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The Influence of Response Mode, Sex and Reading Ability for Three Levels of Difficulty in a Meaningful Learning Task

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THE INFLUENCE OF RESPONSE MODE, SEX AND READING ABILITY
FOR THREE LEVELS OF DIFFICULTY IN A MEANINGFUL LEARNING TASK

A Thesis

Presented to the
Department of Psychology
and the
Faculty of the Graduate College
University of Nebraska at Omaha

In Partial Fulfillment
of the Requirements for the Degree
Master of Arts

by

William B. Todd

July 1969

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Accepted for the faculty of The Graduate College of the University of Nebraska at Omaha, in partial fulfillment of the requirements for the degree Master of Arts.

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INTRODUCTION AND STATEMENT OF THE PROBLEM

The Educator and the Educational Psychologist are actively trying to improve education. In order to do this research has investigated many phases of education. Learning is probably the single most important area being investigated. Both the teacher and the student would like to know what methods and techniques are best for optimal learning. Verbal learning experiments such as those dealing with massed and spaced practice have helped in answering this question. However there are still many questions unanswered.

What is the influence of note-taking, underlining, or just writing on students learning? Does an overt response, such as writing, enhance learning more than simply reading the material? This study considers these questions in light of research that may indicate an insight into the importance of overt vs. covert responding in learning tasks.

Review of the Literature

The literature on covert and overt responses can be traced from studies which investigate programmed instruction, nonsense learning and meaningful learning. An important question in programmed instruction is whether or not the student should write the response or just think or read it. Skinner (1958) states that a student should actively respond in learning tasks and not merely use recognition in the tasks if he is to recall the material. There are many studies

using programmed instruction (Fry, 1960; Krumboltz and Weisman, 1962; Holland, 1964; Kemp and Holland, 1966; Price, 1968) that support Skinner's hypothesis. Other studies also using programmed materials do not support Skinner's position. These studies (Evans, Glaser, and Homme, 1959; Coulson and Silberman, 1960; Kaess and Zeaman, 1960; Silverman and Alter, 1964; Crist, 1966; Elliott and MacMurray, 1966) have investigated reading versus writing of programmed material and have found no significant advantage to either method.

Other studies have used the covert response alone when comparing auditory and visual presentation of material to be learned. King (1968) compared oral presentation - written recall, oral presentation - oral recall, visual presentation - written recall, visual presentation - oral recall. The learning material was prose and poetry of different lengths. He scored the recalls for accuracy by 10 dependent measures and found written recall means to be greater in all cases. Small mean differences in presentation methods of poetry were found for the longer passages but these were not significant. Bartlett's "War of the Ghosts" was among the materials used.

Horowitz and Berkowitz (1967) also compared listening and reading presentations and speaking and writing recalls. Again Bartlett's "War of the Ghosts" was used. Spoken recalls produced a greater number of words but they were more repetitive and wordier than the written recalls.

A combined auditory and visual presentation was included with visual alone and auditory alone in the studies by King and Madill (1968) and Hinz (1968). King and Madill also used "War of the Ghosts" by Bartlett, this time presenting three lengths of the story. When scoring the recalls according to number of words and number of sequences recalled, the dual presentation was significantly better for number of sequences recalled only. The oral presentation produced a minimal number of sequences recalled.

The results of Hinz (1968), who used 12 German nouns, agreed with King and Madill (1968) in that oral presentation was the least effective with visual next and the dual method was the most effective. The dual method was significantly different from the oral but not the visual method. Methods of presentation were also related to whether the test was spoken or written. Auditory was inferior regardless of test mode. The presentation method was found to have no influence on the type of post-test given.

Other types of responding that have been investigated are reading material aloud against reading silently. Hsui and Li (1965) found reading aloud more efficient for memorization of poems while silent reading was better for prose material. Silent reading was best in all cases when comprehension was tested. Poulton and Brown (1967) tested reading aloud and reading silently on four 450-word passages. They found memory (as measured by open-ended questions) for the

first 30% of the passage better if read silently, equally good for the middle portion with the remaining 10% remembered better if it were read aloud.

Using a discrimination learning task O'Brien and Carmean (1967) found that auxiliary responses, such as verbalizing and writing of the stimulus names, were equally effective for retention. The generation of the stimulus was the essential element for learning irrespective of whether it was generated by verbalizing or writing the stimulus.

Another study that dealt with the influence of writing versus reading (Eigen and Margulies, 1963) found that the more distant the information was from what the student knew the more important was the requirement of an overt response. Although these results are similar to studies using meaningful material, overt responding may influence learning of nonsense words differently from the way it influences learning of meaningful material. Eigen and Margulies recognized that the extra time taken to make the overt response might be the reason for the significant advantage which the overt response group had over the covert group for the high information level of the nonsense words.

No studies were found that used meaningful material and varied underlining, reading alone, or note-taking as modes of responding.

These results fail to indicate what is the real influence of overt responding. Cummings and Goldstein (1964) pre-

sented a program on "Diagnosis of Myocardial Infarction" to a group that wrote in the responses and to a group that just read through the filled-in program. The program contained a more difficult pictorial section and an easier verbal section. They found that the overt group performed significantly better on the pictorial section than did the covert group on both the immediate and delayed post-tests. They also found the overt group to be significantly higher on the verbal section but the difference was not as great. They suggested that the longer, more complicated, or unusual the response required, or the more new material that the program contained, the more important is the overt responding.

Williams (1963, 1965, 1966) compared constructed response training with multiple-choice training in relation to the type of criterion test. Williams (1963) used a review program of material already learned and gave a constructed response criterion test. She found that the constructed response training was better on test items that required using novel or technical terminology introduced by the program but not on items that were general familiar vocabulary.

Williams (1965) extended the previous study by using new rather than review material. She also gave a multiple choice as well as a constructed response criterion test. Again she found that constructed response training was more effective than multiple choice training when complex, technical, terminology introduced by the program was required in

the post-test. The main effect of training mode on the post-test was significant.

The latest study by Williams (1966) used three types of tasks and related them to training mode. One task was a program on animal classification, another a program on familiar vocabulary and the third was a combination of both. On the post-test the group that only constructed responses and the group that constructed responses for the technical material and used multiple-choice for the familiar vocabulary were significantly better at the .05 level than the multiple-choice group and the control group. The control group used a combination constructed response and multiple-choice but there was no correlation between these responses and the type of material as there was for the other combination group. Therefore it was concluded that the combination constructed response and technical material caused the significant difference.

The findings of Goldbeck and Briggs (1960) and Goldbeck and Campbell (1962) are further evidence that learning is influenced by the nature of the material. They presented discrete factual items in three progressively more difficult forms. Difficulty was varied by changing the amount of cueing and prompting of passages.

Goldbeck and Briggs (1960) found that overt responding produced superior learning at the medium level of difficulty as compared with the learning at the easy level. They found,

however, that the read group was superior to the overt response group at all levels of difficulty.

