THE DISCRIMINATION OF CHILDREN WITH LEARNING DISABILITIES, RETARDATES, AND NORMALS ON WORD-NAMING AND VOCABULARY ABILITIES

By

PATRICIA LEIGH MORGAN

Bachelor of Business Administration

University of Oklahoma

Norman, Oklahoma

1952

Submitted to the Faculty of the
Graduate College of the
Oklahoma State University
in partial fulfillment of
the requirements for
the Degree of
MASTER OF SCIENCE
May, 1974

THE DISCRIMINATION OF CHILDREN WITH
LEARNING DISABILITIES, RETARDATES,
AND NORMALS ON WORD-NAMING AND
VOCABULARY ABILITIES

Thesis Approved:

H. Stephen Caldwell
Thesis Adviser

Larry Hochhaus

Barbara J. Weiner

N. N. Durham
Dean of the Graduate College

ACKNOWLEDGMENTS

I wish to express my sincere appreciation to all who have contributed to the completion of this study. Special appreciation is expressed to Dr. H. Stephen Caldwell, my thesis adviser, for his investment of time, continued encouragement, and patient guidance throughout the duration of this study. I am also particularly indebted to the other members of my committee, Dr. Barbara Weiner, who supervised the pilot study and whose ideas and suggestions were invaluable, and Dr. Larry Hochhaus, who gave his time and helpful suggestions. Appreciation is expressed to Dr. Barbara Caldwell, whose ideas and suggestions were most helpful, and Dr. Cheryl Scott, who provided suggestions for research resources.

For their assistance in finding subjects, I would like to thank Mr. Paul L. Babiak, Superintendent, Cushing Public Schools, Mrs. Edna Jungers, Director of Special Services, Stillwater Public Schools, Mr. Harry Gootas, Principal, Skyline Elementary School, and Mrs. Roberta Melone, Psychometrist, Cushing Public Schools. I would also like to thank Brian Cysewski and Mrs. Roberta Melone, who provided much help in sharing the WISC testing load, and Mrs. Nila Henderson, who freely gave her time to help in measuring the data. Finally, my thanks go to the children who participated in this study.

TABLE OF CONTENTS

LIST OF TABLES

CHAPTER I

THE PROBLEM

Children with learning disabilities (CLD) are youngsters who seem to have the necessary assets for success in school yet are doing poorly in one or more of the basic academic skills. The inferior performance of these children has been attributed to specific deficits in the basic psychological processes: motor, perceptual, or cognitive. Unfortunately, each child has a unique combination of strengths and weaknesses and identification procedures have been complex and time consuming. Recent reports indicate that there is a central symptom of defective attention which is basic to the specific disability exhibited by the child (Dykman, Ackerman, Clements, and Peters, 1971) and that there is a cardinal strength of verbal fluency. The present study was conducted to determine whether these characteristics can be used to differentiate CLD from the normal learner and the educable mentally handicapped.

Short attention span or distractability has long been clinically conceptualized as one of the core symptoms of learning disabilities children (Birch, 1964; Clements and Peters, 1962; Strauss and Lehtinen, 1947). Recent research provides evidence in support of this viewpoint (Senf and

Freundl, 1971; Dykman, Walls, Suzuki, Ackerman, and Peters, 1970; Stevens, Boydstun, Dykman, Peters, and Sinton, 1967; Luria, 1961). These studies indicate that CLD are lacking in those specific arousal or emotive supports necessary for sustained attention and that disorders of attention are particularly implicated in the inferior classroom performance of these children. Dykman et al. (1970) also suggest that hyperative CLD appear to be over-attentive to their environment, whereas, hypoactive ones are under-attentive and that the net effect of over- and under-attention on performance is the same.

Deficiencies in attention have also been attributed to the mentally retarded (Baumeister and Kellas, 1968), and it appears that the overall performance of mentally retarded children on a task requiring sustained mental effort would be similar to that of CLD. Therefore, to differentiate CLD from other populations, it seems that one must use their assets as well as their liabilities.

