{F}=69.343$, 1/24 df, $p<.001$). The Stimulus Enhancement effect found here and not when the NT-C group was included suggests that pre-treatment is itself a stimulus enhancement procedure.

Analysis of variance--three. A third major analysis was designed to take into account pre-treatment test scores. This was done first by comparing the group trained on the List I concepts against the Not Trained-Contrast (NT-C) group on their performance on the Pre-Treatment Test-List I and on the Post-Treatment Test-Lists I and II. For the subjects in the NT-C group, their scores were derived by combining the Pre-Treatment Test-List I scores from those eight subjects who had received order one in the pre-treatment test with those from the eight subjects who had received order two in the pre-treatment test. The result was a 2 X 2 X 2 X 3 mixed analysis of variance design with repeated measurements on one variable. The factors were Treatment Group (List I and NT-C), level of Number of Exemplars (two or five stimulus words), Order of Presentation of Post-Treatment Test and Tests (the Pre-Treatment Test-List I and the Post-Treatment Test-Lists I and II). The repeated measures were Tests. The analysis of variance is summarized in Table 5.

The Training main effect was not significant (F=3.837, 1/24 df, $p<.059$). There was a significant List effect and a significant Training by List interaction (F=71.883, 2/24 df, $p<.001$, and F=21.893, 2/24 df, $p<.001$ respectively). The Training by List interaction is graphically depicted in Figure 6.

In order to test the differences between means, individual t-tests were done for each list (Pre-Treatment Test-List I and Post-Treatment Test-Lists I and II) between the List I and Not Trained (NT-C) Contrast group. There were no significant differences between List I and NT-C means on the Pre-Treatment Test-List I (means = 21.7 and 19.6 respectively) and on the Post-Treatment Test-List II (means = 27.5 and 26.9 respectively, but there was on the Post-Treatment Test-List I (t=3.741, 30 df, $p<.001$). There was also a signif-

Table 5

Analysis of Variance Summary Table for Comparisons Between Group Trained On List I Concepts and the Non-Trained Contrast Group on Two Levels of Number of Exemplars, Two Orders of Post-Treatment Test List Presentation and Three Lists (One Pre-Treatment and Two Post-Treatment)

Source	df	MS	F
Between Subjects			
Training (T)	1	341.26	3.83
Exemplars (E)	1	71.76	
Order (O)	1	157.59	1.77
T X E	1	61.76	
T X O	1	290.51	3.26
E X O	1	82.51	
T X E X O	1	388.01	4.36*
Subjects within groups (Error between)	24	88.94	
Within Subjects			
List (L)	2	480.21	71.88**
T X L	2	146.26	21.89**
E X L	2	1.44	
O X L	2	4.90	
T X E X L	2	15.94	2.38
T X O X L	2	28.32	4.24*
E X O X L	2	2.26	
T X E X O X L	2	12.63	1.89
L X Subjects within groups (Error within)	48	6.68	

* $p < .05$

** $p < .01$

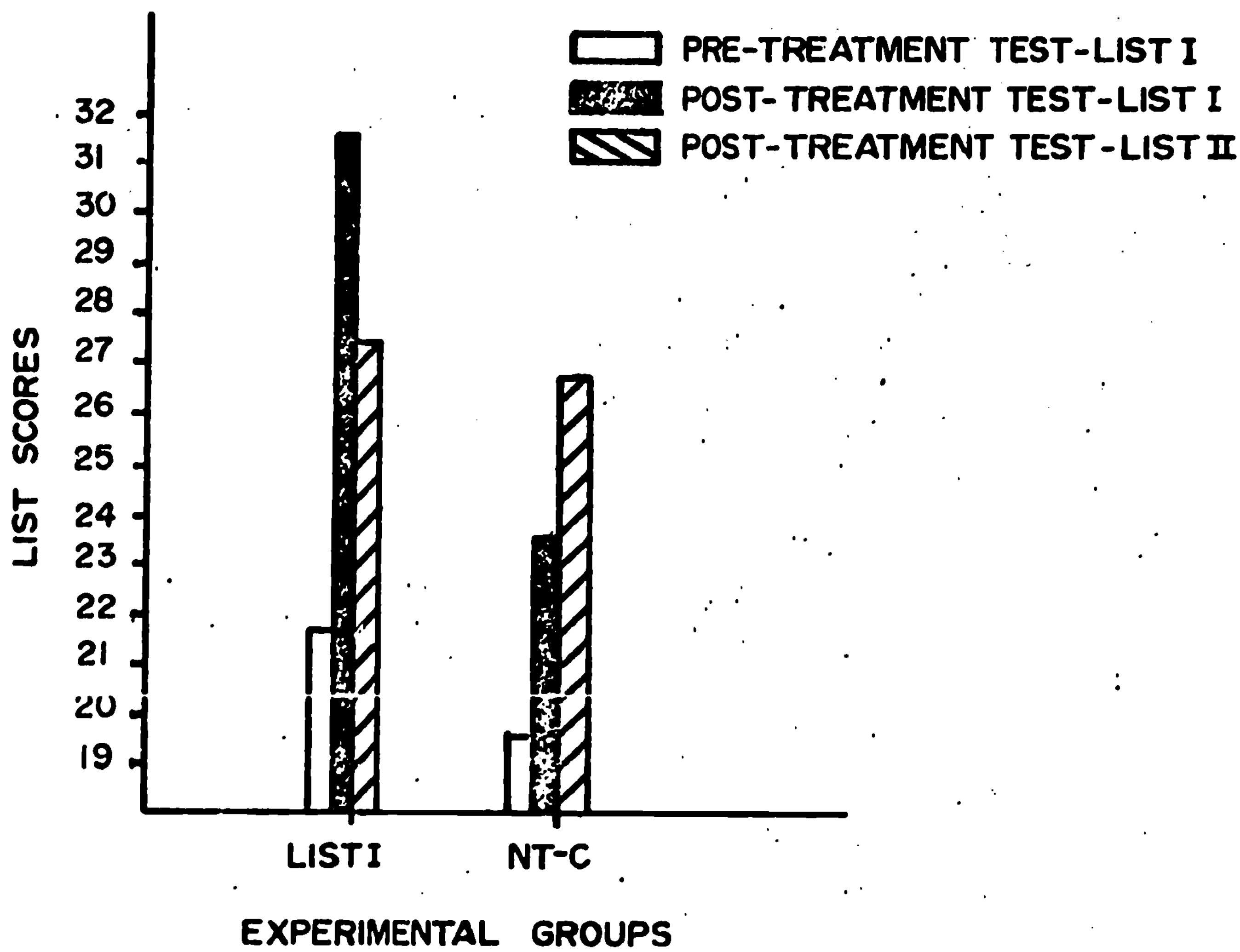

FIGURE 6- DEPICTION OF TRAINING X LIST INTERACTION FOR LIST I VERSUS NT-C COMPARISON

icant difference between the Pre- and Post-Treatment Tests-List I (t=4.125, 30 df, $p<.001$) for the trained group, but not for the not trained group.

Analysis of variance--four. A fourth major analysis was carried out to take into account pre-test scores on Pre-Treatment Test-List II. The design was a 2 X 2 X 2 X 3 mixed analysis of variance with repeated measures on the last variable (test). The factors were Treatment Group (List II and NT-C, i.e., scores on Pre-Treatment Test-List II), Number of Exemplars; i.e., stimulus enhancement (two or five stimulus words), Order of Post-Test Presentation and Test (Pre-Treatment Test-List II and Post-Treatment Tests-Lists I and II). The analysis of variance is summarized in Table 6.

There were significant main effects for Training (F=4.214, 1/24 df, $p<.049$) and List (F=44.442, 1/24 df, $p<.001$), and a significant Training by List interaction (F=10.366, 1/24 df, $p<.001$). The Training by List interaction is depicted graphically in Figure 7. In order to test the mean differences between the means of the trained versus nontrained groups for each test, t-tests were done. There were no significant differences between the List II and NT-C means initially, but there was a significant difference on the Post-Treatment Test-List II (t=4.291, 30 df, $p<.001$). There was also a significant difference between the Pre-Treatment Test-List II and the Post-Treatment Test-List II mean scores (t=3.984, 30 df, $p<.001$) for the trained group, but

Table 6

Analysis of Variance Summary Table for Comparisons Between Group Trained on List II Concepts and the Non-Trained Contrast Group on Two Levels of Number of Exemplars, Two Orders of Post-Treatment Test List Presentation and Three Lists (One Pre-Treatment and Two Post-Treatment)

Source	df	MS	F
Between Subjects			
Training (T)	1	400.16	4.21*
Exemplars (E)	1	8.16	
Order (O)	1	150.00	1.57
T X E	1	9.37	
T X O	1	222.04	2.33
E X O	1	425.04	4.47*
T X E X O	1	160.16	1.68
Subjects within groups (Error between)	24	94.97	
Within Subjects			
List (L)	2	310.32	44.44**
T X L	2	72.38	10.36**
E X L	2	14.88	2.13
O X L	2	12.09	1.73
T X E X L	2	1.90	
T X O X L	2	11.19	1.60
E X O X L	2	2.94	
T X E X O X L	2	1.01	
L X Subjects within groups (Error within)	48	6.98	