Goldbeck and Campbell (1962) also varied discrete facts for three levels of difficulty through amounts of cueing and prompting. They presented 35 factual items three different ways (easy, medium, and hard) to three different response groups (reading, thinking the response, and writing the response). There were six Ss in each of the nine groups. The response mode x difficulty level interaction was significant. They found the overt response group superior but not significant at the intermediate level of difficulty and significantly inferior at the easy level.

These results suggest that there is an influence of an overt response in a learning task which may be related to the task difficulty. Further support is provided by another study (Ushkow, 1967) that compared writing with reading a program on symbolic logic. Results from 80 college freshmen disclosed that the effectiveness of response modes is influenced by the criterion test type. Ushkow stated that for recall of specific responses overt responding is warranted.

In summary, we find a controversy over how overt responding influences learning. The studies using programmed instruction seem to be inconclusive. Five studies suggest that active responding is important for learning effectively.

Nine studies suggest no significant advantage to the practice of actively responding in programmed learning.

In contrast with overt responding is covert responding. Studies using covert responding vary methods of presentation. Results of several studies (Horowitz and Berkowitz, 1967; Hinz, 1968; King, 1968; King and Madill, 1968) show that there is no significant advantage to either the auditory, visual or dual auditory-visual presentation.

When combining overt and covert responding in a study using other than programmed materials, the results suggest that covert responding (reading silently) is superior to overt responding (reading aloud) for comprehension purposes. The investigators (Hsui and Li, 1965; Poulton and Brown, 1967) used prose and poetry while varying overt and covert responding.

A clearer indication of the influence of overt responding on learning is seen in the studies using nonsense words (Eigen and Margulies, 1963), technical material (Williams, 1963, 1965, 1966), and discrete facts (Goldbeck and Briggs, 1960; Goldbeck and Campbell, 1962). These studies suggest that the influence is related to the nature of the material presented. It seems that the more factual, informational and difficult the material the more important is the overt response for the learning of the material.

Statement of Problem

This research on responding and difficulty of material

has left many questions unanswered. Additional research should be done regarding the influence of overt responding as compared with covert responding for a meaningful learning task. What is the effect of task difficulty on retention? Is there any relationship between overt responding and length of task? The present study attempts to answer these questions. In addition the influence of sex and reading ability in a learning task were investigated.

Hypotheses

This study compares three response modes (a) reading only (covert response), (b) underlining, and (c) note-taking (overt responses) across three levels of difficulty (three lengths of a story) for males and females with high and low reading ability. Comparisons were made on the following dependent measures: the number of words recalled, the number of identical words recalled, the number of eight-word sequences recalled, and the number of idea units recalled. The problem was explored via the following hypotheses:

1. There will be a significant difference in number of words recalled between levels of difficulty.

- a. The number of words recalled at the lowest level of difficulty will be significantly different from the number of words recalled at the middle level of difficulty.

- b. The number of words recalled at the lowest level of difficulty will be significantly different from the number of words recalled at the highest level of difficulty.

c. The number of words recalled at the middle level of difficulty will be significantly different from the number of words recalled at the highest level of difficulty.

2. There will be a significant difference in number of words recalled between the response modes (reading only, underlining, or note-taking).

a. The number of words recalled by the reading group will be significantly different from the number of words recalled by the underline group.

b. The number of words recalled by the reading group will be significantly different from the number of words recalled by the note-taking group.

c. The number of words recalled by the underline group will be significantly different from the number of words recalled by the note-taking group.

3. There will be no significant difference in the number of words recalled between sexes of the subjects.

4. There will be a significant difference in the number of words recalled between the subjects with low reading scores and subjects with high reading scores.

The above hypotheses were also tested for the other three dependent variables, the number of identical words recalled, the number of eight-word sequences recalled and the number of idea units recalled. Since E was primarily interested in these hypotheses the interaction hypotheses were investigated without being stated.

METHOD

Subjects

The design required 36 basic groups (three response modes x three levels of difficulty x male or female x high or low reading ability). Each group contained 5 Introductory Psychology students for a total of 180 subjects. ✓

Age and class were considered important extraneous variables. To control for these factors, Ss were all under 21 years of age and were freshmen admitted the previous fall.

Reading ability was controlled by taking the top 50 and the bottom 50 males, and the top 50 and the bottom 50 females according to their total scores on the Ohio State University Psychological Test. The highest single score achieved by the sample was 127 and the lowest single score was 18. There was no overlapping of scores between the high group and the low group for either males or females. A 25 point differential existed between the top low male and the bottom high male and a 17 point differential existed between the top low female subject and the bottom high female subject. These 200 students were the source of the final 180 students used. The extra twenty students were to allow for students who may have dropped out of school or other extenuating circumstances. Ten of the twenty alternates were needed. Forty-five of each of the four groups of fifty described above made up the final sample. The final sample was stratified for sex and high and high and low reading ability. The 45 Ss of each strata were

randomly assigned to the nine different groups through the use of random numbers. Five Ss from each strata were included in each of the nine groups making a total sample of 180 Ss.

Materials

The story used in this study was Bartlett's (1932) "War of the Ghosts." The three levels of difficulty were operationally defined as three different lengths of the story (44, 140, 256 words). The assumption was made that it was harder to learn a longer passage. These three lengths of "War of the Ghosts" with minor changes had previously been written for another study (King and Madill, 1968). The learning material is presented in Appendix A.

Another major extraneous variable was the complexity of the stories. Minor changes were made in the original 40 word story and the original 260 word story to equate the complexities of the stories as near as possible. Flesch's Reading-Ease formula was applied to the three stories and with the changes a difference of 6 points between stories out of the highest single score of 96 was found, making the complexity of the stories approximately the same. Flesch's Reading-Ease formula was chosen because cross-validation studies with it and the Winnetka, Lorge, and the Dale-Chall formulas have given it high validity coefficients (Chall, 1954). However it is recognized that the reliability of a formula on a passage 44 words in length is less than for longer passages.

Procedure

A pilot study was done to determine the presentation and recall time limits for each story length. An ample time was set for the longest story based on the time it took the pilot subjects to take notes over the longest story. Then the time limit of the other two stories were determined by taking the appropriate proportion of the longest time according to the length of the shorter stories. The 140 word groups were given about 55% of the time allowed the 256 word groups and the 44 word groups got about 16% of the time allowed the 256 word groups.

The recall time limit was established in the same manner. The time for the 44 and 140 word groups were 16% and 55% of the time it took the pilot Ss to recall the longest story. These time limits and percentages are shown in Table 1.

TABLE 1

Time Limits for Presentation and Recall (In Seconds)

Story Length	Read	Recall	% Total
44	80	90	16
140	250	280	55
256	450	520	100

In order that the Ss have at least one exposure to the

material, the time that allowed 90% of the pilot Ss to complete one exposure was chosen. Recall limits allowed at least 90% of the pilot Ss to have completed their recall of the story. All Ss exposed to the same length story were allowed the same amount of time for presentation and recall.