There are indications that CLD generally attain scores on the vocabulary subtest of the Wechsler Intelligence Scale for Children (WISC) which are in line with their predicted level of academic achievement (Ackerman, Peters, and Dykman, 1971; Sabatino and Hayden, 1970). The WISC scores reported in the study of Ackerman et al. (1971) show that the normal controls were significantly higher than the CLD on the verbal scale IQ, yet the CLD had a mean scale score on the vocabulary subtest slightly higher than the normal group.

Wechsler (1958) believes that the vocabulary subtest is a good measure of general intelligence and that it also indicates the amount of verbal information that the subject possesses and the range of his ideas based upon experience and education. Thus it would seem that a child's performance of the vocabulary subtest would reflect his general intellectual abilities and his verbal fluency, but it would not reflect his ability to adequately perform verbal skills, such as reading or spelling. It appears that the CLD's expressive vocabulary, just as with the normal child, is commensurate with his intellectual abilities.

In this paper, data shall be presented from the word-naming task, which is similar to the fifth subtest at the ten year age level of the Stanford-Binet Intelligence Scale, Form L-M (Terman and Merrill, 1960) and from the WISC vocabulary subtest (Wechsler, 1949). The word-naming task is a free response task that requires the child to name as many words as he can. Factor-analytic studies of the Stanford-Binet denote that this task requires the same mental processes that a vocabulary task requires (Lutey, 1966; Sattler, 1965; Valett, 1956). However, the structure is different. Rather than the environment providing the stimuli for each response, after the instructions are understood and the initial response given, the child provides the stimuli for each succeeding response. Any lag in attention will affect the productivity. The word-naming task, as a measure of the CLD's basic deficit, combined with the vocabulary subtest of the WISC, as a measure of strength, should provide a basis for the discrimination of CLD from the normal and retarded populations. It was expected that the normal child would perform well on both these tasks, whereas the retardate would perform poorly. It was further hypothesized that the CLD would have a longer start latency, a longer mean pause time, a shorter overall time, a lower vocalization-pause ratio, and fewer words on the word-naming task, falling significantly below the means of the normal group, and that the CLD would attain a scale score on the vocabulary test that was significantly above the mean of the educable mentally handicapped group.

CHAPTER II

METHOD

Subjects

Ten boys with learning disabilities (CLD) were contrasted with 10 educable mentally handicapped (EMH) and 15 normal boys. The subjects were obtained from south-central United States public school systems and came from adequate homes and were in good physical health. As there is the possibility that CLD begin to cognitively compensate for their disabilities after the age of ten (Ackerman et al., 1971; Sabatino and Hayden, 1970; Dykman et al., 1970), the children ranged in age from 7 years 6 months to 9 years 6 months. The means and standard deviations were: CLD--$\bar{X}$ 8.638, SD .655; EMH--$\bar{X}$ 8.738, SD .610; Normal--$\bar{X}$ 8.368, SD .396.

The criteria for inclusion in a group were as follows: CLD--those children with a deficiency in learning attaining an IQ of 90 or above on either the verbal or performance scale of the WISC and who are free from pervasive motor, visual, hearing or emotional impairments; EMH--those children falling within the range of 50 to 75 IQ; NORMAL--those children falling within the range of 90 or above IQ with no serious problems in school achievement or behavior. The CLD and EMH boys had been previously tested by either the school psychometrist or a psychologist, and they were all attending special classes. Teachers were asked to identify the normal boys who met the required criteria.

Procedure

Test Stimuli. All Ss were given the word-naming task and vocabulary subtest of the WISC. If the WISC had been given to the child within the past 18 months, the vocabulary scaled score attained was used. The Stanford-Binet form of the word-naming task has a one minute time limit. It was felt that to accentuate any impersistance of attention the child should be allowed to respond as long as he was able, but this type of procedure leaves the decision of when the child has finished responding to the subjective judgement of the experimenter. Thus the child was stopped after his first ten-second pause following continuous response for one minute. Based upon a pilot study, it was found that this control provided uniformity and economy while allowing for a measure of variability in the total time responding across children.

