MEANINGFULNESS AND INSTRUCTIONS TO LEARN CONSIDERED INDEPENDENTLY AS THEY AFFECT THE TEACHING AND LEARNING OF VERBAL KNOWLEDGE

BY

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Master of Arts

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by
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To the Graduate Council:

I am submitting herewith a Research Paper written by Edward Rudolph Atkinson, Jr. entitled "Meaningfulness and Instructions to Learn Considered Independently as They Affect the Teaching and Learning of Verbal Knowledge." I recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Arts, with a major in Psychology.

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INTRODUCTION

Meaningfulness is a vital concept to consider in the experimental examination of the dynamics underlying the teaching and learning of verbal knowledge. Consequently, an operational definition of this term would greatly facilitate experimentation in this area of psychology. Clyde E. Noble (1952) has arrived at such a definition. He has defined the term meaningfulness as the number of different associations brought forth by a verbal unit--a nonsense syllable or an English word. Noble has given his definition a theoretical basis by relating it to C. L. Hull's Systematic Behavior Theory (Hilgard & Bower, 1966). Noble (1952) has made the following statement about this basis:

> The present analysis does not assert meaning and habit strength to be identical concepts, although they have some common properties. Meanings are postulated to increase in number not as an expotential growth function of the number of particular S-particular R reinforcements--as H in Hull's theory--but rather as a simple linear function of the number of particular S-multiple R connections established (p. 423).

In order to establish his definition experimentally, Noble proceeded in this way. He gave a sample of 131 basic airmen who were being tested for classification purposes at the Human Resources Center a list 96 words and asked them to write all the associated things, terms, places, and events

they could think of in one minute per word. Noble chose his list partly from the Thorndike-Lorge word count of 1944. He chose both frequently and infrequently used words for his list. Noble found that the words with the highest number of associations are also the words which occur with the greatest frequency in the language. These words are thus also the most familiar words in the language (Noble, 1952; Underwood & Schulz, 1960).

A study by Cofer and Shevitz (1952) shows more direct evidence concerning the number of associates produced and frequency. Four high-frequency words and four low-frequency words--two adjectives and two nouns at each level--were used. The high-frequency words occured 100 times or more per million words, and the low-frequency words, one time per million. Each word was presented for ten minutes during which time the Ss were asked to write down as many different associates as they could for each word. The high-frequency adjectives brought forth an average of 50 associates and the low ones, 42. The high-frequency nouns brought forth an average of 61, and the low ones, 44.

Instructions to learn also play a vital part in the teaching and learning of verbal knowledge. Such instructions to learn may be either incidental or intentional. DeCecco (1968) has stated that intentional learning provides for the previous announcement of both the learning task and the test.

In incidental learning, however, the E does not make instructions available which prepare students for a test on the matter they are to learn. There are two types of incidental learning. In Type I the Ss are given no directions to learn at all. In Type II they are told to learn one task and then they are tested on another one. Postman (1964) has explained the proper usage of the two types of incidental learning in the following words:

> Which one of these two experimental arrangements is more appropriate depends upon the theoretical question at issue. When the emphasis is on associative processes in incidental learning as determined by the nature of the materials and the nature of presentation, Type I is favored because an evaluation of these variables can be made directly without the complications introduced by generality of set and task competition. On the other hand, investigators whose primary concern is with incidental learning as a function of motive and incentive have usually turned to the Type II situation (p. 187).

Because this E has been concerned with meaningfulness and instructions to learn (considered separately), he has made use of incidental learning Type I in making comparisons between intentional and incidental learning, both in the literature survey and in his own experiment.

Although a differentiation has just been made between intentional and incidental learning, one must realize that these two facets of learning "define the extremes of a dimension rather than a dichotomy (Postman, 1964, p. 146)." Furthermore, a survey of the literature concerned with both intentional and incidental learning has shown almost unani-

mously that Ss do not recall material as well under incidental instructions to learn as they do under intentional instructions to learn (Deese, 1964; McLaughlin, 1965; Postman & Senders, 1946). Three studies will now be cited to illustrate this fact.