* $p < .05$
** $p < .01$

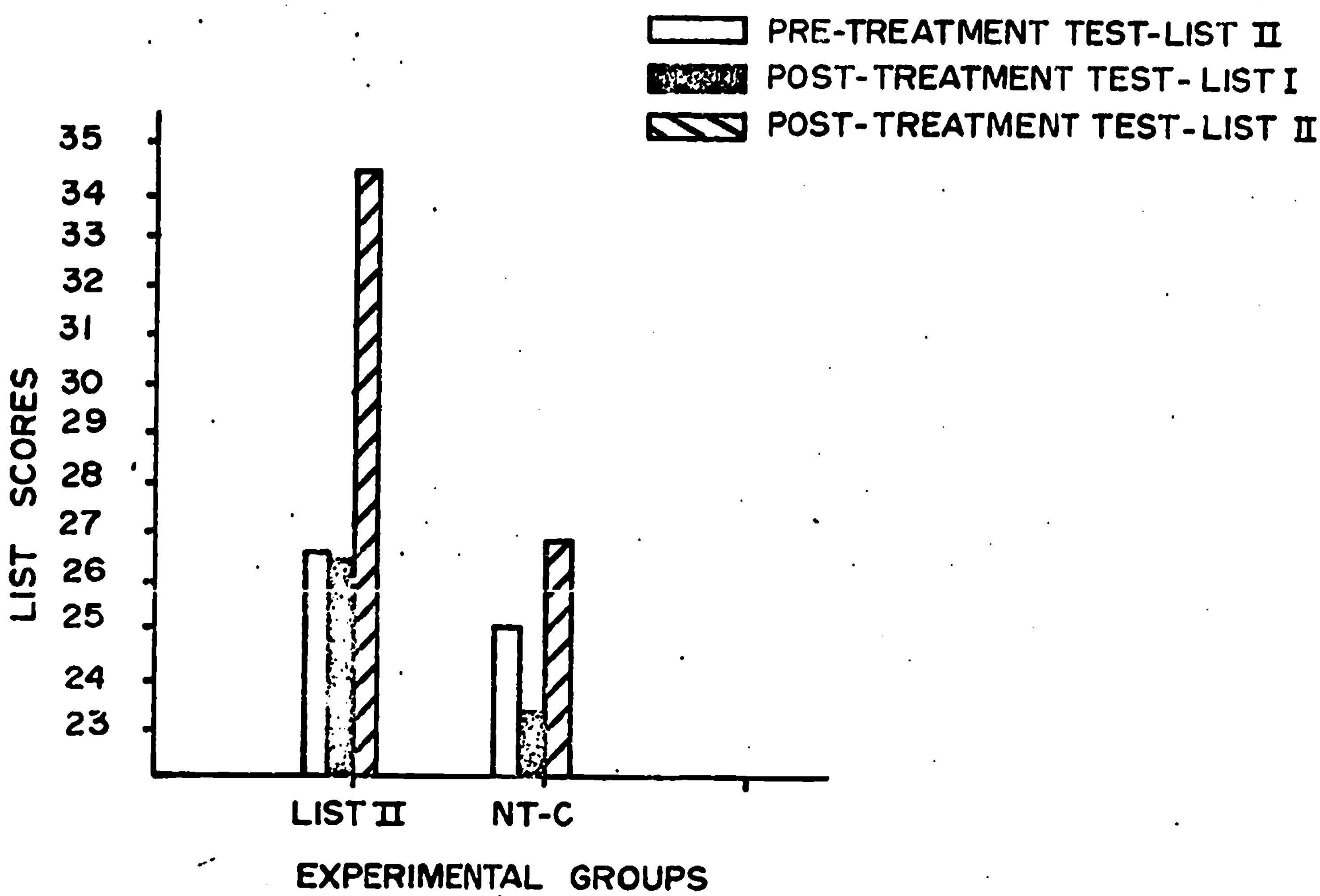

FIGURE 7- DEPICTION OF TRAINING X LIST INTERACTION FOR LIST II VERSUS NT-C COMPARISON

not for the not-trained group.

Discussion

The expectations listed earlier provide the framework for discussion of the results.

Expectation one. Subjects will have greater gains in verbal abstraction scores in the five-word versus the two-word conditions. Subjects did not perform significantly better on the five-word post-test than they did on the two-word post-tests. For both of the trained groups, training improved performance on both the five-word and two-word tests for the concepts on which they were trained, but not for the untrained concepts. That is, training on the List I concepts significantly improved performance on both the Five- and Two-Word Post-Treatment Tests-List I relative to that of the contrast group. The converse was true for training on the List II concepts. For the contrast group, pre-treatment testing on both tests seemed to act as stimulus enhancement by itself and tended to elevate scores on the post-treatment tests, thus negating any effect of stimulus enhancement. This last point is supported by the significant stimulus enhancement effect that was found when an analysis was done only between the two training groups.

None of the above comparisons is directly comparable to those used by either Foster (1970) or Gordon and Haywood (1969), in which a two-word pre-test and a five-word post-test were used to measure the effects of stimulus enhancement. In this study a comparison of the contrast group's pre and post-treatment test scores under five-word or two-word conditions provided a direct test of a stimulus enhancement effect under experimental conditions similar to those used in the Foster (1970) and the Gordon and Haywood (1969) studies. The finding by Foster (1970) that subjects improved their abstraction scores under stimulus enhancement significantly more than under nonenhanced conditions was also found here for the List I tests but not for the List II tests. On the List II tests, the contrast group improved its scores under both conditions, but not significantly so. This discrepancy in the stimulus enhancement effect as a function of test may be due to the general easiness of the items in the List II tests. Alternatively, the pre-treatment testing may have had a greater effect on the easier concepts (List II) than on the harder ones (List I), and thus may have obscured stimulus enhancement effects for the one list but not for the other.

An important difference in methodology between the Foster (1970) and Gordon and Haywood (1969) studies and this study exists, in that in the former studies the same two stimulus words used in the pre-test were used in the post-test. In this study different words were used in the post-treatment tests. The fact that on the List I tests, at least, a stimulus enhancement effect was found, suggests that the effects of stimulus enhancement might be generalizable to different stimulus words of the same concepts.

Expectations two and three. Training on one list of words of one set of concepts will significantly improve performance on different lists of words of the same set of concepts as well as on a list of words of a different set of concepts.

There was strong support for the second expectation and no support for the third. Subjects who were trained on a list containing two exemplary words of one set of concepts achieved higher abstracting scores on a second list of two different words of the same set of concepts. This finding suggests that such training as used in the present study generalizes at least to two new words of the same concept. When new concepts were used, however, such training did not generalize.

Expectation four. Training will significantly improve test scores relative to pre-treatment scores.

This expectation is an extension of expectations two and three and was supported. Training on either list (List I or List II) significantly improved scores when tested on a list of different exemplars of the same concepts.

Expectation five. Training on concepts will significantly improve performance more than will increasing the number of exemplars.

This expectation was supported in both training groups suggesting that for a greater improvement in abstracting scores, training be used rather than stimulus enhancement. Whether or not one or the other strategy has a greater permanent effect upon abstracting scores can only be answered by a longitudinal study of their differential effects. It must be remembered that in the earlier studies on stimulus enhancement, such enhancement was not seen as an educational procedure, but only as a means to support the contention that children from a socially disadvantaged environment suffer from an information input deficit and that this deficit can be overcome. In this study stimulus enhancement was used as an educational procedure as well.

Expectation six. Training and stimulus enhancement in combination will significantly improve performance more than either procedure alone.

This expectation had two components; the first, of training and stimulus enhancement versus stimulus enhancement alone, and the second, of training and stimulus enhancement versus training alone. The first component was supported whereas the second component was not supported in the present study. In both the List I and List II training conditions, training and stimulus enhancement in combination improved post-treatment test scores more than did stimulus enhancement alone, but not more than did training alone. This finding supports the notion that training is a powerful effect, over-shadowing the educational effects of stimulus enhancement.

This finding also suggests that for maximum improvement in abstracting scores, training alone would be as efficacious as training and stimulus enhancement in combination.

The evidence presented offers support for the contention that cultural-familial retarded persons do have an apparent deficiency in forming verbal abstractions. This deficiency may be related to the unstimulating environments from which these persons come. The deficiency may be due to a lack of exposure to activities calling for either categorizing verbal stimuli or for the use of appropriate higher level verbal labels not usually associated with an intellectually restricted environment. That this deficiency is real, but remediable, and that cultural-familial retarded persons do in fact have the capacity to overcome this deficiency, is evidenced by the finding that increasing the amount of information available to them helps elevate their performance in forming verbal abstractions (Gordon and Haywood, 1969; Foster, 1970). This result was replicated here. More basic to the whole problem of remediation of this apparent deficiency in verbal abstracting now that we know the deficiency is remediable, is to delineate the conditions for remediation. Any such procedure if successful in remediating this deficiency, also supports the contention that the deficiency is more apparent than real. The procedure used here offered further support for this position. However, in terms of achieving the best possible immediate elevation of performance, concept training procedures have a substantially greater effect upon the ability to form verbal abstractions than does just increasing the number of exemplars. This finding offers support for the further contention that cultural-familial retarded persons not only do not have adequate experience with language, but also do not have adequate experience with the verbal abstractions themselves. In the Gordon and Haywood (1969) and Foster (1970) studies the subjects could not get more than ten or eleven of the concepts in the five-word conditions which suggests that the concepts were not readily available or not available at all, in the language repertoires of the subjects. The results of this study indicate that the concepts can be readily acquired along with a pair of exemplary stimulus words of each concept and equally as readily generalized to a pair of new exemplary stimulus words of each concept. Within the training procedure used here, the subjects did not acquire a strategy for generalization to new concepts, that is, they did not develop rules with which to tackle new problems. This suggests that training on rules to form verbal abstractions might be a profitable strategy. The cultural-familial retarded person's deficiency in verbal abstracting is related to inadequate language experience and not to an inherent lack of capacity to form verbal abstractions (Bereiter and Englemann, 1966; Deutsch, 1965). By increasing the amount of information available to them, either in the form of practice with concepts or in the form of an increased number of exemplars, the performance of these subjects on verbal abstracting tasks is elevated. Whether or not these procedures have any lasting effect on the ability to form verbal abstractions is yet to be ascertained. If the improvement is short-lived, the cultural-familial retarded person may have difficulty in memory separate from the apparent deficiency in verbal abstracting. If the improvement is maintained over a period of time, the contention that this subject has a relatively intact capacity for cognitive activity may be supported. In addition, it may indicate that even minimal language stimulation may be of value to overcome the effects of language deprivation.