Presentation of Word-Naming Stimuli. Prior to the experimental task each child was familiarized with the experimental setting and then seated at a table in front of a microphone. The child was enclosed by a screen which limited the stimuli from the immediate environment. The following taped instructions were played to each child:

> I want to see how many different words you can say. Just any words will do, like "clouds," "dog," "chair," "happy." I am going to record on this tape recorder what you say. When I say, "Go," you say as many words as you can. Do you have any questions about what I want you to do? (Stop tape player and answer any questions.) "Ready?" (two sec. pause) "Go!"

Recording Word-Naming Responses. The Ss' responses were tape recorded using a high quality microphone and a Sony model 850 tape recorder. All recordings were made at a tape speed of 7½ i.p.s. The recorder picked up the warning signal, "ready," the reaction signal, "go," and the child's responses on the same channel. The recorded samples were later transferred to a Bruel and Kjaer power level strip-chart recorder, model 2304, for obtaining latency, vocalization, and pause measurements. Signal amplitude settings on both the Sony tape recorder and the Bruel and Kjaer recorder were uniform for all S's taped responses. Paper speed was 30 mm/sec.

Measurements

Vocabulary. Vocabulary was defined as the attained scale score on the WISC vocabulary subtest. It was assumed that this measure reflected the verbal fluency and general intellectual ability of each child. The reliability coefficient of the WISC vocabulary subtest for age 7½ is .77 (Wechsler, 1949).

<u>Word-Naming Latency</u>. Word-naming latency was defined as the time (in msec) from the midpoint of the reaction signal, "Go," to the onset of the first response. The reaction signal was identified on the strip-chart recording as the point of a sharp increase in the amplitude from the base line and a return to the base line. The onset of word production was identified as the initial increase in amplitude from the base line after the offset of the reaction signal. To obtain measurements all strip-chart recordings were carefully monitored visually while listening to the auditory signal from the tape recorder. All respirations or subvocalizations which were printed out as signals were monitored out.

As this was a free responding task after the initial response to the reaction signal, only one latency measure was taken for each child. Thus additional precautions were taken to be certain that each child understood the instructions and was prepared to respond to the task. As the maximum readiness to respond is attained in about one to two seconds and decreases thereafter (Woodworth and Schlosberg, 1954), the warning interval used was approximately two seconds. This measurement reflected the preparatory set or state of alertness of the child to an environmental stimulus.

<u>Total Words</u>. Total words was defined as the total number of fully inflected, separate words uttered by the child. Questions, sentences, and non-words were monitored and measured out. Giggling, subvocalizations and the like were not

counted as words but were included in pause time. Total words represented the child's focusing and vigilance abilities.

Total Time. Total time was defined as the time (in sec.) from the midpoint of the reaction signal to the offset of the vocalization of the last word. This reflected the susceptibility to fatigue of the child's attention.

Vocalization Mean. The vocalization mean was the total time (in msec) spent vocalizing divided by the total number of words. Each vocalization was identified on the strip-chart recording as the point of increase in the amplitude from the base line until its return to the base line. The distance between these points was the measured time of vocalization. The measurement represented the average length of time it took a S to physically produce (articulate) a word.

Pause Mean. The pause mean was the total time (in msec) of silence divided by the number of pauses. Each pause was identified on the strip-chart recording as the distance between the offset of one vocalization and the onset of the next. This measure reflected the average time a S took to retrieve a word from long term memory. It was assumed that it was affected by attention, search time, the set of responding chosen by the S, and preparation to phonate.

Vocalization-Pause Ratio. The vocalization-pause ratio was the ratio of the total vocalization time to the total pause time. This represented the relationship of the length of time necessary to vocalize words to the length of time necessary for the S to prepare to phonate--the higher the ratio the more productive the S was in his responding to this task.

Statistical Analyses

The statistic used in the present study was a multivariate discriminant function analysis. This analysis provides a discriminant function for each group of Ss (CLD, EMH, and Normal) based on a weighting system of the seven predictors (WISC vocabulary and six word-naming variables) which maximized the variance among the three groups while minimizing the variance within each of the three groups (Cooley and Lohnes, 1962).