A relevant study by Jenkins (1933) is of importance here. A student, thinking he was serving only as the E, read each of 20 syllables clearly and distinctly as it appeared in the window of a memory drum as he had been told to do. He read the syllables to the S who was unable to see the window and who had been given instructions to learn the syllables as they were presented to him. When the S, after a fitting test, had made one correct set of responses, both he and the E were asked to return 24 hours later to complete the experiment. On their return, each was asked to write a recall list. Data was collected from 24 students who had served as Ss and 24 who had served as Es, unaware that they would be asked to recall the syllables. The mean recall for those instructed to learn was 15.9 $\pm$ 2.4 and for those instructed only to repeat the syllables clearly for the Ss, the mean recall was 10.8 $\pm$ 3.6. The mean recall for the Es would have been even lower if some of them had not repeated the syllables under self-induced instructions to learn.

A study made by Moore (1933) presents similiar findings. Moore divided his Ss into three groups. Each S in each group was given the same prose paragraph. However,

the instruction concerning what to do with the paragraph was varied in a different way for each of the three groups. Group I was told to memorize it, Group II was told to read it, and Group III was told to count the words in it. When recall was tested immediately after the exercise, the respective means for the three groups were 51, 38, and 7. The reason given for the relatively high mean for Group II was that some Ss developed a self-induced set to remember what they had been reading.

Postman and Senders (1946) have also run an experiment, the results of which are pertinent to this discussion of instructions to learn. The Ss were undergraduate students at Harvard and Radcliffe. They were given a 35-word, mimeographed selection from Checkov's short story, "The Bet." The Ss were divided into six groups. The E told the Ss in the first group, the incidental-learning group, to read the piece for timing purposes since he was interested in their reading speed. That is, these Ss were exposed to the material but given no instructions to learn. The E gave each of the other five groups specific instructions to learn by telling them that this investigation was a memory experiment and that they were to read the selection with care. After this general comment of instruction, the E gave each of the remaining five groups a different task. Group B was told that it would be tested for general comprehension of the

material, C for the specific sequence of individual events, D for details of content, E for details of wording, and F for details of physical appearance. Although the directions varied in effectiveness, the intentional learners generally obtained higher test scores than the incidental learners.

The purpose of this experimental study, in the light of the previous survey of the literature, was first to confirm Noble's definition of meaning by a slight variation on his own study (1952), and second to show that overt instructions to learn those key words whose meanings were measured promotes better immediate and delayed free recall of these words than occurs when there have been no instructions to learn these key words.

More specifically, three separate null hypotheses must be stated:

(a) There is no significant difference in the total number of associates listed for each of three groups of words which occur with great, median, and little frequency in the English language.

(b) There is no significant difference in the immediate free recall scores for the key words of those Ss instructed specifically to learn the key words (Group II) and those Ss given no overt instructions to learn the key words (Group I).

(c) When both groups are given a surprise free recall test for the number of key words used on the previous day which

they can remember after a 24-hour interval, there is no significant difference in the number of key words recalled by Group II and those recalled by Group I.

Chapter 2

METHOD

The Ss used in this experiment were those students enrolled in Mrs. Joan Reynolds Harris' two tenth grade English classes at Fort Campbell High School, Fort Campbell, Kentucky. The E had done his practice teaching at the school in the spring of 1969 with Mrs. Harris serving as his supervising teacher. Consequently, he knew that the English classes there were heterogeneously grouped. He could thus assume that these two groups taken together, made up a representative random sample of the total population of tenth graders in the school. Mrs. Harris cast some doubt on this assumption when she warned the E that the first period of 23 Ss (Group I) was "smarter" than the second period of 25 Ss (Group II). On the first day of the experiment, 22 pupils were present in Group I and 24, in Group II. On the second day of the experiment, 21 pupils were present in Group I and 24, in Group II. Except for the fact that the two subjects from the Day I experiment were randomly discarded to facilitate an analysis of variance on part of the data, all subjects were used in the remaining statistical analyses performed (t-tests).