Conclusion

Further evidence concerning two conceptual positions was derived from this study. The first conceptual position stated by Gordon and Haywood (1969), that the nature of the apparent verbal abstracting deficit in cultural-familial retarded persons was a result of an information input deficit, was supported here. Increasing the number of exemplars in a verbal abstraction task helps to overcome the information input deficit, thereby raising verbal abstraction scores. The conceptual position, that is, the efficiency of intervention procedures to overcome this apparent verbal abstracting deficit in cultural-familial retarded persons, was partly clarified. Concept training procedures designed to familiarize the subject with concept names and exemplary words, facilitated performance on a task consisting of the same concepts, but using different exemplars. Such training did not facilitate performance on a task with different concepts. These findings suggest that the verbal abstracting deficit in these subjects is amenable to improvement, but the conditions for generalization are still unknown. In future research emphasis should be placed upon the type of training procedure to be used. The training of subjects in the use of rules to make verbal abstractions is one possible area for research. This procedure could take the form of training on subordinate rules (e.g. light, dark, red, blue, yellow, or round, square, triangular) for generalization to tasks demonstrating the use of superordinate rules (e.g. color or form).

Another remedial procedure could take the form of training on easier concepts for possible generalization of training to harder concepts. The degree of difficulty of the concepts could be established for different developmental stages.

It must be concluded, however, that the conditions for overcoming the apparent verbal abstracting deficit in cultural-familial retarded persons remain to be delineated further.

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APPENDIXES

APPENDIX A

REVIEW OF THE LITERATURE

REVIEW OF THE LITERATURE

Studies of verbal abstracting processes in retarded persons have generally involved the use of associative clustering, sorting, or similarities tasks of verbal abstracting ability. The importance of these studies lies in delineating conditions under which a retarded person can demonstrate an intact ability to abstract. The subsequent review of the literature will demonstrate that these conditions have not as yet been clarified. The format of this paper will be such as to review studies using the associative clustering, sorting, or similarities tasks as measures of verbal abstraction in retarded persons, with subsequent delineation of the conclusions derived from each area.

Associative clustering. Associative clustering in recall was first described by Bousfield (1953) and although a measure of memory rather than of abstraction, it involved categorization and, as such, is related to abstraction as well. Bousfield (1953) presented a randomized list of associated words, asking subjects to write down all that they could recall. Bousfield found that subjects tended to group words into associated clusters, that is, within categories (e.g. animals--horse, cow, pig, etc.) and not in the manner in which the list was presented. Such organization in recall implied the ability to abstract a general principle as well as assigning each word to its correct category.

In the earliest study of associative clustering with retardates, Weatherwax and Benoit (1957) used 12 pictures from four categories in six presentations. The pictures used were of two major types: functional or taxonomic, with two categories under each (bathing and smoking as being functional, and animals and food under the taxonomic category) with three items each, i.e., soap, towels and bathtub; cigarettes, smoke and matches; pig, horse and cow; and apple, candy and bread. The retarded subjects with an organic diagnosis had a mental age (MA) range of 51 to 96 with a mean of 72.8 months, a chronological age (CA) from 111 to 182 months with a mean of 148 months, and an intelligence quotient (IQ) range from 35 to 62 with a mean of 50. The same figures for the retarded subjects without organicity were MA 53-96 with a mean of 72.4 months, CA 86-175 months with a mean of 143 months and IQ 37-73 with a mean of 52.

The results of Weatherwax's and Benoit's study indicated no significant differences in the amount of noncorrected clustering, i.e., not corrected for chance, of organics versus nonorganic retarded subjects. However, both recall and clustering improved over trials for both groups.

Osborn (1960) replicated the findings of Weatherwax and Benoit (1957) of no difference in recall or clustering between organic and familial-retarded subjects. He used institutionalized subjects with a group of normal non-institutionalized equal MA controls. The CA range for the retarded group was 10.0 to 30.0 years with an IQ range from 45 to 70, while the MA range was 5-0 to 11-0 for all groups (no means given).

Osborn presented three randomized series of 32 pictures from four categories which were chosen as being familiar to their subjects, namely four-legged animals, foods, parts of the body, and articles of clothing. All four categories could be represented clearly and unambiguously in line drawings. The words in each category were equated relative to their frequency of occurrence in the juvenile literature according to the Thorndike-Lorge count. The method for presentation was slightly different from that of Weatherwax and Benoit (1957). As each picture was flashed on the screen by a slide projector, the examiner named the object for each of the three trials, after which the subject was asked to recall as many pictures as possible.

The results indicated that although there was a trend toward highest recall and uncorrected clustering in the familial-retarded subjects, next highest in the organics, and least in the controls; these differences did not reach significance. There were no significant differences in the number of perseverations, or irrelevant or categorical intrusions among the groups.

Rossi (1963) used a design with slightly different words than those used by Osborn (1960) as pictures. Five different randomizations of 20 words, five for each of the four categories used by Osborn (1960), were presented for five trials. There were two groups of 90 subjects each; an institutionalized retarded group (no differential diagnosis mentioned) and a normal non-institutionalized group. Each group was divided into equal numbers of matched MA subjects at each of three levels; 4-6, 7-3, and 10-0 years. The overall mean IQ for the retarded groups was 65.5, and for the normal groups, was 95.5.

The subjects were familiar with all of the words, although how this was determined was not mentioned. The procedure was such that Rossi read and had subjects repeat each word on each of five trials followed immediately by a recall period on each trial. Rossi (1963) had two measures:

1) RR or ratio of repetition $= \dfrac{\text{number of pairs of clustered words}}{\text{total number of words}}$

2) DRc or corrected density ratio $= \dfrac{\text{number of stimulus list words clustered}}{\text{total number of words}}$

These measures corrected for repetitions, perseverations and intrusions and were transformed to arc sines in order to reduce skewness of the curves.

Rossi's results indicated no significant differences between retarded and equal MA subjects on noncorrected clustering (RR), primarily because the retarded subjects had significantly more categorical intrusions than normals. When these intrusions were corrected for (DRc), the normal subjects did cluster more but recalled less than did the retarded subjects. In a summary, significant RR differences were found on Trials and on Diagnosis X MA X Trials ($p < .01$) and DRc differences were found on Diagnosis, MA, Trials and on Diagnosis X MA X Trials ($p < .01$). Within the retarded MA groups, the low MA group differed from the other two groups, but there were no differences between the 7 and 10 MA levels. Within the normal MA groups the relationship with corrected clustering was linear.

Evans (1964) repeated Rossi's (1963) procedure, but included reward (candy) and non-reward (nothing) conditions during recall and controlled for CA, but not MA. The subjects were 32 institutionalized retardates; one group was relatively high level, mean IQ=65 and mean CA=30 years, while the other was low level, mean IQ=47 and mean CA=34 years. MA's were 10-6 and 7-6 for the two respective groups. The results were: all subjects recalled more over trials; the lower intelligence groups gave significantly more inappropriate responses over the last two trials and candy increased these responses in all subjects; no differences in clustering between the two MA levels were found.

On the basis of these studies, it might be concluded that when measures of uncorrected clustering are used:

1) there are no differences between organic and non-organic retarded subjects in category clustering in recall of lists of words;
2) retarded subjects cluster and recall less than do equal CA subjects, but do as well as equal MA normal subjects;
3) on a corrected clustering measure, retarded subjects recall as much as, but cluster less well than, equal MA normal subjects largely due to categorical intrusions.

Thus, the retarded person's poor organizational systems (i.e. clustering) may not be due to poor memory or retrieval since these subjects recall well, but rather might be due to a lack of information regarding generalities and similarities within incoming information which would facilitate storage. This point brings into focus the nature of the process of categorization as well as how to enhance this process. Several researchers have attempted to delineate the conditions under which retarded subjects' association scores may be facilitated or depressed.

A study by Wallace and Underwood (1964) used high and low conceptual similarity words ascertained by previous sorting performance under free recall and paired associate conditions. Equal CA normals recalled more high similarity words under free recall than under the paired-associate condition, where high similarity interfered with learning, with a slight opposite effect with low similarity words. The retarded subjects did no better with either low or high similarity words, indicating that they did not take advantage of material lending itself to categorization for more efficient recall.

Wallace and Underwood's (1964) results were essentially replicated by Spitz (1966) who divided 20 high-(mean IQ= 72.04, mean CA=14.49 years) and 20 low-(mean IQ=52.95, mean CA=14.52) grade institutionalized retarded males into equal groups of 10, of which each group received either a sorting task or a word clustering task for recall for five trials first or two weeks later. No order effect was found. The pictures were of the words used by Rossi (1963). Of the 20 high-grade subjects presented with pictures, 14 grouped all into the four categories, whereas only two of the 20 low-grade subjects grouped all into the four categories. On free recall, there were no significant differences between the two groups in the corrected clustering or recall scores. These results indicated that subjects who had mastered the concepts did not use them in aiding recall.

The results of the two studies above imply that giving the retarded subjects practice with the concept might aid in their usage. In the last two experiments of three, Gerjuoy and Spitz (1966) followed that strategy. In the first experiment, however, these two authors did a comparative study including two groups of institutionalized retarded subjects, high and low IQ, an equal MA normal group (to the high), an equal CA group and a group of college students. A randomized list of 20 words (five words from each of four categories) was presented five times with a recall period after each trial. The two retarded groups did not differ on recall, but did from the CA and college groups. The high-grade group did not differ from the equal MA group. The equal MA normals and retarded subjects did not differ on clustering, but cluster-was below chance.