Results of this analysis were used to assess (a) the differences between the mean vectors for the three groups, (b) the order of importance of the variables in differentiating the three groups, and (c) the proportion of Ss statistically classified into the same group as they were originally diagnosed (CLD, EMH, and Normal).

The differences among the mean vectors for the three groups were examined using the U statistic (Wilks lambda criterion), transformed into an F statistic with p and $n - p - 1$ d.f. (Rao, 1952) where p equals the number of variables and n equals the total number of Ss in any one group. Since the discriminant function analysis indicates the order of selection of variables in discriminating between groups, an F test with 1 and $n - g - p$ d.f. was used at each step to determine if each of the remaining variables contributed significantly ($p < .05$) in accounting for the variance that remained. As an example, after the variable that accounted for the most variance among groups was determined, the second variable was the one which contributed most to the prediction system already containing the best single predictor.

In addition to the overall three group comparison, three discriminant function analyses were used to evaluate differences among the three possible pairings of the groups (CLD vs. EMH, CLD vs. Normal, and EMH vs. Normal).

CHAPTER III

RESULTS

The overall statistical hypothesis of no significant difference between the means of the three groups on the seven variables was rejected. Table I contains the means and standard deviations for all seven variables for the EMH, CLD, and Normal groups. The variable that statistically discriminated among the three groups was WISC vocabulary ($F=36.954$, 2,32 d.f., $p < .01$). The EMH group mean was significantly lower than the CLD or Normal groups with no significant difference between the CLD and Normal group on the vocabulary variable.

In the comparison between the CLD and EMH groups, WISC vocabulary ($F=29.241$, 1,18 d.f.) discriminated at the $p < .01$ level of significance. Using this single variable for classification, 9 of the 10 CLD Ss and 10 of the 10 EMH Ss were correctly classified. The initial F to enter was significant at the .05 level or lower for all variables except word-naming latency and total time (see Appendix C for F to enter at step number 0).

In the comparison between the CLD and Normal groups, two variables significantly discriminated. These were word-naming latency ($F=8.349$, 1,22 d.f., $p < .01$) and total

TABLE I

GROUP MEANS AND STANDARD DEVIATIONS OF WORD-NAMING AND VOCABULARY VARIABLES

Variables	EMH		CLD		Normal	
	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD
WISC Vocabulary	4.400	2.547	10.400	2.412	10.866	.915
Word-naming latency (sec)	2.050	1.430	1.473	.838	1.015	.514
Total words	15.800	7.510	25.600	14.151	37.333	13.746
Total time (sec)	70.903	18.240	89.296	23.742	103.871	33.229
Vocalization $\bar{X}$ (sec)	.612	.124	.740	.136	.709	.064
Pause $\bar{X}$ (sec)	4.589	2.390	2.698	1.118	2.323	1.016
Vocalization-pause ratio	.158	.062	.328	.160	.353	.110

time ($F=6.643$, 1,22 d.f., $p < .05$). Using these two variables, 8 of the 10 CLD Ss and 13 of the 15 Normal Ss were correctly classified.

In the comparison between the Normal and EMH groups, WISC vocabulary ($F=82.284$, 1,23 d.f., $p < .01$) discriminated the two groups. Based upon this single variable, 15 of the 15 Normal Ss and 10 of the 10 EMH Ss were correctly classified. The initial F to enter was significant at least at the .05 level for all seven variables (see Appendix C). (See Appendix D for the frequency distributions of probabilities of classification for each of the four comparisons.)

CHAPTER IV

DISCUSSION

The most important contribution of this study is the indication that the characteristics of verbal fluency and defective attention can be used to help discriminate CLD from the normal and EMH learner. The methods used appear to offer promise as a means of screening these children in an economical and reliable manner.

