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GRADUATE COLLEGE

A COMPARISON OF THE LEARNING RATES OF MENTALLY RETARDED AND NORMAL SCHOOL CHILDREN AND THE EFFECT OF MEANINGFULNESS ON A PAIRED-ASSOCIATES LEARNING TASK

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Norman, Oklahoma

1967

A COMPARISON OF THE LEARNING RATES OF MENTALLY RETARDED AND NORMAL SCHOOL CHILDREN AND THE EFFECT OF MEANINGFULNESS ON A PAIRED-ASSOCIATES LEARNING TASK

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A COMPARISON OF THE LEARNING RATES OF MENTALLY RETARDED AND NORMAL SCHOOL CHILDREN AND THE EFFECT OF MEANINGFULNESS ON A PAIRED-ASSOCIATES LEARNING TASK

CHAPTER I

INTRODUCTION

In the educational process, probably the most important aspect that needs to be understood is that of learning. Learning is a very complex process; one which continues to be at the core of conflicting theories. While it is vital to education for educators and theorists to understand what conditions and procedures implement learning, it is also important for them to understand what conditions impede this process.

Psychologists generally agree that much behavior is learned. Because of the vast implications of this simple statement, in-depth investigation of the learning process becomes imperative.

Whether psychologists or other social scientists would agree on a definition of meaning is doubtful; however,

most would agree that the behavior exhibited by an individual in a particular situation depends upon what the situation means or signifies to him. "There are at least as many meanings of 'meaning' as there are disciplines which deal with language, and of course, many more than this because exponents within disciplines do not always agree with one another. 'Meaning' like 'emotion' is a relational or process concept."[1]

The scope of knowledge which we possess about the process of learning in normal children is not complete, but the amount of knowledge we have about the learning process in retarded children is regrettably small by comparison. What is known about the effect of meaningfulness on the performance of mentally retarded children is even smaller.

Any and all research which is designed to investigate how learning can be enhanced and performance benefited is vitally needed. Teachers and theorists alike need to have guidance in improving their techniques so as to more efficiently perform their respective responsibilities.

The theories concerned with learning in retarded children and the methods or materials which can implement learning have had a considerable effect on the procedures utilized in classes for the mentally retarded. Yet, many

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[1]Charles E. Osgood, George J. Suci, and Percy H. Tannenbaum, The Measurement of Meaning, Urbana: University of Illinois Press, 1957, p. 2.

of these procedures are based on conflicting and inconclusive evidence. More will be said about this in the review of the literature.

The primary object of this study was to determine whether or not there was a difference in learning rate between normal and retarded children on a relatively difficult paired-associates task in which learning was a function of meaningfulness.

Review of Literature

Studies relating to learning in retarded and normal individuals

In 1948, McPherson reviewed the studies on learning in retarded individuals, performed between the years 1907 and 1948. These studies dealt with the learning of simple tasks, learning in problem situation, and conditioning. None of these studies involved tasks related to meaning nor were they oriented toward school related experiences. McPherson summarizes these studies in the statement:

> The outstanding impression gained from this review of learning in the subnormal is one of lack of information. The actual experiments have been few, the number of subjects small, the tasks to be learned heterogeneous within a narrow range, and the motivational factors inadequately controlled.[2]

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[2]Marion White McPherson, "A Survey of Experimental Studies of Learning in Individuals Who Achieve Subnormal Ratings on Standardized Psychometric Measures," American Journal of Mental Deficiency, LII-LIII, (1948), p. 252.

In 1958, McPherson again reviewed the literature of studies completed from 1948 to 1957. Of the fourteen studies dealing with learning in the mentally defective, only four involved verbal learning and none used the paired-associates technique. The studies were not concerned with meaning as applied to the learning task, nor were the studies school related.

In the summary of her later review, McPherson stated:

> The review reveals a diversity of methodology and of results. Some papers highlight a slow, arduous learning process among mental defectives whereas others point to more skill in acquisition than is ordinarily assumed.[3]

Since McPherson's 1958 review, there have been numerous studies performed which deal with the learning process in mentally retarded and normal children. Only a few have utilized the paired-associates technique and fewer still have been concerned with the effect of meaningfulness on learning in the mentally retarded child.

Eisman[4] utilized the paired-associates technique for determining differences in learning, generalization,

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[3]Marion White McPherson, "Learning and Mental Deficiency," American Journal of Mental Deficiency, LXII, (1958), p. 877.

[4]Bernice S. Eisman, "Paired Associate Learning, Generalization, and Retention," American Journal of Mental Deficiency, LXIII, (1958), p. 484.

and retention between retarded, average, and superior children. She used a learning task composed of a series of seven pairs of pictures which were learned to a criterion of four consecutive, correct responses. She found no significant differences when comparing the groups on number of trials to learn.

Berkson and Cantor utilized the paired-associates technique for comparing the learning ability of normal and retarded children. They used thirty normal children whose I.Q.'s ranged from 86 to 115, and twenty-four retarded children whose I.Q.'s ranged from 55 to 85. The material to be learned was three lists of paired stimuli consisting of various arrangements of arabic numerals, pictures of common objects, and hexagons of varying colors. Their study showed:

> The analysis of variance revealed no significant differences in the learning of List I either for trials to criterion or number of errors....The results of List II show a slightly different pattern than did those of List I...while for the trials measure there were again no significant differences between any groups, the normal Ss did make significantly fewer errors in learning List II....In List III, the experimental Ss learned significantly more quickly and with fewer errors than did the control S. It may also be seen that on both measures the normals were more efficient than were the retarded S.[5]

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[5]Gershon Berkson and Gordon N. Cantor, "A Study of Mediation in Mentally Retarded and Normal Children," American Journal of Mental Deficiency, LXVI (July, 1961), p. 85.

Ring and Palermo attempted a further investigation into the relationship between intellective level and ability to learn paired-associates. Their stimulus materials consisted of eight pairs of Stanford-Binet vocabulary pictures. They matched fourteen mentally retarded adolescents with fourteen normal adolescents according to chronological age, and with a group of normal elementary school children according to mental age. At the conclusion of their study Ring and Palermo reported:

> The results of the present study differ from Eisman's findings that retarded Ss were not significantly inferior in performance on this learning task, although her results were in the same direction. The findings of this study supported the hypothesis that retarded Ss would perform less well than normal individuals of the same C.A. The two groups of matched mental age did not differ significantly, and when the two normal groups were compared, the older group was superior to the younger in performance.[6]

Cantor and Ryan[7] used pictures for the paired-associates learning task, and did not find significant differences between normals and retardates. However, Johnson and Blake[8] employed printed nonsense syllables and reported

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[6]Elizabeth M. Ring and David S. Palermo, "Paired Associate Learning of Retarded and Normal Children," American Journal of Mental Deficiency, LXVI (July, 1961), p. 105.

[7]G. N. Cantor and T. J. Ryan, "Retention of Verbal Paired-Associates in Normals and Retardates," American Journal of Mental Deficiency, Vol. 66, 1962, pp. 861-866.

[8]G. O. Johnson and K. Blake, Learning Performance of Retarded and Normal Children. Syracuse, N. Y.: Syracuse University Press, 1960.

significant differences between the two groups on the paired-associates learning task. Blue[9] utilized a modified paired-associates task with normal and mentally retarded Ss of approximately equal C.A. Each pair consisted of a visual stimulus item and an auditory response item. He found that the retarded Ss required significantly more trials to learn than did the normal Ss.