Groups

The Reading Group was given the passage to read only as many times as the time limit allowed.

The Underline Group read and underlined the passage as they read it. Their instructions told them to underline effectively and efficiently only important words and phrases.

The Note-taking Group read the passage and took notes on the material as they read it. Emphasis was placed on efficiency of note-taking and writing only the essential words and ideas.

The instructions for the groups are presented in Appendix B. They are taken in part from another study (King and Madill, 1968).

Scoring of Recalls

Each of the recalls was scored for its accuracy in comparison with the original learning material. This accuracy was determined by the following four measures:

1. Number of Words. The total number of words written by the S on a recall were counted regardless of spelling.
2. Number of Eight-word Sequences. The number of eight-word sequences present in a recall that also appeared

in the original learning material were counted.

3. Number of Idea Units. Each of the stories were divided into idea units. For an idea unit to be scored as present the essentials of the idea had to be present in the recall. Direct word for word similarity was not required and there was no penalty given for the recalled material being out of sequence with respect to the original material.

4. Number of Identical Words. All words were checked to see if they matched the words in the original passage. To be considered as present in the recall the word had to be exactly as given in the original except for minor spelling variations. No penalty was given for sequence errors or for the presence of words not in the original passage. There was a check off system so the recalled words counted only as many times as they were present in the original passage.

The scoring of the number of words, the number of sequences, and the number of identical words was done by an NCR 315 RMC Mark II computer. A thorough check of the input insured a very high reliability of the output. The idea units were scored by the E. Each of the three stories was broken down into idea units. The 44 word story having 16, the 140 word story 48 and the 256 word story 77 possible idea units. The idea units for the three stories are presented in Appendix C.

Interscorer reliability of the idea units was tested by having another graduate student score them and a reliability

coefficient computed for scores on 25 of the 180 stories. The correlation was .99. The scoring instructions are included in Appendix D.

The dependent measures chosen above were among those used in previous studies on scoring the accuracy of recalls (King, 1960, 1961, 1968; King and Lau, 1963; King and Madill, 1968; King and Russell, 1966; King and Schultz, 1960; King and Yu, 1962). King et al have developed and used from 6 to 13 different scoring methods. In several studies, King factor analyzed the methods and the analysis yielded a two factor solution (King, 1968; King and Russell, 1966; King and Madill, 1968). One factor is quantitative and the other is organizational. The highest loading for the quantitative factor was the number of words. Number of identical words was next (King and Madill, 1968). The organizational factor had the highest loading in the eight-word sequence measure (King and Madill, 1968) and idea units (King and Russell, 1966).

RESULTS

Method of Analysis

The hypotheses were tested by a four factor analysis of variance. The homogeneity of variance assumption was tested by the Cochran's C statistic (Winer, 1962) for each of the four dependent measures. The C values were .0935 for idea units, .0536 for number of words, .0702 for number of sequences, .0554 for number of identical words [$C_{.95}(4,36) = .1400$]. Therefore the homogeneity of variance assumption was met.

The dependent measures were converted to Percentages and T-scores since the original scores were not comparable across difficulty levels. In the case of idea units the scores were transformed to percent of the total possible and the scores of the remaining three measures were converted to T-scores. The data will be presented using these converted scores. Cell means and variances of converted scores are presented in Tables 2-5.

Number of Words

The results of the tests of the hypotheses for the number of words recalled are presented in Table 6. Group means for main effects are presented in Table 7.

1. There were no significant differences in the mean number of words recalled for difficulty levels.

2. There were no significant differences in the mean number of words recalled for response modes.

TABLE 2
Cell Means and Variances
Number of Words (T-scores)

44 Word Story							
Rdg Level	Mode	Read		Underline		Note-taking	
	Sex	M	F	M	F	M	F
Low	Mean	51.20	49.40	44.40	47.20	38.20	49.00
	Var	57.20	153.80	137.30	37.20	96.70	41.00
High	Mean	55.60	55.20	52.40	54.80	47.20	55.60
	Var	59.30	115.70	164.30	44.20	79.70	80.30
140 Word Story							
Low	Mean	42.00	48.60	42.40	45.40	45.60	49.80
	Var	31.50	96.30	114.30	24.30	162.80	113.70
High	Mean	52.80	59.00	51.20	57.00	50.20	53.40
	Var	70.20	137.00	61.70	125.50	63.70	57.80
256 Word Story							
Low	Mean	49.20	43.40	50.40	52.20	39.80	48.60
	Var	88.70	172.80	85.80	45.70	32.70	159.80
High	Mean	50.40	53.80	49.40	56.40	52.80	54.60
	Var	10.30	98.70	92.30	177.80	125.70	79.80

TABLE 3
Cell Means and Variances:
Idea Units (Percent)

44 Word Story							
Rdg Level	Mode	Read		Underline		Note-taking	
	Sex	M	F	M	F	M	F
Low	Mean	60.00	66.25	60.00	62.50	60.00	66.25
	Var	109.38	246.09	460.94	625.00	246.09	50.78
High	Mean	68.75	76.25	75.00	82.50	61.25	78.75
	Var	78.13	339.84	292.97	66.41	437.50	246.09
140 Word Story							
Low	Mean	55.00	62.92	55.83	64.17	53.33	66.25
	Var	75.09	144.09	174.47	31.25	344.17	115.88
High	Mean	74.17	73.75	70.00	77.92	70.00	66.25
	Var	75.08	135.85	68.57	96.78	59.90	46.44
256 Word Story							
Low	Mean	48.83	40.52	51.43	55.84	34.80	41.82
	Var	232.42	331.76	122.79	65.78	54.31	320.79
High	Mean	50.91	53.25	55.58	59.74	53.50	52.73
	Var	60.22	125.65	150.45	161.07	389.09	100.86

TABLE 4
 Cell Means and Variances
 Number of Eight-word Sequences (T-scores)

44 Word Story							
Rdg Level	Mode	Read		Underline		Note-taking	
	Sex	M	F	M	F	M	F
Low	Mean	46.20	50.00	47.20	48.20	41.60	46.20
	Var	60.20	103.50	47.70	43.20	28.80	84.20
High	Mean	55.00	55.80	52.80	61.00	47.80	53.20
	Var	93.50	126.20	148.70	20.00	64.20	118.70
140 Word Story							
Low	Mean	45.00	42.00	45.80	55.00	43.60	48.20
	Var	48.50	68.00	25.20	26.00	58.30	103.20
High	Mean	59.00	54.00	56.60	57.00	47.20	47.20
	Var	72.50	172.50	63.80	110.00	117.20	15.70
256 Word Story							
Low	Mean	43.40	42.60	53.60	56.20	43.40	39.00
	Var	48.80	24.30	17.80	31.20	48.80	0.00
High	Mean	56.40	52.40	59.20	55.00	54.80	47.40
	Var	117.80	44.30	79.20	46.00	54.70	123.30