The overall inferior performance of the EMH group appears to have accounted for most of the significant differences in the comparison among the three groups. It appears that the deficit in general intellectual abilities of EMH had a substantial effect on the performance of this group. It is difficult to determine which factor, retardation or defective attention, exerted the most influence on the responding of the EMH on the word-naming task. It is possible that both vocabulary and word-naming are functionally related to intelligence within the retarded population. In all comparisons in which the EMH group was involved, vocabulary was the best and only predictor necessary to correctly classify 100% of the EMH. In the comparisons with CLD and normal controls, the proportion of these Ss correctly classified was 90% and 100% respectively. Vocabulary clearly discriminated EMH from the other two groups.

It appears that a child with a low vocabulary score will do poorly on the word-naming task. It is possible that his verbal fluency is such that his responding to any verbal task is poor. However, when a child with apparent verbal fluency, average or above vocabulary score, does poorly, it would seem that some other factor is exerting an influence.

The similarity of the means of the CLD and normal groups on the vocabulary variable provide the opportunity to examine the effectiveness of the word-naming measurements to discriminate between these groups while holding constant the verbal fluency or intelligence factor. In the comparison between these two groups, word-naming latency and total time were selected as the best predictors. It was assumed that latency reflected the child's state of alertness to an environmental stimulus and that total time reflected the ability of the child to focus and to maintain his vigilance to the task. As alerting, focusing, and vigilance are the essence of attention, it appears that the longer latency and shorter total time of the CLD group as compared to the normal group is indicative of defective attention. It also seems that this deficit can be used to discriminate CLD from normals.

Senf and Freundl (1971) found that learning disability children are heavily auditorially preferant, and that it is possible that this preference indicated that these children are stimulus bound, their attention being captured by auditory stimulation. It was also suggested that the modality of a stimulus is a highly salient dimension for the learning disabled child and may influence how he remembers things. The requirement for responding to the word-naming task is the ability to recall words which are stored in auditory memory. The structure of the task and the experimental situation appears to have relied on the auditory modality, for visual stimuli and distraction were minimized by the use of a screen. It seems that a child with an auditory learning disability (visually preferant) would do very poorly on this task, whereas, the child with visual-motor problems (auditorially preferant) would perform well. The unexpected similarity between the means of the CLD and normal controls on the pause $\overline{X}$ and the vocalization-pause ratio suggests that the majority of the CLD in this study were auditorially preferant.

It is possible that CLD, when utilizing the preferred modality without distraction from other modalities, are as productive as normals. They also appear able to select a set of responding that is similar to the normal group and to have a comparable search time. The determination of the effects of visual stimuli upon both auditorially and visually preferant CLD and normal groups while responding to this task would possibly provide information on the differential effect of the visual classroom environment upon the attending abilities of these children. It is felt that the visual stimuli would not benefit the visually preferant while performing an auditory task and that it would be distracting to the CLD that preferred the auditory modality, making the performance of these two groups similar. However, for the normal child who can integrate information from both modalities, the visual stimuli should enhance their performance.

CHAPTER V

SUMMARY AND CONCLUSIONS

The present study has sought to determine whether the central symptom of defective attention and the cardinal strength of verbal fluency can be used to differentiate CLD from the normal and EMH learners. Using the WISC vocabulary subtest and a word-naming task, the differences among groups of 10 boys with learning disabilities, 10 who were educable mentally handicapped, and 15 normal controls were examined on a measure of verbal fluency and six measures of attention.

Four discriminant function analyses were performed to determine those variables that discriminated groups of subjects. Results indicate that WISC vocabulary clearly discriminated EMH from CLD and normal controls. The two variables that deterentiated the CLD from the normals were word-naming latency and total time. The learning disability group expressed a strength of verbal fluency that distinguished them from the EMH group and an attentional deficit that distinguished them from the normal controls.

The similarity between the means of the CLD and normals on the pause $\bar{X}$ and the vocalization-pause ratio suggests that the CLD in this study were heavily auditorially preferant.

It seems that CLD, when utilizing the preferred modality without distraction from other modalities, are able to select a set of responding that is similar to the normal group, to have a comparable search time, and to be as productive as normals.

The conclusions drawn from these data are that there are definite indications that this method could be helpful as a screening measure among children with learning disabilities, mentally retarded, and normals. Even though the CLD's performance on the word-naming task was very like the normals in some respects, their defective attention did disrupt certain aspects of their responding.