In a study by Vergason, in which he utilized pictures of common objects from the Peabody Picture Vocabulary Test for the material of the paired-associates task, the results supported his predictions:

> ...(1) retarded and normal Ss learned the paired-associates task at the same rates; (2) normal Ss were superior to retarded Ss on retention of the minimum task after one and 30 days; (3) retarded and normal Ss did not differ on retention of the over learning task after 30 days.[10]

Studies related to meaningfulness in learning of normal individuals

Noble, Stockwell, and Pryer, in a study investigating the influence of meaningfulness upon the rote learning of words and paralogs, reported:

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[9]C. Milton Blue, "Performance of Normal and Retarded Subjects on a Modified Paired-Associate Task," American Journal of Mental Deficiency, Vol. 68, No. 2, 1963, pp. 228-234.

[10]Glenn A. Vergason, "Retention in Retarded and Normal Subjects as a Function of Amount of Original Training," American Journal of Mental Deficiency, Vol. 68, No. 5, 1964, pp. 623-629.

> The major results and implications of these studies are as follows: (a) increasing m value, as measured by Noble's association-frequency method, facilities both serial and paired-associate learning....[11]

In a study investigating the role of meaningfulness in paired-associates verbal learning, Noble and McNeely found that "As expected from serial learning research, rate of acquisition was a positive function of m, and the curves showing the percentage of correct response tended toward positive acceleration with decreasing m value....Contrary to recent opinion, these findings indicate that the law relating to difficulty and meaningfulness for specific S-R connections can be determined by the method of paired associates."[12]

Hunt, who examined the effect of meaningfulness of stimulus and response in paired-associates learning, reported that with his college student Ss:

> Variations in response meaningfulness produced a significant effect upon acquisition. Stimulus meaningfulness produced significantly greater stimulus recall, and the effect of response meaningfulness on stimulus recall approached significance. Learning curves for each of the four main

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[11]Clyde E. Noble, Fredric E. Stockwell, and Margaret W. Pryer, "Meaningfulness (m') and Association Value (a) In Paired-Associate Syllable Learning," Psychological Reports, Vol. 3, 1957, p. 441.

[12]Clyde E. Noble and Deldon A. McNeely, "The Role of Meaningfulness (m) in Paired-Associate Verbal Learning," Journal of Experimental Psychology, Vol. 53, No. 1, 1957, pp. 16 and 22.

> experimental conditions were negatively accelerated and conformed to the hierarchy of effects predicted by Noble and McNeely.[13]

Lindley[14] studied the hypothesis that the relationship between published association values and ease of serial learning was due to familiarity and found that the lists of familiar syllables were easier to learn than lists of unfamiliar syllables when the items were spelled, even though the average published association values for the lists were identical. Furthermore, no significant difference was obtained between the rate of learning of meaningful words and nonsense syllables when familiarity was equated.

Kothurkar,[15] using undergraduate and graduate college students, analyzed the effects of meaningfulness on learning and retention, utilizing the paired-associates technique. Ss learned, recalled, and relearned four differently constituted paired-associates lists, consisting of dissyllables and paralogs of high and low meaningfulness. Both stimulus and response meaningfulness facilitated learning, though the

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[13]Raymond G. Hunt, "Meaningfulness and Articulation of Stimulus and Response in Paired-Associate Learning and Stimulus Recall," Journal of Experimental Psychology, Vol. 57, No. 4, 1959, p. 266.

[14]Richard H. Lindley, "Association Value and Familiarity in Serial Verbal Learning," Journal of Experimental Psychology, Vol. 59, No. 6, 1960, pp. 366-370.

[15]V. K. Kothurkar, "Effect of Stimulus-Response Meaningfulness on Paired-Associate Learning and Retention," Journal of Experimental Psychology, Vol. 65, No. 3, 1963, pp. 305-308.

effect of the latter was much greater. As expected, the increasing rank order of difficulty of High-High, Low-High, High-Low, and Low-Low was obtained for learning. However, this hierarchy of effects was disturbed in the case of retention by Low-High scoring over High-High. High meaningful responses were better remembered when paired with low meaningful stimuli than when associated with high meaningful stimuli. He utilized CVC from Noble's 1952 list.

In contrast, Cieutat[16] found that in a group experiment where the effect of independent variation of stimulus and response meaningfulness was measured, the effect was opposite to that found with memory drum methods, (i.e., stimulus meaningfulness had a stronger effect than response meaningfulness).

Studies related to meaningfulness in learning in retarded individuals

Lance[17] appears to be the first investigator to study the effects of meaningfulness in normal and retarded children. He suggested that "the meaningfulness of task materials, as well as the conditions of presentation of the

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[16]Victor J. Cieutat, "Group Paired-Associate Learning; Stimulus vs. Response Meaningfulness," Perceptual and Motor Skills, Vol. 12, 1961, pp. 327-330.

[17]Wayne D. Lance, "Effects of Meaningfulness and Overlearning on Retention in Normal and Retarded Adolescents," American Journal of Mental Deficiency, Vol. 70, No. 2, 1965, pp. 270-275.

task, all affect the rate of acquisitions in retardates in a manner different from the effect upon normals."[18] His study was designed to test the hypothesis that retarded Ss would suffer a learning deficit when verbal materials of low meaningfulness were employed, but not when verbal materials of high meaningfulness were used. He utilized Noble's consonant-vowel-consonant (CVC) combinations, scaled for meaningfulness (m'), paired with digits for the paired-associate task. Six items of high m' and six items of low m' were paired with digits 3 through 8 for the response items. The high m' stimulus CVC's were words whereas the low m' stimulus CVC's were non-words. For the original learning task, he found: "That the Ss learning the high m' task required significantly fewer trials to reach criterion than the Ss learning the low m' task."[19] Lance stated in his discussion:

> Whereas a number of paired-associates studies using pictures of common objects have demonstrated that retardates learn the task in about the same number of trials as normals of the same C.A., the present experiment using CVC material found significant difference in favor of normals.[20]

Ring used eight pairs of Stanford-Binet, Form L-M vocabulary pictures as the high meaningful non-verbal material and found a clearly defined and significant difference

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[18] Ibid., p. 271.

[19] Ibid., p. 274.

[20] Ibid., p. 275.

between normal and retarded Ss of matched C.A. in trials to learn a paired-associate list.[21]

Prehm[22] attempted to investigate the ability of mentally retarded and normal children to learn selected lists of paired-associates. The performance of the two groups was compared as a function of task difficulty and the nature of the learning materials. Four treatment conditions were utilized: meaningful, low difficulty; meaningful, high difficulty; non-meaningful, low difficulty; and non-meaningful, high difficulty. No attempt was made to match Ss in terms of C.A. or M.A. The non-meaningful paired-associates were comprised of nonsense, pictorial, stick-figure stimuli paired with low meaningful CVC trigrams. The meaningful paired-associates were comprised of pictures of common objects from the Peabody Picture Vocabulary Test paired with high meaningful CVC trigrams. The pictures served as the stimulus member and the trigram as the response member. Prehm found that the associative learning abilities of mentally retarded children are inferior to those of normal children. The results also indicated that

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[21]Elizabeth M. Ring, "The Effect of Anticipation Interval on Paired-Associate Learning in Retarded and Normal Children," American Journal of Mental Deficiency, Vol. 70, No. 3, 1965, pp. 466-470.

[22]Herbert J. Prehm, "Associative Learning in Retarded and Normal Children as a Function of Task Difficulty and Meaningfulness," American Journal of Mental Deficiency, Vol. 70, No. 6, 1966, pp. 860-865.

the performance superiority of normal Ss occurs, in general, for both meaningful and non-meaningful lists of paired-associates and that the effect of meaningfulness varied as a function of subject classification.