TABLE 5
 Cell Means and Variances
 Number of Identical Words (T-scores)

44 Word Story							
Rdg Level	Mode	Read		Underline		Note-taking	
	Sex	M	F	M	F	M	F
Low	Mean	47.40	50.00	44.60	47.60	39.80	47.00
	Var	35.30	113.00	122.30	118.80	95.20	38.50
High	Mean	54.00	55.20	55.00	56.80	46.80	55.40
	Var	60.50	99.70	137.50	42.20	123.20	97.30
140 Word Story							
Low	Mean	44.40	43.20	42.80	47.80	42.20	51.60
	Var	49.80	114.70	57.70	36.70	127.20	107.80
High	Mean	57.20	56.00	52.80	61.60	49.60	50.80
	Var	62.20	78.50	43.70	104.80	93.30	42.70
256 Word Story							
Low	Mean	48.00	42.20	50.00	53.00	39.20	46.40
	Var	59.50	164.20	74.00	58.50	19.20	124.30
High	Mean	51.80	54.80	50.40	56.40	57.00	51.20
	Var	75.70	88.70	68.80	140.30	171.00	40.20

TABLE 6

Analysis of Variance
Number of Words

Source of Variance	df	SS	MS	F
Difficulty Level (A)	2	0.5333	0.2667	0.0029
Response Mode (B)	2	123.6333	61.8167	0.6720
Sex (C)	1	684.4500	684.4500	7.4406*
Reading Ability (D)	1	2101.2500	2101.2500	22.8424*
AB	4	316.5333	79.1333	0.8602
AC	2	41.7333	20.8667	0.2268
AD	2	40.9333	20.4667	0.2225
BC	2	200.4333	100.2167	1.0894
BD	2	3.0333	1.5167	0.0165
CD	1	4.0500	4.0500	0.0440
ABC	4	230.5333	57.6333	0.6265
ABD	4	355.5333	88.8833	0.9662
ACD	2	19.7333	9.8667	0.1073
BCD	2	127.4333	63.7167	0.6927
ABCD	4	80.7333	20.1833	0.2194
S/ABCD	144	13246.4000	91.9889	
Total	179	17576.9500		

*Significant at .05 level

TABLE 7

Group Means for Main Effect
Number of Words (T-scores)

Variable	Mean
Difficulty Level	
44	50.0167
140	49.9500
256	50.0833
Response Mode	
Read	50.8833
Underline	50.2667
Note-taking	48.9000
Sex	
Male	48.0667
Female	51.9667
Reading Ability	
Low	46.6000
High	53.4333

3. There was a significant difference at the .05 level in the mean number of words recalled for males and females. The F ratio was 7.44 $[F_{.95} (1,144) = 3.91]$. The females recalled significantly more words than the males.

4. There was a significant difference at the .05 level in the mean number of words recalled for the different reading levels. The F ratio was 22.84 $[F_{.95} (1,144) = 3.91]$. The high group recalled significantly more words than the low group.

Idea Units

The results of the tests of the hypotheses for the number of words recalled are presented in Table 8. Group means for main effects are presented in Table 9.

1. There was a significant difference at the .05 level in the mean number of idea units recalled for difficulty levels. The F ratio was 31.75 $[F_{.95} (2,144) = 3.06]$. Duncan's Multiple Range Test (Bruning and Kintz, 1968) was used to test for differences between levels.

a. There was no significant difference between the lowest level and the middle level of difficulty.

b. There was a significant difference between the lowest level and the highest level in favor of the lowest level.

c. There was a significant difference between the middle level and the highest level. The middle level recalled a significantly greater percent than the highest level.

TABLE 8

Analysis of Variance
Number of Idea Units

Source of Variance	df	SS	MS	F
Difficulty Level (A)	2	11787.8121	5893.9060	31.7541*
Response Mode (B)	2	909.9407	454.9704	2.4512
Sex (C)	1	1106.2537	1106.2537	5.9601*
Reading Ability (D)	1	5256.8923	5256.8923	28.3221*
AB	4	373.3337	93.3334	0.5028
AC	2	317.7837	158.8919	0.8560
AD	2	106.2832	53.1416	0.2863
BC	2	134.8183	67.4091	0.3632
BD	2	25.9907	12.9950	0.0700
CD	1	3.9288	3.9288	0.0212
ABC	4	197.9638	49.4910	0.2666
ABD	4	715.1952	178.7988	0.9633
ACD	2	395.6558	197.8279	1.0658
BCD	2	81.8577	40.9289	0.2205
ABCD	4	361.9559	90.4890	0.4875
S/ABCD	144	26727.9407	185.6107	
Total	179	48503.6058		

*Significant at .05 level

TABLE 9

Group Means for Main Effect
Number of Idea Units (Percent)

Variable	Mean
Difficulty Level	
44	68.1250
140	65.7977
256	49.9134
Response Mode	
Read	60.8822
Underline	64.2091
Note-taking	58.7447
Sex	
Male	58.7996
Female	63.7578
Reading Ability	
Low	55.8745
High	66.6828

2. There was a significant difference at the .10 level in the mean number of idea units recalled for response modes. No further tests were made since the significance was not at the .05 level.

3. There was a significant difference at the .05 level in the mean number of idea units recalled for males and females. The F ratio was 5.96 [$F_{.95}(1,144) = 3.91$]. The females recalled a greater percent than the males.

4. There was a significant difference at the .05 level in the mean number of idea units recalled for the different reading levels. The F ratio was 28.32 [$F_{.95}(1,144) = 3.91$]. The high group scored a significantly greater percent than the low group.

Eight-word Sequences

The results of the tests of the hypotheses for the number of eight-word sequences recalled are presented in Table 10. Group means for main effects are presented in Table 11.