A SELECTED BIBLIOGRAPHY

Ackerman, P., Peters, J., & Dykman, R. Children with learning disabilities: WISC profiles. Journal of Learning Disabilities, 1971, 4, 150-166.

Baumeister, A., & Kellas, G. Reaction time and mental retardation. In N. R. Ellis (Ed.), International review of research in mental retardation, Vol. 3. New York: Academic Press, 1968.

Bax, M., & MacKeith, R. (Eds.) Minimal cerebral dysfunction. Little Club Clinics, #10, London: Heineman, 1963.

Berkson, G., & Baumeister, A. Reaction time variability of mental defectives and normals. American Journal of Mental Deficiency, 1967, 72, 262-266.

Birch, H. C. Brain damage in children. Baltimore: Williams and Wilkins, 1964.

Blanchard, P. Psychoanalytic contributions to the problems of reading disabilities. The Psychoanalytic Study of the Child, 1946, 2, 163-187.

Boydstun, J., Ackerman, P., Stevens, D., Clements, S., & Dykman, R. Psysiological and motor conditioning and generalization in children with minimal brain dysfunction. Conditional Reflex, 1968, 3, 81-104.

Clements, S. Minimal brain dysfunction: terminology and identification. NINDB Monograph no. 3, PH 5, no. 1415, Washington, D. C.: U. S. Department of Health, Education, and Welfare, 1966.

Clements, S., & Peters, J. Minimal brain dysfunction in the school-age child. Archives of General Psychiatry, 1962, 6, 185-197.

Cooley, W., & Lohnes, P. Multivariate procedures for the behavioral sciences. New York: John Wiley & Sons, 1962.

Critchley, M. Developmental dyslexia. London: Heineman, 1964.

Dykman, R., Ackerman, P., Clements, S., & Peters, J. Specific learning disabilities: An attentional deficit syndrome. In H. R. Myklebust (Ed.), Progress in learning disabilities. New York: Grune & Stratton, 1971.

Dykman, R., Walls, R., Suzuki, T., Ackerman, P., & Peters, J. Children with learning disabilities: Conditioning, differentiation, and the effect of distraction. American Journal of Orthopsychiatry, 1970, 40, 766-781.

Ellis, N. R., & Sloan, W. Relationship between intelligence and simple reaction time in mental defectives. Perceptual Motor Skills, 1957, 7, 65-67.

Hermann, K., & Norrie, E. Is congenital word blindness an hereditary type of Gerstmann's syndrome? Psychiatrie et Neurologie, 1958, 136, 59-73.

James, W. The principles of psychology. New York: H. Holt & Co., 1890.

Johnson, D., & Myklebust, H. Learning disabilities: Educational principles and practices. New York: Grune & Stratton, 1967.

Laufer, M. W., & Denhoff, E. Hyperkinetic behavior syndrome in children. Journal of Pediatrics, 1957, 50, 436.

Luria, A. In J. Tizard (Ed.), The role of speech in the regulation of normal and abnormal behavior. New York: Liveright Publishing Corp., 1961.

Lutey, C. Individual intelligence testing: A manual. Greeley, Colo.: Executary, Inc., 1966.

Morgan, W. P. A case of congenital word-blindness. British Medical Journal, 1896, II, 54-57.

Ordahl, E. E., & Ordahl, C. Qualitative differences between levels of intelligence in feeble minded children. Journal of Psycho-Asthenics Monograph Supplement, 1915, 1, 3-50.

Rao, C. Advanced statistical methods in biometeric research. New York: Wiley and Sons, 1952.

Rapaport, W. M., Gill, M., & Schafer, R. In R. E. Holt (Ed.), Diagnostic psychological testing. (Rev. ed.) New York: International U. Press, 1968.

Ribot, T. The psychology of attention. London: Longmans, Green & Co., 1890.

Sabatino, D. A., & Hayden, D. L. Information processing behaviors related to learning disabilities and educable mental retardation. Exceptional Children, 1970, 37, 21-29.