McManis' study in which he was attempting to study the von Restorff isolation effect, showed that the low meaningfulness of some items had a negative effect with the retardates that prevented the usual facilitation in the learning of the isolated item. He utilized items from the list of CVC trigrams published by Noble in 1952. In the discussion, McManis commented that "if this finding can be replicated with other samples of retarded Ss, it may be an indication that retardates are more dependent upon meaningfulness in the materials on such learning tasks than are normal Ss."[23]

Ahmad[24] investigated the effect of stimulus and response meaningfulness on short term and long term memory using the paired-associate technique. He utilized words from Thorndike's graded words of AA and 1 frequency value. All the words were three or four letter, English, pronounceable, and familiar. Four lists were used in order to pair meaningful stimulus and meaningful response,

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[23]Donald L. McManis, "The von Restorff Effect in Serial Learning by Normal and Retarded Subjects," American Journal of Mental Deficiency, Vol. 70, No. 4, 1966, pp. 569-575.

[24]Syed Khurshid Ahmad, "Paired Associate Verbal Learning by Normals and Mentally Retarded Under Variations of Stimulus and Response Meaningfulness," Dissertation Abstracts, Vol. 25 (8), 1965, 4533.

non-meaningful stimulus and non-meaningful response in all possible combinations. He found that normals were significantly superior to retardates in mean number of trials for both learning and retention. The normals had significantly fewer errors on each list. He also found that the high meaningful response was more crucial than high meaningful stimulus for both groups.

Those studies by proponents of the hypothesis that there are significant differences between the verbal learning of normals and retardates have been reviewed as well as the studies by the proponents of the alternative hypothesis that the verbal learning of normals and retardates is equivalent.

Lance's study[25] found significant differences in favor of normals. However, he used words and non-words paired with digits as learning material. This method placed the retardates at a disadvantage because of their reading deficiency and because an emotional involvement often exists where reading is concerned. Ring[26] was primarily concerned with the effect of varying anticipation time and used only high meaningful pictures. Prehm[27] utilized pairs composed of pictures to serve as stimuli and CVC trigrams to serve as responses. McManis[28] attempted, primarily, to study

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[25]Lance, loc. cit.

[26]Ring, loc. cit.

[27]Prehm, loc. cit.

[28]McManis, loc. cit.

isolation effects caused by meaningful and non-meaningful items. Ahmad's[20] study utilized words in attempting to differentiate rates of learning of verbal material as a function of meaningfulness and, as a result, was methodologically biased in favor of normals for the same reasons as stated for Lance's study.

Since previous studies conflict in their results and methodology, the current investigation was attempted. The study was designed to use paired-associate non-word CVC trigrams exclusively for the learning task. This seemed to be important because the task is comparable to many school situations. The learning task itself appeared to be more difficult than learning tasks using pictures, stick figures, colors, or geometric designs. Because of this increased difficulty, it was believed that a more discriminative task had been constructed. If the learning rates of mentally retarded children could be clarified to any degree, then perhaps procedures and methods of instruction for special education classes might be improved.

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[29]Ahmad, loc. cit.

CHAPTER II

STATEMENT OF THE PROBLEM

The purpose of this study was to investigate the effect of meaningfulness on the rate of learning of intellectively normal children and mentally retarded children as judged by the number of trials required to learn the material and the number of errors committed in the process. A recall paired-associates technique was employed, utilizing consonant-vowel-consonant (CVC) trigrams scaled for meaningfulness (m'). This material and design was selected in order that the effect of meaningfulness could be investigated as it varied from a position of stimulus to response and in all possible combinations of stimulus and response.

In order to determine the differences, if any, in the learning rate of normal and mentally retarded children as a function of meaningfulness, the following null and alternate hypotheses were tested:

1. There is no statistically significant difference between normal and mentally retarded children in the number of trials required to learn Treatments A, B, C, and D to criterion.

2. There is no statistically significant difference between normal and mentally retarded children in the number of errors committed while learning Treatments A, B, C, and D to criterion.

3. Normal children will require an equal or greater number of trials to learn Treatments A, B, C, and D to criterion than do mentally retarded children.

4. Normal children will commit an equal or greater number of errors while learning Treatments A, B, C, and D to criterion than do mentally retarded children.

5. Normal children will require significantly fewer trials to learn Treatments A, B, C, and D to criterion than will mentally retarded children.

6. Normal children will commit significantly fewer errors while learning Treatments A, B, C, and D to criterion than will mentally retarded children.

CHAPTER III

PROCEDURE OF THE STUDY

A paired-associates learning task was selected for this investigation since this method is indigenous to all classrooms. Educational procedures rely heavily upon the association technique in order to teach nearly every subject. At some point the teacher and student inevitably rely upon the association of one concept, fact, equation, or principle with another in order to learn the necessary material.

> The teacher who has tried to train students how to think has struggled in vain....Many teachers have persistently raised the problem of understanding, holding that some place in the process of learning there must be room for what they variously describe as 'getting the idea' or 'principle' or 'meaning' or 'understanding.'[30]

The question of the effect of meaning on associative learning stimulated the inquiry which prompted this investigation.

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[30]B. R. Bugelski, The Psychology of Learning Applied to Teaching, Indianapolis: The Bobbs Merrill Co. Inc., 1964 pp. 201-202.

The Subjects

The subjects used in this study were thirty-two boys and thirty-two girls selected from the elementary schools of Midwest City Public Schools, Midwest City, Oklahoma. Although subjects from four different schools were used, both normal and retarded subjects attended neighborhood schools which drew students from fairly homogeneous populations. The cultural and socio-economic level of all schools was judged by school officials to be within the range of lower-middle and middle-middle groups.

The subjects ranged in chronological age from 132 months to 156 months. Thirty-two of the subjects were mentally retarded students and the other 32 students were intellectively normal children attending regular classes. Recent Stanford-Binet Intelligence Test or Wechsler Intelligence Scale for Children data was available on the mentally retarded children. The retarded children ranged in I.Q. from 55 to 78 with the mean I.Q. being 70. California Test of Mental Maturity data, obtained within the past nine months as part of the regular school testing program, was available on the intellectively normal children. The normal subjects ranged in I.Q. from 90 to 110 with a mean I.Q. of 101.

The mentally retarded and normal children were divided into four treatment groups. Each child served in only one of the treatment groups.

The Test Instrument

Test materials consisted of four series of paired consonant-vowel-consonant (CVC) trigrams scaled for meaningfulness (m').[31] Each series, A, B, C, and D consisted of two booklets. Each booklet contained eight five-inch by eight-inch cardboard cards bound together by a plastic spiral binder. Booklet One of each series contained eight cards, on each of which was one pair of CVC trigrams. The letters of these trigrams were one-inch black upper case letters produced by means of a Columbia, Number 200, Sign and Chart Printer. Booklet One served as the stimulus cards. Booklet Two of each series contained eight cards, on each of which appeared the first CVC trigram of the corresponding stimulus pair of each series. Booklet Two served as the response cards. One pair of cards, stimulus and response, served as examples for instructional purposes but were not bound within their respective booklets. The treatment series and corresponding m' values are contained in Appendix A.