The 15 key words which the E chose to be measured for their meaningfulness were taken from E. L. Thorndike's book (1931) which rates each word contained in it from 1 to 20 according to the frequency of its occurence in written English. The E purposefully chose five words from the twentieth thousand most frequently used words, five words from the tenth thousand most frequently used words, and five words from the first thousand most frequently used words. His first hypothesis then refers to the fact that there is no significant difference in the total number of associates (that is, the meaningfulness) of these three groups of words. To determine which word went on which page of the data sheet booklet for Day I of the experiment, the E placed separate copies of the 15 words in a box, covered it, shook it, and drew out the words one at a time. The first word drawn was placed on page one, the last word drawn, on page 15. The words used in the experiment are given below. The first five are from the twentieth thousand words; the second five, from the tenth thousand; and the third five, from the first thousand. The number in parenthesis beside each word denotes the page number on which the word was located in the data sheet booklet for Day I of the experiment: recalcitrant (1), ingratiate (2), fusillade (5), immolation (9), calumnious (12); insight (3), heredity (4), humiliation (7), canyon (13), slimy (14); garden (6), egg (8), sleep (10), mile (11), hard (15).

The E made use of the two-group design in his experiment. He randomly determined by the flip of a coin that Group II would receive instructions to learn the key words and that Group I would not receive these instructions. A stop watch was used in the timed portions of the experiment.

The principal variables in the E's hypotheses were meaningfulness and intent to learn. In the survey of the literature, meaningfulness is defined as a function of frequency or familiarity and intent to learn is defined as a function of instruction to learn.

This experiment took place during the first part of the two above-mentioned English classes on two consecutive days. After Mrs. Harris had called the role and introduced the E, he said to the Ss, "Please clear your desks except for a pen or pencil." Next, he asked a student to give out one copy of the data sheets to each S, placing it face-down on the desk. As this was being done, the E said, "Do not turn the papers over until I tell you to do so." After the sheets had been distributed, the E said, "Turn the papers over now, and follow along as I read the directions aloud." The directions and procedure were adapted from Noble (1952). Both groups received the following directions printed on the cover sheet of the data collection booklet:

Please fill in your name and English period in the proper blanks at the top of this page (the E paused 30 seconds).

This exercise has nothing whatever to do with your English grade. After you begin to do the exercise, there can be no questions asked. Please do your own work.

On each of the following sheets you are given a key word, and you are to write down as many other words which the key word brings to mind as you can. These other words which you write down can be things, places, ideas, or whatever you happen to think of when you see the key word. Keep working on each word until you are told to stop and to go on to the next page. Do not go back and work on any previous key word.

At this time the E, with the help of Mrs. Harris, showed each of the classes an example. His words to each of the two classes are quoted below.

A sample key word, "steam," has been done for you on the poster which Mrs. Harris will now show you. As you see, the word "steam" has been written in two columns on the sample page. Beside each copy of the key word "steam" there is a blank. These blanks are for you to fill in with other words which the key word brings to mind. On this sample page, you can see that the student has written nine other words which the key word "steam" has brought to his mind. These other words are hot, water, boat, engine, boil, bath, ship, roller, and gas. For some words you may have many associations, and for others, few or even none. Are there any questions now?

After answering any questions, the E told Group I: "Please turn to page 1 and begin work now." After saying "now," the E started his stop watch and gave the Ss 60 seconds to write down associates for the first key word. When the minute was up, E said, "Stop. Please turn to page 2 and begin work now." This same procedure was followed for the 15 key words, each of which appeared on a separate page, with 18 words and their corresponding blanks in each of two columns on the $8\frac{1}{2}$ by 11 paper.