1. There were no significant differences in the mean number of sequences recalled for difficulty levels.

2. There was a significant difference at the .05 level in the mean number of sequences recalled for response modes. The F ratio was 11.83 [$F_{.95}(2,144) = 3.06$]. Duncan's Multiple Range Test was used to test for differences between modes.

a. There was a significant difference between the reading group and the underline group in favor of the under-

TABLE 10

Analysis of Variance
Number of Eight-word Sequences

Source of Variance	df	SS	MS	F
Difficulty Level (A)	2	4.1333	2.0667	0.0303
Response Mode (B)	2	1614.2333	807.1167	11.8307*
Sex (C)	1	19.3389	19.3389	0.2835
Reading Ability (D)	1	2516.2722	2516.2722	36.8835*
AB	4	241.7333	60.4333	0.8858
AC	2	370.7111	185.3556	2.7169
AD	2	7.6444	3.8222	0.0560
BC	2	135.2111	67.6056	0.9910
BD	2	214.6778	107.3389	1.5734
CD	1	76.0500	76.0500	1.1147
ABC	4	159.6889	39.9222	0.5852
ABD	4	391.1556	97.7889	1.4334
ACD	2	103.6000	51.8000	0.7593
BCD	2	0.6333	0.3167	0.0046
ABCD	4	106.6667	26.6667	0.3909
S/ABCD	144	9824.0000	68.2222	
Total	179	15785.7500		

*Significant at .05 level

TABLE 11

Group Means for Main Effect
Number of Sequences (T-scores)

Variable	Mean
Difficulty Level	
44	50.4167
140	50.0500
256	50.2833
Response Mode	
Read	50.1500
Underline	53.9667
Note-taking	46.6333
Sex	
Male	49.9222
Female	50.5778
Reading Ability	
Low	46.5111
High	53.9889

line group.

b. There was a significant difference between the read group and the note-taking group in favor of the read group.

c. There was a significant difference between the underline group and the note-taking group in favor of the underline group.

3. There were no significant differences in the mean number of sequences recalled for males and females.

4. There was a significant difference at the .05 level in the mean number of sequences recalled for the different reading levels. The F ratio was 36.88 [$F_{.95}(1,144) = 3.91$]. The high group scored a significantly greater number of sequences than the low group.

Identical Words

The results of the tests of the hypotheses for the number of identical words recalled are presented in Table 12. Group means for main effects are presented in Table 13.

1. There were no significant differences in the mean number of identical words recalled for difficulty levels.

2. There were no significant differences in the mean number of identical words recalled for response modes.

3. There was a significant difference at the .05 level in the mean number of identical words recalled for males and females. The F ratio was 4.72 [$F_{.95}(1,144) = 3.91$]. The females recalled significantly more identical words than the males.

TABLE 12
 Analysis of Variance
 Number of Identical Words

Source of Variance	df	SS	MS	F
Difficulty Level (A)	2	0.1333	0.0667	0.0008
Response Mode (B)	2	375.0333	187.5167	2.1868
Sex (C)	1	405.0000	405.0000	4.7230*
Reading Ability (D)	1	2944.3556	2944.3556	34.3365*
AB	4	105.5333	26.3833	0.3077
AC	2	68.8000	34.4000	0.4012
AD	2	38.1778	19.0889	0.2226
BC	2	235.2333	117.6167	1.3716
BD	2	18.7444	9.3722	0.1093
CD	1	6.4222	6.4222	0.0749
ABC	4	149.0667	37.2667	0.4346
ABD	4	523.8222	130.9556	1.5272
ACD	2	2.8444	1.4222	0.0166
BCD	2	192.8111	96.4056	1.1243
ABCD	4	226.0222	56.5056	0.6590
S/ABCD	144	12348.0000	85.7500	
Total	179	17640.0000		

*Significant at .05 level

TABLE 13

Group Means for Main Effect
Number of Identical Words (T-scores)

Variable	Mean
Difficulty Level	
44	49.9667
140	50.0000
256	50.0333
Response Mode	
Read	50.3500
Underline	51.5667
Note-taking	48.0833
Sex	
Male	48.5000
Female	51.5000
Reading Ability	
Low	45.9556
High	54.0444

4. There was a significant difference at the .05 level in the mean number of identical words recalled for the different reading levels. The F ratio was 34.34 [F._{.95} (1,144) = 3.91]. The high group recalled significantly more identical words than the low group.

None of the interaction hypotheses were significant for any of the four dependent variables.

Correlation Matrix

All of the intercorrelations among the 4 dependent measures were calculated for the recalls. The results are presented in Table 14 with the mean and standard deviation of each scoring measure.

TABLE 14
Correlation Matrix of Four Scoring Methods

Scoring methods	1	2	3	4	Mean	S.D.
1. Number of words		-.080	.917	.988	102.190	58.827
2. Number of sequences			.111	.003	6.899	8.002
3. Number of idea units				.944	27.101	13.486
4. Number of identical words					82.386	45.532

DISCUSSION

Number of Words

1. There were no significant differences for difficulty levels. Raw score differences due to the three different time periods were eliminated by converting the raw scores to T-scores. The ability of the Ss to produce words is not affected by the length of the task.

2. There were no significant differences for response modes. Differences here were expected on the basis of the literature. For instance Goldbeck and Briggs (1960) and Goldbeck and Campbell (1962) found overt responding to be better for intermediate levels of difficulty. However these studies used discrete facts and this material was a meaningful prose passage. The lack of differences found in this study therefore could be due to the difference of material. Also these previous studies allowed only one exposure to the material. Additional readings do not offer an advantage for the overt groups over the covert group for recalling words.

3. Females did recall significantly more words than males. This contradicts the literature which suggests that there should be no differences between males and females in the upper grade levels (Wozencraft, 1967). Wozencraft compares third and sixth graders and suggested that the older the children, the more equal the reading abilities of males and females. Previous studies by King (King, 1960; King, 1961)

had found no sex differences and therefore sex was eliminated as an independent variable for subsequent studies (King and Russell, 1966; King and Madill, 1968). The differences between experimental procedures of this study and previous studies might be an explanation for the sex differences found here. Two procedural differences are the number of readings permitted and the time limit on the recalls. Further studies would be very valuable in helping determine a more definite cause of why sex differences were found in this study.

4. The high reading ability group recalled significantly more words than the low reading ability group. This was expected. Reading ability affected all the recall measures significantly. Possible explanations are that persons with higher reading ability understand more words, generally read faster and think faster. In addition these results suggest that the high reading level group writes faster because they produced a greater number of words.

Idea Units

1. The low difficulty group recalled significantly more idea units than the high difficulty group and the middle difficulty group recalled significantly more idea units than the high difficulty group. These results suggest that a persons memory will store a few ideas quickly and if exposed to a greater number it takes more practice and several more exposures to recall the extra amount. Additional research could examine this question by having a different number of readings for each level of difficulty.

2. The F-test for main effect of response mode indicated a difference between group means for number of ideas recalled to be at the .10 level. These results are in the same direction as the results of the other organizational measure, that of number of sequences recalled. Number of sequences was significant at the .05 level for main effect of response mode. Were the idea units main effect for response mode significant at the .05 level, organizational aspects of learning the material might be considered a part of the reason for the significant difference.

3. Females also recalled significantly more idea units than males. The sex differences found in this study suggest educational implications. Possibly different teaching methods are needed for males than for females. Course offerings might be geared for the different sexes.

4. The high reading ability group recalled significantly more idea units than the low reading ability group. This was expected. The better the reader the more able he is to organize the material into ideas and recall more of those ideas.