A review of the literature revealed that in the five studies investigating the effects of meaningfulness, three of them used CVC trigrams paired with digits, meaningful pictures or non-meaningful pictures.[32, 33, 34] The writer

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[31] Clyde E. Noble, "Measurement of Association Value (a), Rated Associations (a') and Scaled Meaningfulness (m') For the 2100 CVC Combinations of the English Alphabet." Psychological Reports, Vol. 8, 1961, p. 511. (487-521)

[32] Lance, loc. cit.

[33] Prehm, loc. cit.

[34] McManis, loc. cit.

rejected the idea of using any of these methods since it appeared that to attempt to equate meaningfulness of digits and CVC's, meaningful pictures and CVC's, or non-meaningful pictures and CVC's would introduce an uncontrollable variable. The associations that the subjects might make with the pictures would present a mediating and interfering factor that would be impossible to control and very difficult to measure. The assumption was made that non-words CVC trigrams would not be as likely to elicit this factor as other types of materials. Words, such as were used by one investigator[35] were not considered because of (a) the differing degrees of reading ability of school children; (b) the danger of attempting to measure an affective response which some words might precipitate; (c) the general reading deficiency of mentally retarded children; and (d) because a reading task might cause a negative response in the retarded subjects, which is just the opposite reaction to what was desired.

Noble[36, 37, 38, 39] presented convincing evidence

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[35]Ahmad, loc. cit.

[36]Noble, Psychological Reports, Vol. 3, 1957, p. 441.

[37]Noble, Psychological Reports, Vol. 8, 1961, p. 511.

[38]Clyde E. Noble and G. V. C. Parker, "The Montana Scale of Meaningfulness (m)," Psychological Reports, Vol. 7, 1960, pp. 421-430.

[39]Clyde E. Noble, "An Analysis of Meaning," Psychological Review, Vol. 59, 1952, pp. 421-430.

that through his operational index of stimulus meaning (the "mean frequency of continued written associations made by subjects within a 60-second time interval")[40] he had succeeded in numerically scaling the meaningfulness values of 2100 CVC combinations.[41] The reliability of the meaningfulness (m) scale is indicated by intergroup correlation coefficients which range from .92 to over .99, depending on population differences. It must be pointed out here that Noble indexed these CVC's as they served as stimulus items, not as response items nor with a paired-associate task. The population from which this data were drawn was undergraduate university students.

In what appears to be the only study dealing with the scaling of meaningfulness of any set of stimuli with children, Shapiro[42] used Noble's m' values for 52 CVC's as a comparison for the values he obtained on these 52 CVC's from 100 boys and 100 girls in Grades 4, 6, and 8 of five public elementary schools. Shapiro found rho's between his studies M_n and Noble's m' to be from .52 to .66. The CVC's used by Shapiro ranged in m' value from 2.64 to 4.78. Thus

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[40] Ibid.

[41] Noble, Psychological Reports, Vol. 8, 1961, p. 493.

[42] S. S. Shapiro, "Meaningfulness Values for 52 CVC's for Grade-School Children," Psychonomic Science, Vol. 1, 1964, pp. 127-228.

for children rather than college students, for production of a maximum of five responses in 18 sec. rather than ratings, and within approximately the upper two fifths of the range of Noble's m' values, M_n and m' were related significantly.[43]

The hypothesis was proposed and supported that scaled judgments of meaningfulness (m') may be regarded as a linear estimate of Ss mean number of overt associations (m).[44, 45]

The CVC's are scaled for meaningfulness (m') from values of .00, low meaning, to values of 4.78, high meaning. However, from values of 3.52 to 4.78, the majority of CVC's are words and were not utilized for reasons mentioned previously. Consequently, the CVC's selected for the high meaningful items had values ranging from 3.40 to 3.66. The CVC's selected for the low meaningful items had values ranging from .00 to .99.

Treatment A was composed of high meaningful stimuli and high meaningful responses. Treatment B was low meaningful stimuli and low meaningful responses. Treatment C was low meaningful stimuli and high meaningful responses

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[43]Albert E. Goss and Calvin F. Nodine. Paired-Associates Learning: The Role of Meaningfulness, Similarity, and Familiarization. New York and London: Academic Press, 1965, p. 44.

[44]Noble, Psychological Reports, Vol. 8, 1961, p. 511.

[45]Noble, Psychological Review, Vol. 59, 1952, pp. 421-430.

while Treatment D was high meaningful stimuli and low meaningful responses.

The CVC's were selected and assigned to their particular list in such a manner that, within the treatment group, the stimulus and response did not share the same letter in any position, nor did consecutive responses share letters. This was done so as to limit similarity of items as much as possible. The mean m' value across all lists was held to within .001 variance to insure equality of list values.

The list length of eight pairs was selected as the optimum number of pairs that would be both discriminative and of minimal length. The selection was based upon a review of the studies investigating the effect of meaning.[46, 47, 48, 49, 50]

The criterion of learning was established as one correct response, after which the item was dropped from the list. This method of adjusted learning was done in order to control for serial effects noted in other paired-associates

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[46] Lance, loc. cit.

[47] Ring, loc. cit.

[48] Prehm, loc. cit.

[49] McManis, loc. cit.

[50] Ahmad, loc. cit.

studies.[51, 52, 53] The method of adjusted learning is suggested by Prehm[54] as an appropriate means of controlling the degree of intralist learning.

The Procedure

Eight subjects, four male and four female, were selected from both the normal group and retarded group and placed in the treatment group A, making a total of sixteen subjects in the series. The same procedure was followed for treatment groups B, C, and D. Each subject, regardless of treatment group, was tested in the same manner. He was to learn the task to criterion.

Each subject was tested in a relatively quiet, well-lighted room. Each child was called for at his classroom. The subject was asked to sit to the Examiner's left at the end of a small table.

The following instructions were given to each subject, regardless of his treatment group:

> Here are a number of cards. Each card in this book has two groups of letters on it. They are not words so you can't read them like words. (The Examiner shows the Subject the sample card with two groups of letters

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[51] Vergason, loc. cit.

[52] Lance, loc. cit.

[53] Annette L. Gillette, "Learning and Retention A Comparison of Three Experimental Procedures," Archives of Psychology, Vol. 28, No. 198, 1936, p. 54.

[54] Herbert J. Prehm, "Verbal Learning Research in Mental Retardation," American Journal of Mental Retardation, Vol. 71, No. 1, 1966, p. 44.

> on it.) I want you to look at both groups of letters and try to remember which two groups go together. Then I will show you another book of cards like this. (The Examiner shows the Subject the sample card with only the first group of letters of the stimulus pair.) I want you to tell me what group of letters went with this group of letters. (If Subject does not respond, Examiner restates the task.) So, when you see the two groups of letters, try to remember what two groups of letters go together.

The eight pairs of CVC's were presented to each subject visually at the rate of one every four seconds. Then, Booklet Two was opened and the first CVC was presented singly at the rate of one every five seconds. The Examiner recorded either a correct or incorrect response on an individual response sheet.

Before the second trial the Examiner said:

> Now we shall look at the two groups of letters again. Two to remember what two groups of letters are together.

Intertrial intervals were ten seconds in duration. If the subject questioned the Examiner about the test, the Examiner said:

> We shall keep looking at the groups of letters until you learn them all.

After each subject learned the series to criterion, he was finished. The subject was thanked and allowed to return to his classroom.

The Obtained Data

The following information was obtained for each of the sixty-four subjects taking part in the study: name of

child, chronological age, intelligence quotient, treatment group membership, correct or incorrect response to each item, total number of errors committed while learning the task to criterion, and number of trials required to achieve the criterion. School records were the exclusive source of information in regards to date of birth and I.Q.