After the E had completed the example on the poster for Group II, he returned to their direction sheet and read this last paragraph which had not been included on the direction sheet for Group I.

"At the end of this exercise, you will be asked to write down as many of the key words as you can recall, without looking back at your previous work."

After reading this last paragraph aloud as the Ss followed along, the E said, "Are there any questions?" After answering questions, the E said, "Please turn to page one and begin work now." The same procedure used for Group I was followed in administering pages 1 through 15 to Group II. When both groups had been given one minute to work on page 15, the E said to them, "Stop. Please turn to page 16 and write down as many of the key words as you can recall without looking back at your previous work. You may work until I tell you to stop. Begin work now." (Allow five minutes for this free recall, using the stop watch). After five minutes, the E said, "Stop. Be sure your papers are in the right order. (Pause 30 seconds.) I will have someone take them up. Thank you for your co-operation. I will see you again tomorrow."

On the second day the E returned and administered the same experimental treatment to each of the two groups. Though the members of both groups had been told that E would return, neither group had been told what to expect on the

second day.

Just after the classes had come to order, the E said, "Please clear your desks except for a pen or pencil." He then asked a student to give out the single data sheets one at a time, face-down. He then told the class, "Do not turn the papers over until I tell you to do so." When each student had been given a sheet, the E said, "Please turn the papers over and follow along as I read the directions aloud." The directions were given to both groups. The first two paragraphs of these directions were identical to the first two paragraphs of directions given to both groups on the first day of the experiment. Consequently, only the third and final paragraph of the directions given to both groups on the second day is quoted here.

> Write down as many of the fifteen (15) key words that you worked with yesterday as you can remember. Put each word in one of the blanks provided below. You may work until I tell you to stop. Begin work now.

The E gave the Ss five minutes of free recall time as recorded on the stop watch. When the time was up, he said, "Stop. I will take your papers up one at a time. Thank you for your co-operation."

The E used the free recall method in testing for retention in studying intentional learning and incidental learning as functions of instructions to learn because it was sensitive to differential habits of association which are extremely important in the comparison of intentional and incidental learning (McLaughlin, 1965).

Chapter 3

RESULTS

In order to see whether Noble's definition of meaningfulness could be confirmed when applied to three different groups of words of known frequency in written English which had been given to two groups of Ss for subsequent controlled association, complex analysis of variance was used to determine the significance of the findings. A probability level of .05 was set by the E prior to the experiment to delimit the level of significance. The two independent variables in this part of the experiment were the frequency of word usage which was varied in three ways (Variable A) and the two distinct groups of Ss (Variable B). Table 1 presents a summary of these findings.

Table 1

Summary of the Analysis of Variance of Experiment on Meaning as Related to Word Frequency and Individual Groups

Source of Variation	SS	df	MS	F	P
word frequency (A)	35,500.92	2	17,750.46	160.53	**
individual groups (B)	524.01	1	524.01	4.74	*
interaction (A X B)	135.29	2	67.64	.61	
within groups	13,932.05	126	110.57		
total	50,092.27	131			

*$p < .05$.

**$p < .01$.

The table shows the evaluation of the three F-ratios. According to these evaluations, the three word frequency groups differed significantly beyond the 1% level. Moreover, Groups I and II also differed significantly at the 5% level. However, since the F for the A X B interaction was less than one, it was obviously insignificant. Thus the E concluded that while both word-frequency group and individual S group were significantly related to meaning as defined by Noble, the magnitude of the effects of one variable was the same whatever the specific conditions of the other variable. The two variables, in other words, combine additively. While the mean total number of associates for all 15 key words for an individual S in Group I was

67.09, the mean total number of associates for all 15 key words for an individual S in Group II was 79.04. Thus, the list of key words, taken as a whole, was more meaningful for Group II than for Group I, in spite of the fact that, according to Mrs. Harris, Group I was "smarter" than Group II.