In the second study Gerjuoy and Spitz attempted to raise the retarded subjects level of recall through inducement of clustering by one of two methods, presented or requested clustering as compared to the standard method. In the presented method in a list of 20 words of four categories, the five words of each category were presented as a category but randomized by category over five trials. In the second method presentation was random, but recall was preceded by requesting the subject to recall all the animals, etc. over each of five trials. The subjects were two groups of institutionalized retarded subjects matched on CA (mean=15.0 and 15.8) and IQ (mean=63).

The results indicated that there were significant differences between both of these methods and the standard method used in the first experiment, but not between themselves.

In the third experiment the two facilitation procedures in combination were compared to the results of the other two studies. The authors reported that the combined procedure aided recall significantly more than either facilitation procedure alone or the standard procedure to the extent that the retarded subjects did not differ significantly from the college students in the first experiment.

Gerjuoy (1967) used similar groups of normal and retarded subjects and used the presented clustered list with half of each group and the randomized list with the other half. In a second session all subjects received a new but randomized list (different categories). Results indicated that all subjects recalled significantly more words under the presented clustered procedure, but experience with this list did not facilitate recall on a standard list. In a second experiment subjects were instructed to categorize as the list was presented and were compared to themselves under a standard condition with counterbalancing for order. These instructions significantly improved the recall of both retarded and normal subjects over the randomized or presented methods.

Madsen and Connor (1968), on the basis of Spitz' (1966) conclusion that retarded subjects were primarily deficient in categorization of incoming information rather than in simple memory (or experience), found that retarded subjects could utilize processes of clustering and information reduction during free recall if the concepts were part of their experience. These authors used six male and six female non-brain damaged institutionalized retarded subjects (IQ range of 61 to 77, median of 67 and CA range of 22 to 49 years with a median of 31) and normal college students. Madsen and Connor (1968) used 18 categories with four words per category taken from Rossi (1963). There were two sessions: the first, a pre-training one in which the experimenter said a category and then four words in each; the subject repeated the words twice. On trial two, the experimenter said the category and the words missed previously and so on, until all words were learned. Interestingly, there were no intrusions later. During the experimental session, 42 lists of 12 words each were taken from the 18 categories. These lists were divided into seven groups of six lists each. Each of the seven groups differed in the number of categories and in the order of words, but each of the total 72 words were used. Lists were also such that some had words from the same categor presented contiguously or alternately.

The results were:

1) the normal subjects recalled more than the retar

subjects under all conditions;

2) both groups recalled more as the number of categories lessened;

3) both groups recalled more from the contiguous than from the alternate lists;

4) normal subjects categorized significantly more when an uncorrected measure was used, but no differences were found on a corrected measure;

5) within each group, recall tended to be within categories;

6) the data indicated that for both groups, information was reduced for expediency.

The authors concluded that these results were in opposition to those of Gerjuoy and Spitz (1966) who reported that retarded subjects did not cluster well under alternative presentations and that retarded subjects required experience with abstraction categories.

Cobb and Barnard (1969) extended these findings and those from paired-associate learning studies with retarded populations in which mediational cues facilitated learning (Jensen, 1965). These authors determined the associative values of words common to the ages of their subjects and pre-trained them on two lists of six words each from two categories, foods and animals. The subjects were 20 institutionalized retarded subjects (no diagnosis) with a mean IQ of 57 and matched for age and sex with 20 normal subjects with a mean IQ of 114, ranging in age from 10-4 to 15-1 with a mean age of 13-3 years.

In the experimental condition all subjects listened to a tape of five lists of 12 words decreasing in the number of words that were associated with the pre-trained words over the five lists so that the last list contained words that had no relationship to the pre-trained words or categories. After each list, the subject was given a free recall period. Words in the lists were randomized.

The results indicated that:

1) the normal subjects recalled significantly more than did the retarded subjects;
2) both groups recalled fewer words as the degree of association decreased, but;
3) whereas the normal subjects dropped only from a mean of 9.80 words recalled on List I to a mean of 6.65 words on List V, the retarded subjects dropped from 8.20 to 2.36. The difference between lists was significant for the retarded subjects, but not the normal subjects.

The authors concluded that whereas normal subjects were able to take advantage of even the slightest associative cues, the retarded subjects performed well only when such cues were strong and made evident by practice.

Reiss (1968) attempted to determine whether rhyming of words had a facilitating effect upon recall. He used 30 institutionalized educable mentally retarded subjects (EMR) with a mean IQ of 62.2 and a mean age of 16-2 years, divided into two groups receiving three lists in the following order: 1, 2, 3 and 2, 1, 3. List one contained five words each for four categories; list two contained rhyming words and list three contained a combination of rhyming and associated words. All lists were given in one session without pretraining and it was found that there was better recall of associated words than there was of a mixed list and finally than there was of rhyming words regardless of order of presentation.

Bilsky and Evans (1970) also demonstrated that organized word presentation facilitated clustering and recall in a retarded population, but they also demonstrated that such presentation facilitated clustering on subsequent nonorganized trials. This latter finding was in opposition to that reported by Gerjuoy and Alvarez (1969) and Cobb and Barnard (1969) where such facilitation did not occur. In both of these cases such methodological differences as categories and types of words used could possibly account for the differences.

Bilsky and Evans (1970) used a 20 word list of four categories taken from Rossi (1963) presented four times, twice randomly and twice clustered according to category. Words were presented auditorily via a tape recorder and visually via a slide projector. A recall period followed each trial. Subjects were 32 institutionalized retarded subjects, 16 males and 16 females, with a mean IQ of 56.97 (SD=5.14), a mean CA of 183.72 months (SD=24.93), and a mean MA of 101.19 months (SD=13.78). It was found that the group that had received a clustered list in the first trial block produced significantly higher overall clustering scores than the group which had received a random list in the first trial block. A significant effect of list organization on trial two indicated that transfer had occurred to the random lists. The authors concluded that it might be possible to establish relatively stable and generalizable strategies for categorizing verbal materials, but that conditions to do so had not yet been established.

The results reported above are interesting in the light of the negative transfer effect reported by Gerjuoy and Alvarez (1969) who used different categories on the second list. These authors used a MA matched institutionalized population (N=60, mean IQ=59.4±8.8, mean CA=15.2±1.7) and non-institutionalized normals (N=60, mean IQ=111.3±10.4, mean CA=10.3±4.3). There were two lists of four categories each with five words in each (list one included categories of animals, body parts, clothing, and food whereas list two contained categories of furniture, colors, family members and occupations). There were two types of presentation, clustered and random, with order of list presentation randomized. The findings indicated that the equal MA normal subjects had better recall and corrected clustering scores, but that no transfer occurred on the second list given one week later. The authors pointed out that the words used might have been outdated. However, it was not known if the concepts were known to the retarded subjects and the week's interval was longer than any other reported.

Gerjuoy, Winters, Pullen and Spitz (1969) studied the associative clustering phenomenon with stimuli other than words. These stimuli included 20 cards, five each of geometric forms, two digit numbers, colors and letters. The subjects included 24 adolescent institutionalized EMR's (16 male and 8 female with a mean IQ of 64.67, SD=8.60 and a mean CA of 15.61 years, SD=1.18) and 24 fifth grade normal subjects (12 male and 12 female with a mean IQ of 109.61, SD=12.80 and a mean CA of 10.-6, SD=0.43).

There were two conditions, randomized or presented-clustered, where the cards were flashed tachistoscopicly for five trials with a two minute free recall period after each trial. The results indicated that the groups improved significantly on recall over trials, but were not different among themselves. On the corrected clustering scores, the equal MA normal subjects did better than the EMR's (p .05) on either presentation, but the presented-clustered method significantly improved the EMR's scores. Clustering improved significantly over trials for both groups. There were no significant interactions.

In the second experiment the authors used all new subjects, 14 male and 10 female EMRs (mean IQ=63.33, SD=8.95, mean CA=16.25, SD=1.09) and 12 male and 12 female normals (mean IQ=110.29, SD=14.60, mean CA=10.69, SD=0.50). The stimuli were the same as previously used, but each card now held two stimuli of the same type. The results were similar to those reported in Experiment I. Important interactions were found, however; the normal subjects recalled 55 percent more items when random-paired as compared to the first experiment and 58 percent more when clustered-paired. And the EMR's improved 28 percent and 58 percent for the two new conditions; therefore, it would seem that twice the input improved recall by 50 percent. In addition, the EMR's improved more over five trials under the paired conditions while the normal subjects tended to asymptote quickly. In both experiments there was more recall of color and form than there was of letters and numbers.

On the basis of the present review of the studies on associative clustering, some conclusions can be made:

1) equal MA normals and retarded subjects recall randomized or presented-clustered lists differently, but not

significantly so. The difference between retarded and normal subjects becomes a significant one when compared to equal CA normal subjects.

2) recall improves in both retarded and normal groups over five trials, but asymptote is reached by the second or third trial in the normal group with a slower learning curve in the retarded group.

3) there is no difference in recall between organic and cultural-familial retarded subjects.

4) there are significant differences in clustering between retarded and normal subjects when a measure including categorical intrusions is not used, but this difference disappears when such a measure is used.

5) retarded subjects do not have many of the concepts available to them and when pre-trained on concepts, significantly improve their recall and clustering scores.

6) a presented-clustered technique aids retarded subjects recall and clustering as compared to a randomized procedure.

7) generalization may or may not occur for retarded subjects from trained to untrained concepts.

8) a combined auditory-visual presentation method facilitates clustering and recall more in retarded subjects than does the visual method alone.

9) including several examples of stimuli significantly improves retarded subjects' clustering scores.

10) few studies take into account institutionalization or differential diagnosis.