CHAPTER IV

THE RESULTS

Thirty-two mentally retarded children with Stanford-Binet or Wechsler intelligence quotients ranging from 55 to 78 and 32 normal children whose California Test of Mental Maturity I.Q.'s ranged from 90 to 110 participated in a paired-associates learning test. The purpose of the investigation was to determine if there were statistically significant differences in the learning rate between these two groups when meaningfulness varied from the stimulus position to response position using all possible combinations of stimulus and response. Comparisons were made on the number of trials required to meet the criterion of learning and on the number of errors committed in reaching this criterion. In order to study the effect of meaningfulness in all stimulus-response positions, the mentally retarded and normal children were divided into four treatment groups. The required level of statistical significance was set at the .05 level.

The statistical techniques chosen for treatment of the data were the nonparametric Friedman Two-Way Analysis of Variance, the Mann-Whitney U Test, and the Two Sample

Proportions Test. The scores obtained through the testing procedure yielded the following data for each of the sixty-four subjects: (1) number of trials required to reach criterion of learning; and (2) number of errors committed in reaching the criterion of learning.

Each experimental group contained eight normal and eight retarded children. The intelligence subgroups within the experimental conditions were evenly divided with respect to sex.

To test for overall differences in the normal and retarded groups and in the treatment conditions, the data were cast in a two way design conducive to the Friedman Two-Way Analysis of Variance Test. The eight columns of the design contained the experimental samples to be tested, while the eight rows contained the experimenter by sex interaction. The Friedman Two-Way Analysis of Variance Test checks for differences which occur in the column sum of ranks when the rows have been ranked stochastically. The formula used for the Friedman Two-Way Analysis of Variance is:[55]

$$\chi^2_r \,(k-1)\ df = \frac{12}{Nk(k+1}\sum_{j=1}^{k}(R_j)^2 - 3N(k+1)$$

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[55]Sidney Siegel, "The Friedman Two-Way Analysis of Variance," Nonparametric Statistics. New York: McGraw-Hill Books, 1956, p. 120.

The probability of occurrence under the null hypothesis for the observed χ^2_r was determined directly from chi square tables. The raw data from which the statistical calculations were made appear in Appendix B.

TABLE 1

FRIEDMAN TWO-WAY ANALYSIS OF VARIANCE ACROSS NORMAL AND RETARDED AND TREATMENTS BY SEX AND EXPERIMENTER FOR THE NUMBER OF TRIALS TO CRITERION

	Normals				Retarded			
	A	B	C	D	A	B	C	D
R_k[a]	16	50	12	30.5	38.5	55	34	52
χ^2_r 7 df.	37.71							
$p \geq$	.001							

[a] R_k = column sum of ranks

The data in Table 1 reveal that within the two samples, a highly significant difference exists in the number of trials required to achieve the criterion of learning. The obtained χ^2_r of 37.71 is significant beyond the .001 level of confidence.

TABLE 2

FRIEDMAN TWO-WAY ANALYSIS OF VARIANCE ACROSS NORMAL-RETARDED AND TREATMENTS BY SEX AND EXPERIMENTER FOR THE NUMBER OF ERRORS COMMITTED TO CRITERION

	Normals				Retarded			
	A	B	C	D	A	B	C	D
R_k	16.5	48.5	14.5	32	37.5	55	32	52

χ^2_r 7 df. = 33

$p \geq$ .001

The data in Table 2 show that within the two samples, a highly significant difference exists in the number of errors committed by the two samples before they reached the criterion. This overall χ^2_r value of 33 is considerably larger than the value of 24.32 which was required at the .001 level in order to be significant. Thus, it becomes quite evident that there is a significant difference within the samples on both the trial and error performance measures.

The Mann-Whitney U Test was utilized in testing for differences between normal and retarded groups and for differences between the normals and retardates in each treatment group (A, B, C, and D). It was predicted that retardates would use more trials and commit more errors in achieving the criterion of learning than would normals.

Since the data clearly achieved ordinal measurement, the use of the U Test was justified. The first test was between normals and retardates for the two total groups. In order to afford a statistical analysis of overall differences, the samples were pooled and ranked from one to 64. The criterion for ranking was the number of trials (or errors) the individual used before achieving the criterion of learning. The algebraically smallest number of trials received the rank of 1. The notation n_1 was assigned the number of cases in the normal group since it was predicted to be smaller, and n_2 was respectively assigned to the number of cases in the retarded group. The sums of ranks were tallied across the n_1 cases and these sums were assigned the notation R_1. To determine the value of U, the corresponding values were placed into the formula:[56]

$$U = n_1 n_2 + \frac{n_1(n_1 + 1)}{2} - R_1$$

The significance of the observed U was determined through the use of a Z test which was corrected for tied ranks, where N equals n_1 n_2 and ΣT is the sum of the tied ranks correction.[57]

$$Z = \frac{U - \frac{n_1 n_2}{2}}{\sqrt{\left(N \frac{n_1 n_2}{(N-1)}\right)\left(\frac{N^3 - N}{12} - \Sigma T\right)}}$$

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[56] Ibid., p. 125.

[57] Helen M. Walker and Joseph Lev, Statistical Inferences. New York: Holt, Rinehart and Winston, 1953, p. 78.

TABLE 3

MANN-WHITNEY U TEST FOR DIFFERENCES IN NORMALS AND RETARDATES TOTAL TRIALS AND ERRORS

	Trials	Errors
n_1	32	32
n_2	32	32
N	64	64
R_1	763.5	777
U	788.5	775
z	3.723	3.317
p	0.000105	0.000458

As evidenced by the data contained in Table 3 the retardates were using significantly more trials and errors to achieve the criterion of learning than were the normal children.

TABLE 4

MANN-WHITNEY U TEST FOR DIFFERENCES IN NORMALS AND RETARDATES BY TREATMENT GROUP FOR NUMBER OF TRIALS

	A	B	C	D
n_1	8	8	8	8
n_2	8	8	8	8
N	16	16	16	16
U	0	18	4	8
p	.0009	.08	.001	.005

TABLE 5

MANN-WHITNEY U TEST FOR DIFFERENCES IN NORMALS AND RETARDATES BY TREATMENT GROUP FOR NUMBER OF ERRORS

	A	B	C	D
n_1	8	8	8	8
n_2	8	8	8	8
N	16	16	16	16
U	0	17	5	11
p	.009	.065	.001	.014

From the data in Tables 4 and 5 it becomes apparent that the number of trials required to achieve the criterion of learning on Treatment A is the most discriminative while Treatment B is least discriminative. Treatment B fails to reach the .05 level of significance on either number of trials or number of errors committed. The number of errors on Treatment A was quite significant at the .009 level, while both number of trials and number of errors committed were fairly significant at the .001 level on Treatment C.

The Two Sample Proportions Test was used to detect significant differences in the difficulty between the four treatment groups. The procedure followed was to first compute the total trial mean, $\overline{X} = 11.78$. Then a table of frequencies was cast for each treatment in which the first half of the table contained the number of individuals whose

score was above the mean and the second half of the table contained the number of individuals who scored below the mean.

TABLE 6

NUMBER AND PROPORTION OF SUBJECTS ABOVE THE MEAN FOR EACH TREATMENT GROUP

	A	B	C	D
TRIALS				
Number Above Mean	2	12	2	8
Proportion[b]	.125	.75	.125	.50
ERRORS				
Number Above Mean	2	13	2	8
Proportion[b]	.125	.8125	.125	.50

[b]Because of the near duplication in trials and errors for these proportions, the two -sample proportion tests were conducted for the trials only.