The second part of the experiment dealt with intentional and incidental learning as functions of instructions to learn. The significance of the difference between the mean number of words recalled by the intentional (Group II) and the incidental (Group I) learners was determined by the use of the t-test for use with small samples of equal or unequal N's. Both an immediate and a delayed (after 24 hours) free-recall test were given to both groups.

On Day 1 the mean number of words recalled for an individual S in Group I was 7.77 with a standard deviation of 2.26. On this same day, the mean number of words recalled for an individual S in Group II was 8.33 with a standard deviation of 2.57. The t-ratio for this set of data was .77. Therefore, though the mean for Group II was larger than that for Group I, it was not significantly larger. In other words, the difference between the two means was not significant.

On the second day of the experiment, both groups were given a surprise free-recall test which asked them to write down as many of the key words used the day before as they were able to remember.

On Day II the mean number of key words recalled for an individual S in Group I was 6.95 with a standard deviation of 2.02. On that same day, the mean number of words recalled by an individual in Group II was 8.62 with a standard deviation of 2.06. The t-ratio for this second set of data was 2.69. Thus the E concluded that on Day II the two groups differed significantly at the 5% level in the mean number of key words recalled by an S in each group.

With these results in hand, the E rejected the null hypotheses labeled (a) and (c), and he failed to reject the null hypotheses labeled (b). These hypotheses are stated in Chapter 1, page 6 of this research paper.

Chapter 4

DISCUSSION

With one exception the results of this study confirmed what the E had expected to find as a result of his study of the literature concerning the problems under consideration. This one exception was the fact that on Day I the mean number of key words recalled per S in Group II was not significantly greater than the mean number of key words recalled per S in Group I. Postman and Senders (1946) have some relevant comments which help to explain this unexpected finding. They have noted that in both intentional and incidental learning, the learner's sense organs must be appropriately stimulated by the stimulus material. Postman (1964) has reached the core of the problem:

> In a study of incidental learning the experimental arrangement must be such as to ensure the exposure of the S to the learning materials. The particular procedure used for this purpose constitutes the orienting task. To be useful, an orienting task must satisfy two criteria: (a) it must, indeed, create conditions which make it certain that the S perceives the incidental stimulus materials, and (b) it should minimize the development of uncontrolled sets to learn. The requirement of an orienting task raises important problems of control and interpretation in the experimental analysis of incidental learning....
>
> The activities required by an orienting task may be more or less consistent with the responses which mediate associative learning. One may conceive of a continuum of orienting tasks, ranging from those requiring responses maximally favorable to learning to those requiring responses

maximally antagonistic to learning. For example, when the task is to give meaningful associations to each of a series of items, the responses are similar to those which are assumed to occur in learning. By contrast, guessing one of a set of numbers to each of a series of verbal items or matching such items to a limited set of geometric designs is probably unfavorable to learning because the repeated use of the same response is likely to result in response-produced generalization.

When the orienting task is performed by both groups, the difference between intentional and incidental learners should depend on the position of the orienting task along the continuum described above. It should be minimal when the orienting task falls at either extreme of the continuum. At the unfavorable extreme, the beneficial effects of intent would be minimized by massive interferences from the orienting activity while at the favorable extreme there would be maximal facilitation of incidental learning. The data support these expectations....

Thus the difference between the means (see above) was not significant because the orienting task, giving meaningful associations to the 15 key words, is located at the favorable extreme of the above-mentioned continuum.

On Day II, however, the mean key word recall score for individuals in Group II was significantly superior to that for individuals in Group I. The phenomenon of reminiscence accounts for this new significant difference between the means of the two groups, a difference which is in the direction expected by the empirical hypothesis. According to McGuigan (1968), "reminiscence occurs when the recall of an incompletely learned task is more complete after a period of time has elapsed than it is immediately after the learning period (p. 29)." Thus the mean recall scores of the intentional learners (Group II) increased from Day I to Day II

while the mean recall score of the incidental learners (Group I) decreased from Day I to Day II.