Sorting. Studies of sorting usually involve the presentation of a group of stimuli which must be grouped together according to similarities among them. Stacey and Portnoy (1951) matched two groups of 25 institutionalized retardates each on CA to include a low MA group (mean CA=12.72 years, mean MA=7.49 years, mean IQ=59.32) and a high MA group (mean CA=13.02, mean MA=9.48, mean IQ=73.64). The test used was the Object Sorting Test (OST) from the Goldstein-Scheerer tests of abstractness and concreteness which involved sorting according to material, color and form. In the first task the items of the test were spread out on a table and the subjects were requested to group those items which belonged together. When the groupings were complete, the subject was asked for the reason for the groupings. During the second task, the subject was presented with several preformed groupings and asked why they were grouped thus. The results indicated that there were no significant differences on either task, but there was an indication that the high-MA group was superior on verbal naming tending to use functional classifications.

Iscoe and Giller (1959), also using the OST, attempted to match four groups of institutionalized retarded subjects (without evidence of organicity or psychopathology and who could communicate verbally) on MA with CA varying. The groups' mean CA's and MA's were 12.1 years and 6.5 years; 17.6 and 8.7; 28.2 and 8.9 and 43.4 and 9.9. It was found, however, that the MA's of the three remaining groups differed significantly from that of the first. The results indicated that with age, frequency of "public" responses (commonly accepted criteria for inclusion by the social culture) increased, but after age 35, "private" responses tended to predominate. The authors concluded that part of the retarded person's difficulty in sorting appeared to be due to their lack of "public" definitions for conceptual boundaries which might be due to institutionalization.

Clark and Thompson (1963) investigated the performance of institutionalized retarded subjects on easy and hard concept usage tasks with pictures instead of objects. The hardness of the concepts was established on an a priori basis with 16 cards each of four hard and four easy concepts. The procedure was similar to that of the OST with two tasks involved. The total mean IQ of all subjects was 63 with four CA groupings, 5 to 12 years, 13 to 20, 21 to 40, and 41 to 60. It was found that IQ was significantly correlated with successful grouping for only the easy series (r=.53), but 75.6 percent of the subjects did categorize at least somewhat. The difficult task was significantly more difficult for the subjects than was the easy task. It was observed that subjects either categorized or failed.

Furth and Milgram (1965) used four tasks in two comparative experiments of sorting including 1) picture sorting--18 sets of seven pictures laid in a row of four and one of three; the subject is asked to point out which four went together; 2) picture verbalization--the 18 sets of the three correct pictures were presented and the subject asked to tell why these went together; 3) word sorting--same as the first condition, but with words, 4) word verbalization--same as the second condition, but with words. In the first experiment with 38 non-institutionalized retarded subjects (mean CA=12 years, mean IQ=70, mean MA=9 years) and 38 normal children (mean CA=9.1) they found that the IQ X Modality interaction was significant; perusal of the means indicated that the retarded subjects were poorer on the verbal tasks, but were equal to the normal subjects on the non-verbal tasks. Verbal tasks were harder for all subjects than the non-verbal tasks and the authors felt that the difficulty was in verbal input not in output.

In the second study the subjects were 16 non-institutionalized retarded subjects (mean CA=9.2 years, mean IQ=66.9, mean MA=6 years) and 16 normal subjects (mean CA=6.1). The procedure was the same as above. The IQ X CA X Modality interaction was significant indicating that in comparison to the first study, the retarded subjects (MA 6 to 9) improved less than did the normal subjects (CA 6 to 9), but only on the verbal tasks. Both groups did equally well on the picture tasks.

Milgram (1966) used the picture procedure only, with two groups of institutionalized trainable mentally retarded subjects (TMR) (N=15, mean CA=18.1 years, mean MA=5.9 years) and non-institutionalized EMRs (N=16, mean CA=9.2, mean MA= 6.1, IQ=approximately 30 points higher than that for the TMRs), and non-institutionalized normal subjects (N=16, mean CA=6.1, mean IQ=60 points higher than TMRs). There were no significant differences between the groups on sorting, but the TMR's were significantly poorer on verbalization than the other two groups who did not differ among themselves. The effects of institutionalization were not controlled for.

Stephens (1964) matched 30 special class EMRs (mean IQ= 60) with 30 regular class normal subjects (mean IQ=101) on CA and tested them on a procedure similar to that used by Milgram and Furth above. There were 25 cards with seven pictures on each, four of which represented a single category. The experimenter named the category and the subject pointed out the four in the category. The normal subjects were able to give significantly more correct responses and were able to identify all the cards of more categories than did the retarded subjects.

Stephens (1966b) replicated his 1964 study with some differences. His subjects included regular class normals (N=30, mean IQ=101) and special class retarded subjects (N=30, mean IQ=60) in three age groups: CA 90-101 months, 102-113 months, and 114-126 months. Stephens' procedural difference was in showing the series twice to each subject, once with instructions to indicate which four pictures went together and state why they did so, and once giving the category name and having the subject point out the representative cards. The results corroborated those of the earlier study and Stephens concluded, unlike previously when he stated that retardates had fewer and simpler categories and were not thereby able to profit from experience as did the normal subject, that the retarded subjects did have some of the concepts in their repertoires, but that they were poorly delineated, i.e., not all the referents were identified.

Stephens (1966c) went one step further to identify the types of categories used most frequently by retarded subjects as compared to those used by normal subjects. His groups included Older Normals (mean IQ=101, mean CA=108 months, mean MA=109 months), Younger Normals (mean IQ=99, mean CA=65 months, mean MA=65 months) and special class EMRs (mean IQ=60, mean CA=107 months, mean MA=65 months) so that MA and CA controls were available. The same procedure as before was used. There were three types of categories: perceptual (e.g. size), use (e.g. heating) and human (e.g. size, age) with two conditions. Under the unstructured task when the categories were not named by the experimenter the Older Normals did significantly better than the EMRs on all three categories whereas the Younger Normals and the EMRs only differed on use categories (p .02); the two normal groups did not differ between themselves in any categories. In the structured task when the categories were named, the same results as above were reported, but now the two normal groups differed on perceptual and human catego-ies (p .05).

This latter study suggests that retarded subjects do not have a generalized deficit in concept usage or information, but perhaps specifically to certain types of concepts outside their training and/or experience. The study also pointed out that EMRs could make use of verbal labels for concepts as well as equal MA normals when these labels were supplied (i.e., making the subject very aware of what is demanded of him).

Hermelin and O'Connor (1958) in an interesting study with 20 institutionalized imbeciles (IQ range 28 to 50, mean IQ=40.7, mean CA=12.9 years) compared the rote learning of a task against the learning of a similar task when an abstraction would aid learning. Six series of 12 drawings were presented in pairs with candy hidden in a well beneath the correct drawing. All subjects received 20 trials on each series and each subject was able to name the object depicted in each drawing. The stimuli were two rote series (correct items had nothing in common), two concrete series (correct items were either furniture articles or an animal) and two abstract series (three of a kind; more than one). The 20 subjects were divided into two groups of 10 each; the first group receiving the rote series, concrete series and the abstract series in that order and the second, receiving the reverse order.

The results indicated that both groups required fewer trials to reach criterion on the concept series than on the rote series. Learning was described to be gradual for the rote series and sharp for the concept series. It appeared that abstractions were used whenever possible. There was also a significant positive correlation of 0.545 between IQ and errors. Only two subjects were able to identify verbally the basis for their correct response indicating either the lack of verbal labels or verbal mediation at all.

Prehm (1966a) constituted two groups of 54 non-institutionalized EMRs (CA=4 to 7 years) on the basis of IQ less than 83 and greater than 84 with means of 78.17 and 92.11 respectively (a significant difference) and matched for CA (67 and 63 respectively) and MA (53 and 58 respectively). Of three sub-groups within each IQ grouping, one (N=27) received a verbal label for the relevant concept, one was given a concept similar to the relevant one whereas the last received no cues. The tasks were two card sorting tasks with one relevant and two irrelevant concepts in each. Each group was given a pre-training task of sorting 16 cards relevant to their experimental group designation. Reinforcement was used for correct responses. The results indicated that there were no significant differences between the IQ groups, but pre-training on a similar task significantly affected performance on both transfer tasks. Subjects in the verbal label group attained the concepts in significantly fewer trials than did those in the other two groups while the performance of the similar concept group was significantly better than that of the no cue group. There were no significant interaction effects.

In a second study Prehm (1966b) found that meaningfulness exerted no statistically significant effect on the paired-associate performance of special class EMRs, but that significantly more trials were required to reach criterion on the high difficulty list than on the low difficulty list. It appeared to Prehm that whereas normal subjects did not exhibit intruding responses, the EMRs did and these intrusions were invariably relevant, but incorrect which suggests that the retarded subject requires training on relevant associations and abstractions.

The Stephens studies and those of Prehm suggest that retarded subjects do have concepts, but require practice in their use. In addition, these studies suggest that transfer of training in abstracting can also be attained thus offering possibilities for the construction of a hierarchy of abstraction tasks.

Gallagher (1969a, 1969b) clarified the paired-associate performance of retarded subjects somewhat indicating that retarded subjects do make use of implied associations in the learning of A - C lists in comparison to A - P lists where no associations were evident. Similarly, the subjects learned higher related pairs of words (e.g. deep-hole, run-fast, i.e. functional) better than those of a paradigmatic relationship (black-white). These results suggest another strategy for the training of retarded subjects.