The data contained in Table 6 also indicates that Treatment B is the most difficult task by revealing that twelve subjects required more than the mean number of trials in order to achieve criterion. The number of errors committed by the subjects in Treatment B is considerably above the mean although not in direct proportion to the number of trials. Treatments A and C appear to be the least difficult tasks. Those scores above the mean would denote more difficulty in achieving the criterion.

When casting the tables it was found that scores for Treatment A and Treatment C were equal in frequency of occurrence, both above and below the mean. All possible combinations of two were then made for those treatment groups which differed in their proportions of greater than the mean occurrence. Those tests conducted were between Treatments A and B, A and D, and B and D. The formula used for the Two Sample Proportions Test is:[58]

$$z = \frac{p_1 - p_2}{\sqrt{\frac{pqN}{N_1 N_2}}}$$

where p_1 is the proportion of trials above the mean for sample one; p_2 is the proportion of trials above the mean for sample two; p is the total proportion of the number of trials above the mean for both samples; q is equal to 1-p; N_1 is the number of subjects in the first sample; N_2 is the number of subjects in the second sample; and N is equal to N_1+N_2. The formula for p is:[59]

$$p = \frac{N_1 p_1 + N_2 p_2}{N_1 + N_2}$$

The same notations hold for this formula that were used for z.

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[58] Ibid.

[59] Ibid.

TABLE 7

TWO SAMPLES PROPORTIONS TEST DATA FOR COMPARISONS OF TREATMENT GROUPS BY PAIRED TREATMENTS

	p	z	Probability
A[e] and B	.4375	5	$0.0^{6}53594$
A and D	.3125	2.287	0.014622
B and D	.6250	1.462	0.072156

[e]A and C will not be duplicated in this table, since they are equal in frequency of occurrence, both above and below the mean.

It may be ascertained from Table 7 that both Treatments B and D were more difficult than Treatment A or C, and that the comparison of Treatments B and D fell slightly above the level required for significance.

Discussion of Results

In summary, there were statistically significant differences found: in the total number of trials required to achieve the criterion of learning with the two samples taken together by sex and experimenter and across all treatment groups; in the total number of errors committed while achieving the criterion of learning with the two samples taken together by sex and experimenter and across all treatment groups; between the normal and retarded groups in total number of trials required and total number of errors

committed while learning Treatments A, B, C, and D; between normals and retardates in number of trials required to achieve the criterion of learning on Treatments A, C, and D; and between normals and retardates in number of errors committed while achieving the criterion of learning on Treatments A, C, and D.

Statistically significant differences were not found between normals and retardates on either number of trials required or number of errors committed on Treatment B.

Across both samples, Treatment B had the highest proportion of subjects requiring more than the mean number of trials to achieve the criterion of learning. Treatment D was next highest while Treatments A and C had equal proportions of subjects requiring more than the mean number of trials to achieve criterion.

There were statistically significant differences found when comparisons of proportions of performance, across both samples, were made by pairs of treatment groups. Treatments A and C had equal proportions, and thus were not compared. Significant differences were found between Treatments A and B, and A and C. Although the comparison approached significance, Treatments B and D were not statistically significant.

CHAPTER V

CONCLUSIONS AND SUMMARY

The complex process of learning, with all its implications for education, continues to be a process that is not totally understood. It is imperative, however, that as much as possible be known about the conditions which implement and impede learning. More is known about learning in normal children than is known about learning in mentally retarded children since considerably more research has been done in that area. The amount of research done on learning in mentally retarded children continues to grow but the research dealing with the effect of meaningfulness on learning in mentally retarded children is still negligible. Conflict and inconclusiveness marks the research which has been attempted in this area. McPherson, in two separate reviews, surveyed the experimental studies of learning in retarded individuals which were accomplished during the period from 1907 to 1957. Her reviews revealed that information concerning learning in mentally retarded individuals was scarce and contradictory, and did not satisfactorily demonstrate that mentally retarded individuals were consistently inferior

to normal individuals in learning ability. Eisman did not find significant differences when comparing retarded, normal, and superior children on a paired-associate learning task utilizing pictures.

Berkson and Cantor found significant differences between mentally retarded and normal subjects when they administered a paired-associate learning task composed of pictures of common objects and hexagons of varying colors. Significant differences were found between the retarded and normal subjects in the number of errors made and number of trials required to learn certain lists to criterion, while no differences were found in the number of errors made or in number of trials required to learn other lists. Ring and Palermo found significant differences between normal and retarded subjects of the same chronological age when compared on a paired-associate learning task. Cantor and Ryan did not find significant differences between normals and retardates on a paired-associate learning task utilizing pictures. Johnson and Blake reported significant differences between the two groups on a nonsense syllable paired-associate learning task. Blue, utilizing a modified paired-associate learning task which consisted of visual stimuli and auditory responses, found retardates requiring significantly more trials to learn the task than did the normal subjects.

Vergason found that normals and retardates learned

the paired-associate learning task at equal rates when pictures of common objects were used, but he found the normals were superior to retardates in retention after one and thirty days. However, there was no difference between retarded subjects and normal subjects on retention of an overlearning task after thirty days.

Noble, Stockwell, and Pryor, in a study investigating the effect of meaningfulness upon the rote learning of words and paralogs in normal individuals, reported that meaningfulness (m), as measured by Noble, facilitated both serial and paired-associates learning. Noble and McNeely report, after studying the effects of meaningfulness in paired-associates verbal learning, that meaningfulness and difficulty for specific stimulus-response connections can be determined by the paired-associates method. Hunt confirmed Noble and McNeely's findings and found significant effects of meaningfulness in a paired-associates learning task which utilized college students. Lindley found no significant differences between groups of normal subjects on a learning task consisting of meaningful words when the words were equated for familiarity. Kothurkar, utilizing consonant-vowel-consonant (CVC) trigrams scaled for meaningfulness found that both stimulus and response meaningfulness facilitated learning, with the effect of the latter being the greatest. Cieutat found that in a group experiment, stimulus meaningfulness had a stronger effect than response meaningfulness.

In a study involving normal and mentally retarded children, Lance investigated the effects of the meaningfulness of materials in a paired-associates learning task. He utilized Noble's CVC's scaled for meaningfulness (m') paired with digits. He found significant differences in favor of the normal subjects when high m' stimulus CVC's were words and low m' response CVC's were non-words. Ring, using pictures for high meaningful, non-verbal learning materials, found significant differences between normal and retarded subjects in number of trials to learn the paired-associates task. Prehm, without attempting to match subjects in terms of C.A. or M.A., utilized stick-figure pictures, low m' CVC trigrams, pictures of common objects, and high m' CVC trigrams in an attempt to measure the effect of meaningfulness on a paired-associates learning task. He reported that mentally retarded children are inferior to normal children in associative learning abilities. McManis found that the low m' of CVC's seemed to have a negative effect with retardates which prevented them from learning such items when the items were in isolation. Ahmad used the paired-associates technique to study the effect of meaningfulness on short-term and long-term memory in normal and mentally retarded subjects. He utilized English words in the learning task and found that normals are significantly superior to retardates in the mean number of trials required for both learning and retention. He also found that a high

meaningful response was more crucial than a high meaningful stimulus for both groups.

This study was designed to investigate the effect of meaningfulness and the differences in learning rate, if any, between normal and mentally retarded children on a paired-associates learning task. The test utilized non-word CVC trigrams, scaled for meaningfulness for both stimulus and response in four different treatment groups.