Though reminiscence accounts nicely for the above experimental findings, it also points out a weakness in this study. For here the E has used the early type of experimental design for studying reminiscence, the one-group design. This design, however, leaves one important variable uncontrolled--the amount of practice given in the first test of retention (the recall test on Day I). In other words, the earlier design does not tell whether the first retention test is more effective in increasing performance than an equal amount of time spent in associating with the key words.

Ward (1937) has studied reminiscence using a two-group design much like that used in studying the distribution of practice. The earlier design and Ward's design are contrasted in Table 2.

Table 2

Comparison of the One and Two-Group Experimental Designs in the Study of Reminiscence

Early type of design	Original Learning	1st Retention test	Rest	2nd Retention test
Ward-type of design	Group 1	Original Learning	Rest	Relearning
	Group 2	Original Learning	No Rest	Relearning

Ward's design is superior to the earlier design in two ways: (a) It controls the variable of the amount of practice given on the first retention test. (b) It can be used to study a wider variety of different learning methods and materials (McGeoch, 1952).

There are also problems in the assessment of meaning when Noble's production method is used, as it was in this study. In spite of precautions taken to prevent chaining, it may still occur. Moreover, there is the problem of how to count similar responses (Underwood & Schulz, 1960). This E arbitrarily decided to accept all associates for any given key word that were "readable." In the part of the experiment dealing with instructions to learn, the E accepted a recalled word if he was able to recognize it easily as the same form of the key word originally used on the data sheets, whether or not the spelling was actually correct. In situations such as these, some arbitrary standards must be established by the E so that he can differentiate acceptable and unacceptable responses.

Chapter 5

SUMMARY

This paper has dealt with an experiment designed to confirm Noble's definition of meaning and to confirm the fact that more learning takes place under intentional than under incidental instruction to learn. Thorndike's Teachers Word Book of 20,000 Words (1931) was used to select three groups of words of known frequency in the English language, a high-frequency group, a median-frequency group, and a low-frequency group. Five words per group were used. These 15 words then became the key words for use in Noble's production method for measuring meaning.

The students in two heterogeneously grouped tenth grade English classes at Fort Campbell High School, Fort Campbell, Kentucky, served as Ss. There were 23 Ss in Group I and 25 Ss in Group II when all were present. The experiment took place on two consecutive days, and Noble's account of his own work (1952) was used in planning the method of presentation for it.

The experiment made use of the two-group design. Complex analysis of variance was used to assess the significance of the difference in the three groups of key words for the two groups of Ss. The three word-frequency groups were

found to differ significantly beyond the 1% level. In addition, Group I and Group II also differed significantly at the 5% level. However, the interaction between these two variables was not found to be significant. For Group I, the mean total number of associates for all key words per S was 67.09. The corresponding mean for Group II was 79.04. Thus, the complete list of key words was more meaningful for Group II than for Group I. The t-test was used to evaluate the significance of the difference between the mean recall scores of both groups for the 15 key words. On Day I, Group I received no instructions to learn these words while associating with them. Group II, however, did receive specific instructions to learn the key words for a free-recall test at the conclusion of the exercise. Though the mean recall score for Ss in Group II was greater than that for Group I, it was not significantly so. The characteristics of the orienting task used in this experiment have been cited as reasons for this lack of significance. However, on Day II, after a surprise free-recall test for the key words used on the previous day, the mean recall score for the Ss in Group II was significantly greater (at the 5% level) than that for Group I. The phenomenon of reminiscence has been cited to explain this new significance. However, the fact that this E used only one group in explaining reminiscence does

ot control for the amount of practice given in the first etention test. This limitation, along with those inherent n Noble's <u>production</u> method and in establishing criteria or acceptable free-recall responses in the retention tests sed in studying intentional and incidental learning are roblems which must be dealt with in a study of this type.

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