A study by Hamilton (1966) provides more evidence for a transfer effect in concept training. Table 1 contains the basic descriptive statistics of his group:

Table 1

Summary Data from Hamilton (1966)

Groups	Total Number	Male	Female	Age		Duration of Institution-alization		IQ	
				$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD
I	20	7	13	16.5	2.50	4.92	4.17	40.95	10.39
II	20	9	11	16.67	2.08	4.83	3.17	36.55	8.62
III	20	11	9	16.32	2.88	4.67	2.41	41.95	7.89

Hamilton's subjects were selected from custodial wards and screened for ability to operate the apparatus and to do no better than chance on a pre-test. Pre-training included naming of the concept by the subject (animal, person, or thing) for group I, naming of the specific picture for group II and no response by either the examiner or the subject except pressing for group III. During the training session, each group received two sets of slides. Each subject was required to group the pictures together and if wrong, received a buzzer and a marble if correct. The criterion was five consecutive errorless choices on the first set before proceeding to the second set of slides. The results indicated that having the training on the first condition significantly improved trials to criterion as well as promoting greater generalization from the first to the second series of slides than did either of the other two conditions. A second analysis indicated that in 20 subjects where there was negative transfer, i.e., longer trials to criterion on the second task, all had significantly longer durations of institutionalization.

Several conclusions can be derived from the sorting studies:

1) Retarded subjects do have access to some concepts and can make use of them;
2) Retarded subjects have difficulty in utilization of these concepts especially where verbal labels are required;
3) Retarded subjects can be trained to use these and other concepts;
4) such training can be transferred to other situations with the same or similar concepts;
5) equal CA normal subjects do better than retarded subjects but there are no differences in performance on sorting tasks between equal MA normal and retarded subjects.

Studies of verbal abstracting using similarities tasks. The importance of language in abstracting performance is pointed to by Furth and Milgram (1965) who found that retarded subjects, regardless of etiology, i.e., cultural familial versus organic, performed as well as normal MA controls on concept tasks where language experience was not assumed to be relevant, but were inferior where language attainment or previous language experience was necessary. The studies by Griffith and colleagues suggest the same, i.e., the deficit in detecting similarities may be due to inadequate language experience. Gordon and Haywood's (1969) study suggests that unless retarded subjects have had experience with the concepts, stimulus enhancement may not help.

Griffith and Spitz (1958) in the first of a series of studies sought to determine to what extent the ability to abstract a common property from a group of three nouns was related to the way in which the subject defined those nouns. The subjects were 26 mildly retarded institutionalized boys (mean IQ 66, range 48 to 83) ranging in age from 14 to 20 with a mean of 17-2 years. The authors determined the level of difficulty for the concepts used in a pilot study. The experiment consisted of two sessions. In the abstraction sessions subjects were presented with eight groups of three nouns and asked to identify verbally the trait in common for each group. In the definition session the subjects defined these words plus filler words. Order of presentation of the two tasks was counterbalanced and no order effect was found. The results indicated that if at least two of the three words were defined with a common abstraction in each triad, it was significantly likely that the abstraction was correct in the first session. That is, if two or three of the words were defined with a common appropriate abstraction only 5.1 percent failed on the abstraction test whereas 49.3 percent succeeded; if no definitions or only one was given as an adequate abstraction, 32.1 percent failed and 13.5 percent succeeded--a highly significant difference.

Griffith, Spitz and Lipman (1959) replicated these findings, but added two normal groups. There were 44 institutionalized male and female retarded subjects: an MA 9 group (mean IQ=74, mean CA=17-9); an MA 7 group (Mean IQ=56, mean CA=16-9); and 56 normal school children: an MA 9 group (N=31, mean IQ=109, mean CA=9-3); and an MA 7 group (N=25, mean IQ="average," mean CA=7-0). The results indicated that: if a subject in either MA 7 group had a suitable abstraction in only one definition, he got the triad correct 10 percent of the time (retarded subjects) or 40 percent of the time (normal subjects) whereas in the MA 9 groups the figures were 60 percent for retarded subjects and 80 percent for normal subjects; and if a subject had a suitable abstraction in two or three definitions, he got the triad correct 90 percent of the time.

Griffith (1960) attempted to determine if the critical ratio of correct definitions to number of words in order to obtain the suitable abstraction was two-thirds. In this study groupings were of three and six nouns. Eighty-nine institutionalized retarded subjects in two IQ groups were used: IQ above 65 (mean IQ=72, mean CA=209 months) and IQ below 65 (mean IQ=53, mean CA=193 months). The results indicated that for the low IQ group at least, the proportion of correctly defined words was the important variable; the results for the high IQ group were more difficult to interpret, but seemed to indicate that only one word was needed to contain a suitable abstraction in the definition for the subject to correctly identify the commonality of the two groups of words.

Miller and Griffith (1961) attempted to assess the effects of training and reinforcement on the ability to correctly identify similarities in triads. Four groups of eight subjects were the trained groups with one group of 10 subjects as the untrained group. All groups were matched on full scale IQ, verbal IQ, and age as well as on performance on previous abstraction tests. The four concepts were selected on the basis of their difficulty in the earlier studies: small, large, white and round. There were six words for each concept divided into two triads and for each word an irrelevant concept was also chosen. Training consisted of pictures drawn to emphasize either the relevant or irrelevant or no reinforcement. Relevant reinforcement was "good" for the relevant concept whereas in the irrelevant condition, "good was given for the irrelevant concept. Training lasted for three consecutive sessions with an abstraction session seven days later and a definition session seven days after that.

Results indicated that: reinforcement had no differential effect upon performance but that training did; training did not generalize to materials not used in training, i.e., to the foil items.

Another avenue of studying (or improving) the poor verbal abstraction performance of retarded subjects has been through an enrichment procedure. This strategy derived from a study by Blaufarb (1962) who reported that presentation of sets of three proverbs to schizophrenic subjects significantly improved their ability to give an abstract interpretation when compared to a group given a single proverb condition. Normal subjects did not improve in the three proverb conditions. Blaufarb (1962) suggested that schizophrenics had an intact capacity for performing abstract functions, but that this capacity was marked by an input deficit.

Hamlin, Haywood and Folsom (1965) extended Blaufarb's findings with three schizophrenic groups of varying degrees of pathology and a non-schizophrenic but hospitalized group. These authors used the same stimulus conditions and found that the subjects with medium and mild degrees of pathology significantly improved on the enriched condition, whereas the severely pathologic patients and normal subjects did not. This finding suggested to the authors that in more severe schizophrenic cases, the capacity to verbally abstract became impaired and no amount of enriched input would overcome such an impairment.

Gordon and Haywood (1969) extended these findings in an experiment with organic and cultural-familial retarded subjects with the hypothesis that the latter group would benefit from enrichment because of their impoverished backgrounds whereas the former group would not because their capacity for verbal abstracting had been impaired. The subjects were 24 institutionalized retarded subjects matched on WAIS vocabulary scaled scores, CA and on WAIS IQ; there were 12 organically impaired and 12 cultural-familial retarded subjects. The stimuli used were a two-word similarities test made up of items from the similarities subtests of the WISC and WAIS and a five-word similarities test which included three new words for each concept. Each subject was presented with each list but some received the two-word list first and others the five-word list first. There were no order effects.

The results indicated that the original prediction was upheld; the cultural-familial group significantly improved its abstraction scores on the five-word or enriched test over its scores on the two-word or non-enriched test whereas the organic subjects improved only negligibly. An equal MA group of normal institutionalized subjects tested later did not significantly improve its scores, but was significantly better than either retarded group on original testing; on the enriched test, however, the cultural-familial subjects did not differ significantly from normal subjects. The authors concluded from this that the cultural-familial subjects suffered from an input deficit as a result of their impoverished environments which could account for their poor abstracting ability.

This improvement in abstraction scores, however, may be slightly misleading because the improvement is from a mean of 13.25 to 19.00 for the familial group--still well below the maximum of 40 points or even the 27.14 found for normal non-institutionalized 11 year olds (Foster, 1970). Obviously, enrichment procedures do not overcome the familial-retarded subject's poor abstracting ability completely.

The results reported by Gordon and Haywood (1969) were essentially replicated by Foster (1970). Foster (1970) used 2, 3, 4 and 5 word similarities tests with slow learning children enrolled in regular classes and with equal MA and CA matches. All subjects improved their abstracting scores under the verbally enriched conditions, but the slow learning children exhibited significantly greater improvement than did those in the equal MA and CA groups. In addition, it was found that the three-word enrichment was sufficient to produce a maximum gain for the slow learning children; adding the fourth and fifth words produced no more gains.

Whereas the Griffith et al. series of studies indicated that how well a retarded subject performs on a verbal abstraction test depends upon how familiar he is with the definitions of the words involved, i.e., how familiar he is with the concept(s), the Gordon and Haywood (1969) and Foster (1970) studies suggested that how well a retarded subject performs is related to the number of referents he has available to determine the concept required of him. These latter studies imply that the subject has a knowledge of all of the concepts and increasing the number of referents merely primes the subject to recall the concept. That this may not be so in all cases is attested to by several things:

1) perusal of some of the raw data of Haywood et al. indicates that many of the subjects do not have several of the concepts available especially squares, cutting instruments, fuel, measurements, senses, furniture and cleaning instruments.
2) the Griffith et al. data suggests that Haywood et al. are helping the retarded subject clarify those concepts with which they have had experience, but training is required before the other concepts become familiar since the subjects only get those abstractions with which they are familiar.

3) that subjects in answering the questions often refer to many of the concrete stimulus characteristics, but cannot give the unifying concept trait.
4) Blount (1969, 1970) found that although retarded subjects did just as well on abstraction tasks where the words used were familiar to them (via an earlier association task) when the labels were given, they did poorer than the normal subjects when they were required to give the appropriate concept label.

Each of these pieces of evidence points toward the possibility that the retarded subject's poor verbal abstracting ability is due to an input deficit, but that it is not only limited to limited concept referents; it is also due to a limited number of concepts available to them in association with their referents.