Eight-word Sequences

1. There were no significant differences for difficulty levels. Previous literature suggested that this sequence measure was an organizational measure and is the reason it was used here. The other studies however used auditory and visual presentations allowing only one exposure of the ma-

terial. The allowance of more than one reading of the material as this study permitted may have altered the organizational loading that previous studies found. Further research with this sequence measure and others both longer and shorter than this one would be very valuable.

2. The underline group recalled significantly more sequences than either the read group or the note group. The read group recalled significantly more sequences than the note group. The finding that underlining was the best technique was not expected. Past studies (Williams, 1966; Cummings and Goldstein, 1964; Ushkow, 1967) found that the overt response of writing significantly aids the learning of more difficult material. They found no difference between writing and reading for less difficult material. Programmed materials were used in the previous studies thus permitting only one reading of the material. The additional readings allowed in this study probably altered the influence of the overt response in the recall of this learning task. The implications are that the usefulness of the writing response should be re-evaluated when time is controlled and not number of readings.

3. No significant differences for males and females were found for the number of sequences recalled. Since this was the only measure for which no sex differences were found the explanation possibly lies in the measure itself. Further research would be valuable in assessing the importance and usefulness of this dependent measure.

4. The high reading ability group recalled significantly more eight-word sequences than the low reading ability group. This was expected and further substantiates the fact that reading ability plays a very large role in learning.

Identical Words

1. There were no significant differences for difficulty levels. As stated, these same results were found for the other quantitative measure. Differences would have been expected here if the raw scores had been used. No differences for the converted scores (T-scores) indicates that the time allowed for each level was adequate for the recall of the same proportion of identical words for all three levels of difficulty.

2. There were no significant differences for response modes. Further research is needed in clarifying the issue of overt responding but the results of this study show that overt responding is not essential for the recall of identical words.

3. Females recalled significantly more identical words than males. The finding of a sex difference in three of the four dependent measures led to an ex post facto inspection of the Ss reading scores. An examination of the two high reading level groups (male and female) revealed essentially identical means, 91.444 for the females and 91.844 for the males. The low reading level groups did have a difference between the means with females an average score of 45.978

and males an average score of 38.711 for the forty-five low males. This difference was checked for significance by a t-test of uncorrelated means and found not significant at the .05 level. The t value of 1.22 was not significant. Therefore the sex difference was not due to the difference in the reading ability of the male and female groups.

Although the male and female are matched for reading ability, other differences may still exist that have caused the sex difference found. The Ss IQ, achievement level and other variables that influence learning should be controlled, leaving sex as the only variable being varied. This would permit a better determination of the role of sex in learning.

4. The high reading ability group recalled significantly more identical words than the low reading ability group. This was expected for the reasons given in the discussion of the other measures.

Correlation Matrix

The results of the intercorrelations reveal that number of words, idea units, and identical words are highly correlated and seem to measure the same aspect of recalling the material. These correlations are very close to those of previous studies (King and Madill, 1968; King and Russell, 1966). However in these previous studies idea units did not correlate as highly with number of words and number of identical words as they did in the present study.

The number of sequences measured something different

from the other three measures for it has low and in one case a negative correlation with the other measures. These correlations are much lower than previous research has found. This again suggests that more research should be done with the sequence measure to ascertain what it is measuring and what about this study caused the results to be different from the previous studies.

SUMMARY

The influence of the overt response on learning is a much debated question. Previous research suggests that the influence of the overt response is related to task difficulty. This study investigates the influence of overt and covert responding for three levels of difficulty (defined as three lengths of a story) for males and females with high and low reading ability. Four dependent measures were used. They were number of words, number of idea units, number of eight-word sequences, and number of identical words.

The major hypotheses of the study stated for the number of words only are:

1. There will be no significant difference in the mean number of words recalled for difficulty levels (44, 140 and 256 word stories).
2. There will be no significant differences in mean number of words recalled for response modes. The three response modes were a read group that read the material only, an underlining group that underlined as they read and a note group that took notes on the material.
3. There will be no significant differences in mean number of words recalled for males and females.
4. There will be no significant differences in mean number of words recalled for reading level. The reading levels were the top and bottom males and females according to their score on the Ohio State University Psychological Test.

The design of the study consisted of 36 cells (3 levels of difficulty x 3 response modes x male and female x high and low reading ability) with 5 Ss per cell for a total of 180 Ss. Each level of difficulty had its own time limit for presentation and for recall of the material. After being presented their particular story length, the Ss were then asked to recall the story as close to the original as possible.

The four-factor analysis of variance was computed for each dependent measure. Significance due to level of difficulty was found in the idea units measure only. This significance was found to be between the lowest and the highest level and the middle and the highest level but not between lowest and middle levels. For the response modes significant differences were found for the sequence measure only. Tests to see where the significance lies found all three response modes to be significantly different from each other. The main effect of sex on recall was found to be significant for all except the sequence measure. Reading ability significantly influenced the recall of all the dependent measures. There were no significant interaction effects at the .05 level.

The major conclusions of this study in no particular order are:

1. Ss with high reading ability were able to recall the material more accurately than those with low reading ability. These results are as anticipated and present no surprise.

2. Females recalled the stories significantly more accurately than the males for all except the sequence measure. Other research suggests that sex differences should have evened up by the age of the Ss in this study. Additional controls are needed to ascertain the true influence of sex on the learning of meaningful material.

3. One of the intentions of this study was to verify or contradict Skinner's hypothesis that a constructed response must be made to material being recalled. Although this study did not support Skinner's hypothesis, it is questionable whether his theory would apply to the experimental design of this study. Skinner used programmed instruction which usually entailed a one exposure learning whereas this study used a multiple exposure technique. Certain statements, however, can be made in regards to Skinner's hypothesis and the results of this study. For instance, according to the results of this study, when allowed to read over material several times the underlining technique seems to be as good if no better than taking notes on the material. Additional research should be done to determine how many extra readings are necessary on the average to accomplish the same amount of learning that reading once and taking notes accomplishes. The determination of the number of readings needed for optimal learning would aid students in creating effective study methods. Information such as this for predicting amounts of learning would be most valuable for those students that do not have good study

habits. There is a possibility that enough research could be done to help a student decide how much time he should take for studying the material, whether he should read or take notes or a combination of both. ✓

4. Difficulty level does not seem to influence the effectiveness of one study method over another as previous research indicated. There seems to be a direct relation between time allowed to recall and the quantity recalled. This does not hold for the organizational measures. More time is needed to recall organizational measures for the longer stories. This is logical for it would be harder to recall an organizational aspect of a story than a specific number of facts. Of course this would also be influenced by the complexity of the material and the accuracy desired when recalling the material.