The subjects used in this study were sixty-four elementary school boys and girls. The subjects ranged in chronological age from 132 months to 156 months. Thirty-two of the subjects were mentally retarded children who had I.Q.'s ranging from 55 to 78 as measured by the Stanford-Binet or Wechsler Intelligence Scale for Children. Thirty-two of the subjects were normal children ranging in I.Q. from 90 to 110 as measured by the California Test of Mental Maturity.

The mentally retarded subjects and normal subjects were subdivided into four experimental groups with an equal number of boys and girls in each group. The subjects in each group received either Treatment A, B, C, or D which was a paired-associates task to be learned to a criterion of one correct response. The test required the learning of eight pairs of either high m' stimulus - high m' response, low m' stimulus - low m' response, low m' stimulus - high m' response, or high m' stimulus - low m' response CVC's which are scaled for meaningfulness.

Results of the study partially rejected these null hypotheses:

1. There is no statistically significant difference between normal and mentally retarded children in the number of trials required to learn Treatment A, B, C, and D.

2. There is no statistically significant difference between normal and mentally retarded children in the number of errors committed while learning Treatment A, B, C, and D.

3. Normal children will require an equal or greater number of trials to learn Treatments A, B, C, and D to criterion than do mentally retarded children.

4. Normal children will commit an equal or greater number of errors while learning Treatments A, B, C, and D to criterion than do mentally retarded children.

Null hypothesis number one could not be rejected completely since there was not a significant difference between normal and mentally retarded children in the number of trials required to reach the criterion of learning on Treatment B.

Null hypothesis number two could not be rejected completely since there was not a significant difference between normal and mentally retarded children in the number of errors committed in achieving the criterion on Treatment B.

Null hypothesis number three could not be rejected completely since the normal children did not require an equal or greater number of trials to learn Treatments A, C, and D to criterion than did the mentally retarded children.

Null hypothesis number four could not be rejected completely since the normal children did not commit an equal or greater number of errors while learning Treatments A, C, and D than did the mentally retarded children.

Results of the study partially sustained the following alternate hypotheses:

5. Normal children will require significantly fewer trials to learn Treatments A, B, C, and D to criterion than will mentally retarded children.

6. Normal children will commit significantly fewer errors while learning Treatments A, B, C, and D to criterion than will mentally retarded children.

Alternate hypothesis number five was only partially sustained since the normal children did not require significantly fewer trials to learn Treatment B to criterion than did the mentally retarded children.

Alternate hypothesis number six was only partially sustained since the normal children did not commit significantly fewer errors while learning Treatment B to criterion than did the mentally retarded children.

These findings appear to have implications for educators as they plan instructional methods, procedures and materials in school. The effect of meaningfulness in this paired-associate learning task would seem to indicate that the presentation of material, without regard to its applicability to the associative or meaningful repertory of

the children's experiences, is a practice which may be wasteful in terms of time and learning. Apparently Treatment B in which both stimulus and response were low in meaningfulness was difficult enough so that normal children were not able to do significantly better than retarded children. It is not clear whether the lack of difference was due to a poorer performance on the part of the normals, or an improved performance by the retardates. However, it is clear that both groups did better on the learning task where only one meaningful item in the stimulus position, was introduced. The fact that the subjects did not do significantly better on the treatment series which utilized high meaningful items in positions of stimulus and response would indicate that a high meaningful response is the most crucial to effective learning.

The results of this study support the findings of Lance in that a significant difference was found in favor of normals on the total number of trials to reach the criterion of learning. The present finding, that on one treatment series (Treatment B), a significant difference was not found between normals and retardates on the number of trials required to achieve criterion, does not support Lance's findings.

The findings of the present study support Ring's study in that significant differences are found between normal and retarded subjects when high meaningful material is used on a paired-associate learning task.

The results also support Prehm's findings that the associative learning ability of mentally retarded children is inferior to normal children. However, they do not support Prehm's finding that performance superiority of normal subjects occurs across all levels of meaningfulness and non-meaningfulness.

Since McManis was studying the effects of isolation, the results are not directly comparable with the results of the present study. However, an indication from McManis' study that retardates are more dependent upon meaningfulness in the learning materials than normal subjects is not completely supported by the present study.

Ahmad's finding that normals are significantly superior to retardates, on both trial and error dependent measures, is supported by the findings for three of the four lists in the present study. Based on overall comparisons on total trials and errors, Ahmad's study is supported. His findings that the high meaningful response is more crucial than high meaningful stimulus for both groups is also supported.

In considering the findings of the present study two observations seem important. While administering the learning tasks to the individual subjects it became apparent that a majority of the mentally retarded subjects attempted a serial memorization of the stimuli and responses. A few subjects continued this practice for many trials while most

of them ceased trying after five or six trials and resorted to an associative method of learning the stimuli and responses.

It also seemed somewhat unusual that none of the subjects appeared to learn that once an item was correctly repeated, that item was dropped from the list and he could simply learn one item per trial and complete the task in seven trials after the first correct response. It was anticipated that this might be a factor to confound the comparison between the normals, who could be expected to learn this, and the retarded subjects. However, such was not the case.

Future research might be beneficial in the area of using children as subjects to scale the CVC trigrams for meaningfulness. It might also be interesting to replicate the present study and add a control group who would supply associative responses for the four different treatment series stimuli. This might reveal hidden or unsuspected associations in the material.

In conclusion, the findings of the present study supports some of the earlier studies on a comparison of learning rates as a function of meaningfulness between mentally retarded and normal children while it fails to support others. The findings of this study indicate that mentally retarded and normal children do differ significantly with respect to learning rate on a paired-associate learning task that varied stimulus and response meaningfulness.

BIBLIOGRAPHY

Books

Bugelski, B. R. The Psychology of Learning Applied to Teaching, Indianapolis: The Bobbs Merrill Co., Inc., 1964, pp. 201 and 202.

Goss, Albert E., and Calvin F. Nodine. Paired-Associates Learning: The Role of Meaningfulness, Similarity, and Familiarization. New York and London: Academic Press, 1965, p. 44.

Johnson, G. O. and K. Blake. Learning Performance of Retarded and Normal Children. Syracuse, N. Y. Syracuse University Press, 1960.

Osgood, Charles E., George J. Suci, and Percy H. Tannenbaum. The Measurement of Meaning. Urbana: University of Illinois Press, 1957, p. 2.

Siegel, Sidney. "The Friedman Two-Way Analysis of Variance," Nonparametric Statistics. New York: McGraw-Hill Books, 1956.

Walker, Helen M. and Joseph Lev. Statistical Inference. New York: Holt, Rinehart and Winston, 1953.

Articles and Periodicals

Ahmad, Syed Khurshid, "Paired Associate Verbal Learning by Normals and Mentally Retarded Under Variations of Stimulus and Response Meaningfulness," Dissertation Abstracts, Vol. 25 (8), 1965, 4533.

Berkson, Gershon and Gordon N. Cantor, "A Study of Mediation in Mentally Retarded and Normal School Children," Journal of Educational Psychology, LI (1960), p. 85.

Blue, C. Milton, "Performance of Normal and Retarded Subjects on a Modified Paired-Associate Task," American Journal of Mental Deficiency, Vol. 68, No. 2, 1963, pp. 228-234.

Cantor, G. N. and T. J. Ryan, "Retention of Verbal Paired-Associates in Normal and Retardates," American Journal of Mental Deficiency, Vol. 66, 1962, pp. 861-866.