Conclusion

Generally, the literature on verbal abstraction using associative clustering, sorting and similarities tasks suggests that retarded subjects do suffer from a poor abstracting ability, but that this ability can be improved by remedial procedures such as clustering of similar or high association words and giving an increased number of referents as examples and that these results might be generalizable. However, for more lasting results the literature also suggests that training on concepts would be appropriate, that is, in discerning similarities and generalizing these similarities to other stimuli. By this, a lattice-type network of concepts might be established by which retarded subjects could learn how to learn.

APPENDIX B

CONCEPTS AND TESTS

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Concepts for List I

1. Fruit
2. Animals
3. Alcohol
4. Musical instruments
* 5. Fuel (Occupations)
6. Measurements
7. Things made of metal
* 8. Squares (Numbers)
9. Cutting tools
10. Clothes
* 11. Senses (Parts of body)
12. Furniture
13. Farm animals
14. Sports (with balls)
15. Cooking utensils
16. Cleaning utensils (for floors)
17. Jewelry
18. Vegetables
* 19. Writing Tools (Insects)
20. Transportation

* Indicates changes from Foster's (1970) list. The concepts of fuel, cutting tools, senses and writing tools were changed because more referents could not be generated for each. The concept of squares was removed because in analyzing Foster's data no subject scored full marks and only 8 got 1 each out of a total of a possible 100 points and, therefore, it would be extremely difficult to train the present subjects on its meaning.

Pre-Treatment Test-List I

1. Orange - banana
2. Lion - dog
3. Beer - wine
4. Piano - violin
5. Nursing - teaching
6. Pound - mile
7. Penny - scissors
8. One - twenty
9. Knife - axe
10. Coat - dress
11. Eye - foot
12. Table - desk
13. Cow - pig
14. Baseball - tennis
15. Skillet - kettle
16. Mop - vacuum cleaner
17. Bracelet - necklace
18. Beans - carrots
19. Fly - bee
20. Airplane - car

Concepts for List II

1. Money
2. Emotions
3. Light sources
4. Toys
5. Birds
6. Letters of the alphabet
7. Parts of a building
8. Colors
9. Buildings
10. Flowers
11. Heat sources
12. Trees
13. Made of wood
14. Weapons
15. Made of water
16. Names of people
17. Cats
18. Months
19. Days
20. Family members

Pre-Treatment Test-List II

1. Penny - dime
2. Sorrow - joy
3. Candle - lantern
4. Ball - wagon
5. Owl - parrot
6. A - N
7. Door - window
8. Red - blue
9. School - house
10. Roses - daisies
11. Furnace - match
12. Pine - spruce
13. Chair - sled
14. Gun - bow and arrow
15. Ocean - rain
16. Jim - Sue
17. Tiger - kitten
18. January - November
19. Tuesday - Saturday
20. Mother - cousin

Five-Word Post-Treatment Test-List I

1. Peach - apple - cherry - pear - grape
2. Cat - horse - tiger - rat - mouse
3. Whiskey - gin - bourbon - brandy - rum
4. Guitar - harp - flute - banjo - organ
5. Cook - fireman - clerk - milkman - policeman
6. Ounce - dozen - hour - inch - yard
7. Pan - nail - wire - key - safety pin
8. Nine - thirty - twelve - eight - forty-one
9. Razor - glass - scissors - saw - sword
10. Shirt - pants - hat - skirt - tie
11. Skin - nose - hand - tongue - leg
12. Chair - sofa - television - bed - lamp
13. Chicken - goose - lamb - duck - turkey
14. Golf - football - bowling - basketball - soccer
15. Pot - pan - coffee pot - griddle - toaster
16. Broom - scrub-brush - carpet-sweeper - sponge - dust pan
17. Ring - watch - pin - earrings - cuff links
18. Peas - potatoes - corn - squash - beets
19. Grasshopper - mosquito - ant - beetle - lady bug
20. Boat - bus - bicycle - train - truck

Two-Word Post-Treatment Test-List I

1. Peach - apple
2. Cat - horse
3. Whiskey - gin
4. Guitar - harp
5. Cook - fireman
6. Ounce - dozen
7. Pan - nail
8. Nine - thirty
9. Razor - glass
10. Shirt - pants
11. Skin - nose
12. Chair - sofa
13. Chicken - goose
14. Golf - football
15. Pot - pan
16. Broom - scrub-brush
17. Ring - watch
18. Peas - potatoes
19. Grasshopper - mosquito
20. Boat - bus

Five-Word Post-Treatment Test-List II

1. Cent - nickel - quarter - shilling - dollar
2. Hate - love - fear - anger - depression
3. Flashlight - lightbulb - match - lamp - streetlight
4. Doll - playhouse - bat - teddy bear - puzzle
5. Robin - swallow - eagle - chickadee - cardinal
6. B - G - O - Q - S
7. Floor - roof - chimney - room - wall
8. Yellow - brown - green - purple - orange
9. Church - garage - barn - shed - fire station
10. Tulips - pansies - carnations - azaleas - violets
11. Stove - radiator - register - oven - kiln
12. Oak - maple - palm - dogwood - magnolia
13. Toothpick - bookshelf - kindling - log - desk
14. Hatchet - cannon - spear - club - pistol
15. Sea - river - lake - puddle - stream
16. Ann - Butch - Charlie - Carl - Paul
17. Lion - jaguar - cheetah - cougar - leopard
18. April - June - February - July - September
19. Monday - Sunday - Wednesday - Friday - Thursday
20. Son - uncle - aunt - sister - father

Two-Word Post-Treatment Test-List II

1. Cent - nickel
2. Hate - love
3. Flashlight - lightbulb
4. Doll - playhouse
5. Robin - swallow
6. B - G
7. Floor - roof
8. Church - garage
9. Yellow - brown
10. Tulips - pansies
11. Stove - radiator
12. Oak - maple
13. Toothpick - bookshelf
14. Hatchet - cannon
15. Sea - river
16. Ann - Butch
17. Lion - jaguar
18. April - June
19. Monday - Sunday
20. Son - uncle

APPENDIX C

SCORING CRITERIA

Scoring Criteria for List I*

1. (<u>Orange</u> - <u>Banana</u>) - <u>Peach</u> - <u>Apple</u> - Cherry - Pear - Grapes

   2 pts. Fruit.
   1 pt. Have peelings (seeds, juice, stem)--eat them--they're sweet--can cook them--have vitamins--food.
   0 pts. Made alike--same cost--wash them--help your teeth--taste alike--look alike--treats--dessert--curved and round--round--have the same feelings--they grow.

2. (<u>Lion</u> - <u>Dog</u>) - <u>Cat</u> - <u>Horse</u> - Tiger - Rat - Mouse

   2 pts. Animals.
   1 pt. Have 4 legs (tails, bodies, hair, fur, noses, toes, teeth, ears)--can walk--bite--they eat--they're all meat.
   0 pts. Have eyebrows--same color--got the same legs and tail and head--shaped the same--sound the same--can ride them--can kill each other--make sounds--pets--can lie down--run after you--play with them.

3. (<u>Beer</u> - <u>Wine</u>) - <u>Whiskey</u> - <u>Gin</u> - Bourbon - Brandy - Rum

   2 pts. Intoxicating beverages--intoxicants--alcohol--liquor--alcoholics.
   1 pt. Drink it--got alcohol in them--can make you drunk--fluids--liquids.
   0 pts. In bottles--put in glass--white or light color--found in punch--come from same place--hurts their hearts--taste alike--use when celebrating--pour it--they put some kind of stuff in the water--all like water--got the same stuff in them.

4. (<u>Piano</u> - <u>Violin</u>) - <u>Guitar</u> - <u>Harp</u> - Flute - Banjo - Organ

   2 pts. Musical instruments--instruments, play them--instruments to play music.

* Words which are underlined and within brackets represent those exemplars contained in the pre-treatment test; the underlined words without brackets represent those exemplars contained in the two-word post-treatment test while the five words without brackets are those exemplars contained in the five-word post-treatment test.

1 pt. Play music--are music--can play them--music like in a band--allplay tones--instruments--play sounds--instruments, play alike--plays something.
0 pts. Same color--got a sound to them--have the same notes--you do them with your hands--sound the same--all toys--they make noise--you like to play it--sound alike--use your hands with both.

5. (Nurse - Teacher) - Cook - Fireman - Clerk - Milkman - Policeman

2 pts. Occupations--they're all men, they all work--all workers.
1 pt. Work with fire--people--you work at them--all something like a servant--they all help.
0 pts. One makes fire, other puts it out.

6. (Pound - Mile) - Ounce - Dozen - Hour - Inch - Yard

2 pts. Measurements--you can measure--they all measure.
1 pt. Tell how big--contain smaller measurements--so much in each--amounts.
0 pts. All long--can weigh them.

7. (Penny - Scissors) - Pan - Nail - Wire - Key - Safety Pin

2 pts. Made of metal--all iron--made out of tin or something like that--they're real hard steel.
1 pt. Shiny--all materials are mined.
0 pts. All tools--same color--both got sounds when you drop them.

8. (One - Twenty) - Nine - Thirty - Twelve - Eight - Forty-one

2 pts. Numbers.
0 pts. Some big and some small.

9. (Knife - Axe) - Razor - Glass - Scissors - Saw - Sword

2 pts. Cutting implements--cutting tools--tools, cut things--you cut them, tools.
1 pt. Deadly, cut--cut--cut, chop--sharp.
0 pts. Chop and stab.

10. (Coat - Dress) - Shirt - Pants - Hat - Skirt - Tie

2 pts. Clothes--clothing--garments--wearing apparel.
1 pt. Goes on body--put on--wear it--made of material.
0 pts. Have buttons--made of same material--feel alike.