5. Further research is suggested for additional evaluation of the various study techniques. Further studies of sex differences would help establish if there is or is not any difference between male and female in the upper grade levels. Other studies could vary difficulty in other ways, for instance by changing the complexity, abstractness or type of material used. The influence of number of readings on learning of meaningful material would be an excellent question to investigate. ✓

References

- Bartlett, F. C. Remembering: A study in experimental and social psychology. London: Cambridge University Press, 1932.
- Bruning, J. L. & Kintz, B. L. Computational handbook of statistics. Glenview, Ill.: Scott, Foresman, 1968.
- Cartier, F. A. Comparison of overt and covert responding on a programmed lesson assigned as homework. Journal of Programed Instruction, 1963, 2, 13-19.
- Chall, J. S. Readability: An appraisal of research and application. Bureau of Educational Research Monographs, 1954, No. 34.
- Coulson, J. E., & Silberman, H. F. Effects of three variables in a teaching machine. Journal of Educational Psychology, 1960, 51, 135-144.
- Crist, R. L. Overt vs. covert responding and retention by sixth-grade students. Journal of Educational Psychology, 1966, 57, 99-101.
- Cummings, A., & Goldstein L. S. The effect of overt and covert responding on two kinds of learning tasks. In DeCecco, Educational technology: Readings in programmed instruction. New York: Holt Rinehart & Winston, 1964. Pp. 231-241.
- Eigen, L. D., & Margulies, S. Response characteristics as a function of information level. Journal of Programed Instruction, 1963, 2, 45-54.
- Elliott, R., & MacMurray, T. Effectiveness of two methods of presenting information about simple reflexes. Psychological Record, 1966, 16, 283-288.
- Evans, J. L., Glaser, R., & Homme, L. E. A preliminary investigation of variation in the properties of verbal learning sequences of the "teaching machine" type. Paper presented at the meeting of the Eastern Psychological Association, Atlantic City, April 1959. In A. A. Lumsdaine, & R. Glaser (Eds.), Teaching machines and programmed learning. Washington D. C.: National Education Association, 1960. Pp. 446-451.

- Fry, E. B. A study of teaching machine response modes. Unpublished doctoral dissertation, University of Southern California, 1960. In A. A. Lumsdaine, & R. Glaser (Eds.), Teaching machines and programmed learning. Washington D. C.: National Education Association, 1960. Pp. 469-474.
- Goldbeck, R. A., & Briggs, L. J. An analysis of response mode and feedback factors in automated instruction. Technical Report No. 2, 1960, Santa Barbara, American Institute for Research. Cited in Goldbeck, R. A., & Campbell, V. N. The effects of response mode and response difficulty on programmed learning. Journal of Educational Psychology, 1962, 53, P. 110.
- Goldbeck, R. A., & Campbell, V. N. The effects of response mode and response difficulty on programmed learning. Journal of Educational Psychology, 1962, 53, 110-118.
- Hinz, M. C. The effect of response mode on the learning efficiency of presentation mode. Dissertation Abstracts, 1968, 28, 4025A.
- Holland, J. G. Response contingencies in teaching-machine programs. Journal of Programed Instruction, 1964, 3, 1-8.
- Horowitz, M. W., & Berkowitz A. Listening and reading, speaking and writing: An experimental investigation of differential acquisition and reproduction of memory. Perceptual and Motor Skills, 1967, 24, 207-215.
- Hsii, Y., & Li, C. Effects of reading aloud and silent reading on textual memorization and comprehension. Acta Psychologica Sinica, 1965, 2, 141-147.
- Kaess, W., & Zeaman, D. Positive and negative knowledge of results on a Pressey-type punchboard. Journal of Experimental Psychology, 1960, 1, 12-17.
- Keislar, E. R., & McNeil, J. D. A comparison of two response modes in an autoinstructional program with children in the primary grades. Journal of Educational Psychology, 1962, 53, 127-131.
- Kemp, F. D., & Holland, J. G. Blackout ratio and overt responses in programmed instruction: Resolution of disparate results. Journal of Educational Psychology, 1966, 57, 109-114.

- King, D. J. On the accuracy of written recall: A scaling and factor analytic study. Psychological Record, 1960, 10, 113-122.
- King, D. J. Scaling the accuracy of recall of stories in the absence of objective criteria. Psychological Record, 1961, 11, 87-90.
- King, D. J. Retention of connected meaningful material as a function of modes of presentation and recall. Journal of Experimental Psychology, 1968, 77, 676-683.
- King, D. J., & Lau, A. W. A comparison of three scaling techniques in estimating the accuracy of written recall. Journal of General Psychology, 1963, 69, 203-207.
- King, D. J., & Madill, J. Complex methods of presentation, internal consistency of learning material, and accuracy of written recall. Psychological Report, 1968, 22, 777-782.
- King, D. J., & Russell, G. W. A comparison of rote and meaningful learning of connected meaningful material. Journal of Verbal Learning and Verbal Behavior, 1966, 5, 478-483.
- King, D. J., & Schultz, D. P. Additional observations on scoring the accuracy of written recall. Psychological Record, 1960, 10, 203-209.
- King, D. J., & Yu, K. C. The effect of reducing the variability of length of written recalls on the rank order scale values of the recalls. Psychological Record, 1962, 12, 39-44.
- Krumboltz, J. D., & Weisman, R. G. The effect of overt vs. covert responding to programed instruction on immediate and delayed retention. Journal of Educational Psychology, 1962, 53, 89-92.
- O'Brien, G. L., & Carmean, S. L. Verbalizing and writing as auxiliary responses during discrimination learning. Psychonomic Science, 1967, 9, 335-336.
- Poulton, E. C., & Brown, C. H. Memory after reading aloud and reading silently. British Journal of Psychology, 1967, 58, 219-222.
- Pressey, S. L. A puncture of the huge "programing" boom? Teachers College Record, 1964, 65, 413-418.

- Price, A. H. The effects of subject response mode and peer social reinforcement on childrens learning in programmed instruction. Dissertation Abstracts, 1968, 28(1-A), 131-132.
- Silverman, R. E., & Alter, M. Note on the response in teaching machine programs. Psychological Report, 1960, 7, 496.
- Skinner, B. F. Teaching machines. Science, 1958, 128, 969-977.
- Ushkow, E. A. The influence of criterion test type and the amount of delay between learning and testing on the effectiveness of overt and non overt responding to programmed instruction. Dissertation Abstracts, 1967, 28(4-B), 1716-1717.
- Williams, J. P. A comparison of several response modes in a review program. Journal of Educational Psychology, 1963, 54, 253-260.
- Williams, J. P. Effectiveness of constructed-response and multiple-choice programing modes as a function of test mode. Journal of Educational Psychology, 1965, 56, 111-117.
- Williams, J. P. Combining response modes in programmed instruction. Journal of Educational Psychology, 1966, 57, 215-219.
- Winer, B. J. Statistical principles in experimental design. New York: McGraw-Hill, 1962.
- Wozencraft, M. A comparison of the reading abilities of boys and girls at two grade levels. Journal of the Reading Specialist, 1967, 6, 136-139.