Cieutat, Victor J. "Group Paired-Associate Learning: Stimulus vs. Response Meaningfulness," Perceptual and Motor Skills, Vol. 12, 1961, pp. 327-330.

Eisman, Bernice S. "Paired Associate Learning, Generalization, and Retention," American Journal of Mental Deficiency, LXIII, (1958), p. 484.

Gillette, Annette L. "Learning and Retention A Comparison of Three Experimental Procedures," Archives of Psychology, Vol. 28, No. 198, 1936, p. 54.

Hunt, Raymond G. "Meaningfulness and Articulation of Stimulus and Response in Paired-Associate Learning and Stimulus Recall," Journal of Experimental Psychology, Vol. 57, No. 4, 1959, p. 266.

Kothurkar, V. K. "Effect of Stimulus-Response Meaningfulness on Paired-Associate Learning and Retention," Journal of Experimental Psychology, Vol. 65, No. 3, 1963, pp. 305-308.

Lance, Wayne D. "Effects of Meaningfulness and Overlearning on Retention in Normal and Retarded Adolescents," American Journal of Mental Deficiency, Vol. 70, No. 2, 1965, pp. 270-275.

Lindley, Richard H. "Association Value and Familiarity in Serial Verbal Learning," Journal of Experimental Psychology, Vol. 59, No. 6, 1960, pp. 366-370.

McManis, Donald L. "The Von Restorff Effect in Serial Learning by Normal and Retarded Subjects," American Journal of Mental Deficiency, Vol. 70, No. 4, 1966, pp. 569-575.

McPherson, Marion White, "A Survey of Experimental Studies of Learning in Individuals Who Achieve Subnormal Ratings on Standardized Psychometric Measures," American Journal of Mental Deficiency, LII-LIII, (1948), p. 252.

_____. "Learning and Mental Deficiency," American Journal of Mental Deficiency, LXII, (1958), p. 877.

Noble, Clyde E., "An Analysis of Meaning," Psychological Review, Vol. 59, 1952, 421-430.

Noble, Clyde E., and Deldon A. McNeely, "The Role of Meaningfulness (m) in Paired-Associate Verbal Learning," Journal of Experimental Psychology, Vol. 53, No. 1, 1957, pp. 16 and 22.

Noble, Clyde E., Fredric E. Stockwell, and Margaret W. Pryer, "Meaningfulness (m') and Association Value (a) In Paired-Associate Syllable Learning," Psychological Reports, Vol. 3, 1957, p. 441.

Noble, Clyde E., and G. V. C. Parker, "The Montana Scale of Meaningfulness (m)," Psychological Reports, Vol. 7, 1960, pp. 421-430.

Noble, Clyde E. "Measurements of Association Value (a), Rated Associations (a') and Scaled Meaningfulness (m') for the 2100 CVC Combinations of the English Alphabet," Psychological Reports, Vol. 8, 1961, p. 511. (487-521)

Prehm, Herbert J. "Associative Learning in Retarded and Normal Children as a Function of Task Difficulty and Meaningfulness," American Journal of Mental Deficiency, Vol. 70, No. 6, 1966, pp. 860-865.

_____. "Verbal Learning Research in Mental Retardation," American Journal of Mental Retardation, Vol. 71, No. 1, 1966, p. 44.

Ring, Elizabeth M., and David S. Palermo, "Paired Associate Learning of Retarded and Normal Children," American Journal of Mental Deficiency, LXVI (July, 1961), p. 105.

Ring, Elizabeth M. "The Effect of Anticipation Interval on Paired-Associate Learning in Retarded and Normal Children," American Journal of Mental Deficiency, Vol. 70, No. 3, 1965, pp. 466-470.

Shapiro, S. S. "Meaningfulness Values for 52 CVC's for Grade-School Children," Psychonomic Science, Vol. 1, 1964, pp. 127-128.

Vergason, Glenn A. "Retention in Retarded and Normal Subjects as a Function of Amount of Original Training," American Journal of Mental Deficiency, Vol. 68, No. 4, 1964, pp. 623-629.

APPENDIX

APPENDIX A

Treatment Series and Scaled Meaningfulness (m') Values

TREATMENT A

Stimulus	m'	Response	m'
BOS	3.47	KIL	3.66
DIC	3.44	SAN	3.53
HUN	3.42	GIL	3.41
REC	3.57	HOM	3.52
DIV	3.61	LAT	3.52
BAL	3.52	REV	3.44
RIV	3.45	SAL	3.55
HAL	3.53	KEG	3.40
	Mean 3.5012		Mean 3.5037

TREATMENT B

Stimulus	m'	Response	m'
ZIO	.97	CUJ	.90
XEM	.97	QOG	.89
QUJ	.40	XEH	.52
XOY	.70	QIF	.79
KUO	.84	ZOJ	.17
YEJ	.47	XIK	.85
XEV	.70	WUO	.90
QOH	.85	XEK	.89
	Mean .7375		Mean .7387

TREATMENT C

Stimulus	m'	Response	m'
YIX	.90	BOR	3.42
XOJ	.00	CUS	3.64
OUG	.73	MIN	3.45
YIV	.84	SOL	3.40
WIJ	.85	PAS	3.65
XOS	.97	DEL	3.50
OOJ	.62	PIC	3.41
YAV	.99	BOT	3.57
	Mean .7375		Mean 3,505

TREATMENT D

Stimulus	m'	Response	m'
BAC	3.41	YOF	.87
PUL	3.49	XAH	.97
HOR	3,43	OEX	.73
WEL	3.59	XOH	.84
LIV	3.51	VUO	.89
HON	3.57	ZAJ	.85
MOR	3.51	OIH	.66
CIV	3.51	XEJ	.10
	Mean 3.5025		Mean .7387

APPENDIX B

NORMAL SUBJECTS

Treatment A

Boys			Girls		
Individual	Trials	Errors	Individual	Trials	Errors
1	7	27	5	8	31
2	8	29	6	5	12
3	7	30	7	7	31
4	8	34	8	4	9

Treatment B

Boys			Girls		
Individual	Trials	Errors	Individual	Trials	Errors
9	11	61	13	11	43
10	11	55	14	13	55
11	12	58	15	23	127
12	18	92	16	19	84

Treatment C

Boys			Girls		
Individual	Trials	Errors	Individual	Trials	Errors
17	9	46	21	4	18
18	3	12	22	7	21
19	5	18	23	5	22
20	6	26	24	5	21

Treatment D

Boys			Girls		
Individual	Trials	Errors	Individual	Trials	Errors
25	10	44	29	9	35
26	10	39	30	8	37
27	7	33	31	9	36
28	14	70	32	11	56

MENTALLY RETARDED SUBJECTS

Treatment A

Boys			Girls		
Individual	Trials	Errors	Individual	Trials	Errors
1	11	43	5	9	43
2	10	41	6	17	75
3	16	67	7	10	41
4	9	40	8	10	40

Treatment B

Boys			Girls		
Individual	Trials	Errors	Individual	Trials	Errors
9	16	72	13	17	75
10	26	133	14	14	74
11	11	62	15	19	87
12	26	127	16	15	70

Treatment C

Boys			Girls		
Individual	Trials	Errors	Individual	Trials	Errors
17	8	27	21	10	51
18	13	59	22	26	146
19	9	31	23	6	22
20	7	33	24	11	47

Treatment D

Boys			Girls		
Individual	Trials	Errors	Individual	Trials	Errors
25	17	78	29	26	147
26	14	77	30	26	196
27	7	28	31	12	42
28	18	84	32	14	73