11. (Eye - Foot) - Skin - Nose - Hand - Tongue - Leg

2 pts. Parts of the body--on human bodies.
1 pt. All have skin--part of yourself.
0 pts. On your face--you use them.

12. (Table - Desk) - Chair - Sofa - Television - Bed - Lamp

2 pts. Furniture.
1 pt. Have them in house.
0 pts. Use all of them--part of a house.

13. (Cow - Pig) - Chicken - Goose - Lamb - Duck - Turkey

2 pts. Farm animals--animals used for meat--animals, you eat them--animals, put in barn.
1 pt. Animals--all produce meat--you eat them--all food--all live on a farm--they walk.
0 pts. Pet them--they can hurt people.

14. (Baseball - Tennis) - Golf - Football - Bowling - Basketball - Soccer

2 pts. Sports using balls.
1 pt. Sports--sports and games--we play with them--what you play with--they're balls--play both--they're games.
0 pts. Use them to hit with--throw them in a little hole--all toys--play gym with them--you throw the ball up and hit the ball.

15. (Skillet - Kettle) - Pot - Pan - Coffee Pot - Griddle - Toaster

2 pts. Cooking utensils--all things to cook with.
1 pt. You cook on the stove--cook--cook and clean them--they're made of iron.
0 pts. Both smooth, round, sides on them, bottom--have handles--they're round.

16. (Mop - Vacuum Cleaner) - Broom - Scrub-brush - Carpet-Sponge - Dust Pan

2 pts. Cleaning utensils for floors--utensils for cleaning floors--clean floors--get your floors clean.
1 pt. Clean your house--to clean with--use them to pick up dust and stuff--clean and get up trash--wash your floor with them--housework.

0 pts. You sweep--you rinse the floor with it--sweep with them all--sweep trash and put it in the garbage--you get up things with them--can dry the floor with them--you dry off the floor with them--you dry off the floor--almost the same handle--something to push.

17. (<u>Bracelet</u> - <u>Necklace</u>) - <u>Ring</u> - <u>Watch</u> - Pin - Earrings - Cuff links

2 pts. Jewelry--jewels.
1 pt. You wear them--put them on you--put on.
0 pts. Look just alike--have on clothes--put around arm and neck--most are diamonds--carry around with you--can buy--both fasten--round, stretchy--they're steel--some have diamonds on it.

18. (<u>Beans</u> - <u>Carrots</u>) - <u>Peas</u> - <u>Potatoes</u> - Corn - Squash - Beets

2 pts. Vegetables.
1 pt. You eat them--cook them--put on stove--put in pot--boil them--food--all grow.
0 pts. Look alike--same color--have roots.

19. (<u>Fly</u> - <u>Bee</u>) - <u>Grasshopper</u> - <u>Mosquito</u> - Ant - Beetle - Lady bug

2 pts. Insects.
1 pt. All animals--have legs--all small.
0 pts. All jump--all fly--have wings.

20. (<u>Airplane</u> - <u>Car</u>) - <u>Boat</u> - <u>Bus</u> - Bicycle - Train - Truck

2 pts. Means of transportation--transportation--they take you somewhere--take you places--you ride in them when you go somewhere.
1 pt. Ride in them--you ride, go to the store in them--ride--both got motors--drive.
0 pts. Both got wheels, windows, seats, windshields (or other common properties not highly relevant to being means of transportation)--need gas--both move--they go--can both run--have to have a driver.

Scoring Criteria for List II*

1. (Penny - Dime) - Cent - Nickel - Quarter - Shilling - Dollar

   2 pts. Money--all amounts of money.
   1 pt. Spend them--can buy things with them.
   0 pts. One is bigger than the other.

2. (Sorrow - Joy) - Hate - Love - Fear - Anger - Depression

   2 pts. Emotions--feelings.
   1 pt. They tell about how you feel.
   0 pts. Love or hate someone--they're opposites--names of things.

3. (Candle - Lantern) - Flashlight - Lightbulb - Match - Lamp - Streetlight

   2 pts. Lights--give light.
   1 pt. All shiny--help you see.
   0 pts. Use them--look at them.

4. (Ball - Wagon) - Doll - Playhouse - Bat - Teddy Bear - Puzzle

   2 pts. Toys--playthings.
   1 pt. You play with them--belong to children.
   0 pts. They go together--doll goes in playhouse.

5. (Owl - Parrot) - Robin - Swallow - Eagle - Chickadee - Cardinal

   2 pts. Birds--bird family.
   1 pt. They fly--have feathers (wings, beaks)--have two legs--animals--living things.
   0 pts. Pets--you look at them--pretty.

6. (A - N) - B - G - O - Q - S

   2 pts. Letters--parts of the alphabet.
   1 pt. Write with them--alphabets--read them--spell words.
   0 pts. Use them--need them.

* Words which are underlined and within brackets represent those exemplars contained in the pre-treatment test; the underlined words without brackets represent those exemplars contained in the two-word post-treatment test while the five words without brackets are those exemplars contained in the five-word post-treatment test.

7. (Door - Window) - Floor - Roof - Chimney - Room - Wall

   2 pts. Parts of a house (building).
   1 pt. Has a building.
   0 pts. You walk on the floor under the roof.

8. (Red - Blue) - Yellow - Brown - Green - Purple - Orange

   2 pts. Colors.
   1 pt. You color with them.
   0 pts. Look at them--pretty.

9. (School - House) - Church - Garage - Barn - Shed - Fire Station

   2 pts. Buildings.
   1 pt. Made of same things--have windows and doors--go in them.
   0 pts. Departments--go from one to the other.

10. (Roses - Daisies) - Tulips - Pansies - Carnations - Azaleas - Violets

   2 pts. Flowers.
   1 pt. They grow--have blooms--pick them.
   0 pts. Look at them--like them.

11. (Furnace - Match) - Stove - Radiator - Register - Oven - Kiln

   2 pts. Give out heat--heat--keep you warm.
   1 pt. All burn--fire--dangerous--you might get burned.
   0 pts. Use them--in the house.

12. (Pine - Spruce) - Oak - Maple - Palm - Dogwood - Magnolia

   2 pts. Trees.
   1 pt. They grow--have leaves--all are wood.
   0 pts. They're big--same size.

13. (Chair - Sled) - Toothpick - Bookshelf - Kindling - Log - Desk

   2 pts. All made of wood--wood.
   1 pt. Made of same things.
   0 pts. Use them in the house--build fires with them.

14. (Gun - Bow and Arrow) - Hatchet - Cannon - Spear - Club - Pistol

    2 pts. Weapons--kill with them.
    1 pt. You can get hurt.
    0 pts. Cannon shoots--hatchet cuts.

15. (Ocean - Rain) - Sea - River - Lake - Puddle - Stream

    2 pts. All are water--made of water.
    1 pt. Wet--can drown in them.
    0 pts. Part of Nature--outdoors.

16. (Jim - Sue) - Ann - Butch - Charlie - Carl - Paul

    2 pts. Names.
    1 pt. People.
    0 pts. Brothers and sisters--friends.

17. (Tiger - Kitten) - Lion - Jaguar - Cheetah - Cougar - Leopard

    2 pts. Cats--cat family.
    1 pt. Animals--they growl--have 4 legs (tails, etc.).
    0 pts. Pets--name them.

18. (January - November) - April - June - February - July - September

    2 pts. Months--months of the year.
    1 pt. Parts of a year.
    0 pts. Birthdays--seasons--hot and cold.

19. (Tuesday - Saturday) - Monday - Sunday - Wednesday - Friday - Thursday

    2 pts. Days of the week--days.
    1 pt. They make up a week.
    0 pts. One comes before the other--weekend.

20. (Mother - Cousin) - Son - Uncle - Aunt - Sister - Father

    2 pts. Relatives--relations--kin--all related to you.
    1 pt. All in the family--people.
    0 pts. Son is younger than the uncle--you know them.

APPENDIX D

RAW DATA

Raw Data

Treatment Group	Number of Exemplars	Order of Post-Test Presentation	Subjects	Pre-Treatment Test Scores List I	Pre-Treatment Test Scores List II	Post-Treatment Test Scores List I	Post-Treatment Test Scores List II
List I	5	1	1	19	-	24	22
			2	26	-	35	32
			3	27	-	32	28
			4	27	-	33	32
		2	5	21	-	34	35
			6	19	-	34	30
			7	25	-	37	29
			8	22	-	34	32
	2	1	9	20	-	31	21
			10	24	-	26	27
			11	25	-	33	35
			12	19	-	36	26
		2	13	32	-	34	27
			14	18	-	29	20
			15	13	-	29	21
			16	11	-	29	23
List II	5	1	17	-	29	22	36
			18	-	33	31	36
			19	-	27	30	33
			20	-	26	30	37
		2	21	-	23	31	31
			22	-	24	32	38
			23	-	25	24	40
			24	-	25	21	30

Raw Data (Continued)

Treatment Group	Number of Exemplars	Order of Post-Test Presentation	Subjects	Pre-Treatment Test Scores		Post-Treatment Test Scores	
				List I	List II	List I	List II
List II	2	1	25	-	29	27	35
			26	-	23	22	27
			27	-	34	26	38
			28	-	22	21	32
		2	29	-	24	28	35
			30	-	32	31	38
			31	-	26	24	32
			32	-	24	23	32
Not-Trained Contrast Group	5	1	33	18	28	25	27
			34	16	22	26	25
			35	26	35	32	34
			36	14	18	18	18
		2	37	23	29	28	31
			38	28	26	30	32
			39	13	12	15	22
			40	17	26	18	23
	2	1	41	15	21	19	25
			42	24	32	29	31
			43	15	20	18	23
			44	2	3	3	3
		2	45	24	27	27	35
			46	26	34	30	35
			47	25	34	27	35
			48	28	33	26	32

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