APPENDIX A

The Learning Material

Forty-four Word Length

The War of the Ghosts

Two Indians went to war. They were on the side of the ghosts. Many people were killed on both sides. The Indians fought the people. After a while, one Indian said: "Let us go." Subsequently, one of them died.

140-Word Length

The War of the Ghosts

Two Indians went down to the river to fish. It became foggy and calm. This was known as an omen of ghosts. Then two men in a canoe came along. They asked the Indians to help them fight the white man.

One Indian refused to go. The other Indian went with them to Kalama. Many whites were killed. Some had said: "Let's go, the Indian has been hit." He felt well, even though he had been hit.

When he got home he told his strange story. He said: "They said I was hit but I felt alright." His people told him that he must have been fighting on the side of the ghost. "Two ghosts," he thought.

As the sun rose he became quiet, then something black came out of his mouth.

He was dead.

APPENDIX A (cont.)

256-Word Length

The War of the Ghosts

One night two young men from Egulack went to hunt seals in the river, and while they were there it became foggy and calm. Then they heard war-cries, and they thought: "Maybe this is a war-party." They escaped to the shore, and hid behind a log. Now canoes came up, and they heard the noise of paddles and saw one canoe coming up to them. There were five men in the canoe, and they said:

"We wish to take you along."

One of the young men said: "I have no arrows."

"Arrows are in the canoe," they said.

And the warriors went on up the river to a town on the other side of Kalama. But presently the young man heard one of the warriors say: "Quick, let us go home; that Indian has been hit." Now he thought: "Oh, they are ghosts." He did not feel sick, but they said he had been shot.

So the canoes went back to Egulack, and the young man went ashore to his house, and made a fire. And he told everybody and said: "Behold I accompanied the ghosts, and we went to fight. Many of our fellows were killed, and many of those who attacked us were killed. They said I was hit, and I did not feel sick."

He told it all, and then he became quiet. When the sun rose he fell down. From his mouth came something black.

APPENDIX A (cont.)

256-Word Length (cont.)

His face contorted. The people jumped up and cried.

Then he died.

APPENDIX B

General Directions for All Groups

The purpose of this experiment is to determine which of a number of study techniques most effectively facilitate the learning of meaningful material. This experiment will not influence your grade other than allowing credit to you for participating in an experiment. Your participation will be reported to your particular teaching assistant. I want to thank you now for your cooperation.

Now I would like you to write your name at the top of the sheets of paper. Record also your group letter N, U, or R at the top.

Please leave the story that I am about to pass out face down on your desk until we are ready to begin. When we begin, you are to read through this story at your normal reading rate. (Specific group instructions were given)

Everyone is to keep track of the approximate number of times that you were able to read through the story. You will be asked to put this number on the blank paper when time is called.

After the time is up you will be asked to recall the story as close to the original as possible. You may now begin. (Start timing)

Will everyone please turn the story face down on your desk. In the upper right hand corner of the blank paper please indicate the number of times you were able to read

APPENDIX B (cont.)

General Directions (cont.)

the story. If you got more than half way through the story on the final reading count that as a whole reading otherwise drop any fraction of a reading. Now pass in the stories and notes. Note group be sure your name is on your notes and underline group be sure your name is on the story.

Now I would like you to recall the story as close to the original as possible on the paper you have. You probably won't be able to get it perfect, but do the best you can.

Please pass your papers in. Be sure that your name is at the top. That completes the experiment and I wish to thank you very much.

APPENDIX B (cont.)

Individual Group Directions:

Read Group

The read group is to keep reading over the story until time is called.

Underline Group

As you read I would like for you to underline important words and phrases. Do not underline the whole passage or whole sentences unless you feel them especially important. If time allows read over your underlinings first then read over the rest of the story and keep reading over the story until time is called.

Note-taking Group

As you read I would like for you to take notes on the material on one of the blank sheets provided. Outlining is an excellent note-taking method and you may do that or other note-taking methods that are usual to your study habits. Write down at least important words and phrases but do not write whole sentences unless they are very important. If you finish taking notes read your notes again and then read over the story itself until time is called.

APPENDIX C

Idea Units:

Forty-four Word Length

The War of the Ghosts / Two Indians / went to war / They
were / on the side of the ghosts / Many people / were killed /
on both sides / The Indians / fought the people / After a
while / one Indian said / Let us go / Subsequently / one of
them / died

140-Word Length

The War of the Ghosts / Two Indians / went down / to the
river / to fish / It became / foggy and calm / This / was
known as an omen / of ghosts / Then two men / in a canoe /
came along / They asked / the Indians / to help them fight /
the white man / One Indian / refused to go / The other Indian /
went with them / to Kalama / Many whites / were killed /
Some had said / Let's go / the Indian / has been hit / He
felt well / even though / he had been hit / When he got home /
he told his strange story / He said / They said / I was hit /
but I felt alright / His people told him / that he must have
been fighting / on the side of the ghost / Two Ghosts / he
thought / As the sun rose / he became quiet / then something
black / came out / of his mouth / He was dead

APPENDIX C (cont.)

256-Word Length

The War of the Ghosts / One night / two young men / from
Egulack / went to hunt seals / in the river / and while they
were there / it became / foggy and calm / Then they heard
war-cries / and they thought / Maybe this / is a war-party /
They escaped / to the shore / and hid / behind a log / Now
canoes came up / and they heard / the noise of paddles /
and saw one canoe / coming up to them / There were five men /
in the canoe / and they said / We wish / to take you along /
One of the young men said / I have no arrows / Arrows are in
the canoe / they said / And the warriors / went on up the
river / to a town / on the other side / of Kalama / But pre-
sently / the young man heard / one of the warriors say /
Quick / let us go home / that Indian / has been hit / Now he
thought / Oh they are ghosts / He did not feel sick / but
they said / he had been shot / So the canoes / went back to
Egulack / and the young man / went ashore / to his house /
and made a fire / And he told everybody / and said / Behold
I accompanied / the ghosts / and we went to fight / Many of
our fellows / were killed / and many of those who attacked us /
were killed / They said / I was hit / and I did not feel
sick / He told it all / and then / he became quiet / When the
sun rose / he fell down / From his mouth / came something
black / His face contorted / The people jumped up / and
cried / Then he died

APPENDIX D

Instructions for Scoring Idea Units:

1. They must have the essential meaning of the idea unit.
2. They may substitute a pronoun like they or he if it is easy to tell that the pronoun is referring to the noun in the idea unit.
3. They may substitute verbs such as shot, wounded, or hurt for hit.
4. The verb tenses are not essential as long as they show that they understand what the original meant.
5. If the pronoun one or one warrior is substituted for the pronoun they it is not scored, and if one or he is substituted for they it is not scored.
6. The ideas do not have to be in the original sequence. Whole phrases and sentences may be turned around as long as the essential meaning is recalled.
7. Examine what they have written and try to fit it into one of the original idea units.