Sattler, J. M. Analysis of function of the 1960 Stanford-Binet intelligence scale, form L-M. Journal of Clinical Psychology, 1965, 21, 173-179.

Scott, W. S. Reaction time in young intellectual deviates. Archives of Psychology, 1940, 36, 1-64.

Senf, G., & Freundl, P. Memory and attention factors in specific learning disabilities. Journal of Learning Disabilities, 1971, 4, 94-106.

Stevens, D., Boydstun, J., Dykman, R., Peters, J., & Sinton, D. Relationship of presumed minimal brain dysfunction to performance on selected behavioral tasks. Archives of General Psychiatry, 1967, 16, 281-285.

Strauss, A., & Lehtinen, L. Psychopathology and education of the brain-injured child, Vol. 1. New York: Grune & Stratton, 1947.

Terman, L. M., & Merrill, M. A. Stanford-Binet intelligence scale, manual for the third revision, form L-M. Boston: Houghton Mifflin Co., 1960.

United States Department of Health, Education, and Welfare, Office of Education, "Special education for handicapped children--Toward fulfillment of the nation's commitment . . . ." First Annual Report, National Advisory Committee on Handicapped Children, January 31, 1968.

Valett, R. E. Description of a clinical profile for the Stanford-Binet intelligence scale (L-M). Palo Alto, Calif.: Consulting Psychologist Press, 1965.

Wechsler, D. Manual: Wechsler intelligence scale for children. New York: Psychological Corporation, 1949.

Wechsler, D. The measurement and appraisal of adult intelligence. Baltimore: Williams & Wilkins, 1958.

Woodworth, R., & Schlosberg, H. Experimental psychology. New York: Holt, Rinehart, and Winston, 1954.

APPENDIX A

LITERATURE SEARCH

The disabled learner has been ascribed many labels since Morgan (1896) coined the term "word-blindness" in 1896. Terms such as minimal cerebral dysfunction syndrome (Bax and MacKeith, 1963), cerebro-asthenic syndrome (Luria, 1961), hyperkinetic syndrome (Laufer and Denhoff, 1957), and Strauss syndrome (Strauss and Lehtinen, 1947) have not encompassed the population. Learning disabled children fail to demonstrate academic competence in many ways and from various causative or predisposing factors. Thus, the concept of learning disabilities--or the medical equivalent, minimal brain dysfunctions--has recently evolved to encompass the heterogeneous group of children who given at least average intellectual abilities, cultural opportunities, and general family emotional adequacy would be expected to keep pace academically with their age mates but in fact are unable (Clements, 1966). The most widely accepted definition is the following formulated by the National Advisory Committee for the Handicapped (1968):

> Children with special (specific) learning disabilities exhibit a disorder in one or more of the basic psychological processes involved in understanding or in using spoken or written language. These may be manifested in disorders of listening, thinking, talking, reading, writing,

> spelling, or arithmetic. They include conditions which have been referred to as perceptual handicaps, brain injury, minimal brain dysfunction, dyslexia, developmental aphasia, etc. They do not include learning problems which are due primarily to visual, hearing, or motor handicaps, to mental retardation, emotional disturbance, or to environmental disadvantage.

The word special is very important in the above definition since it indicates that the child has a definite retardation in one or more areas but that this retardation is not caused by a sensory deficit or severe mental retardation and that it exists in spite of the fact that the child has certain abilities in other areas. According to Johnson and Myklebust (1967), it is the abilities that clearly differentiate children with learning disabilities from mentally retarded children. For in the retardate it is the generalized intellectual inferiority that brings about homogeneity, while in the disabled learner it is the fact of normative motor development, average to high intelligence, adequate hearing and vision, and adequate emotional adjustment together with a deficiency in learning that constitutes the basis for homogeneity.

In the past, interest has been focused on the etiological bases of learning disabilities. Explanation of the child's failures in school was sought in terms of hereditary factors (Hermann and Norrie, 1958), developmental irregularities (Critchley, 1964), and environmental and emotional factors (Blanchard, 1946). This was an appropriate approach to attain the dual goals of prevention and remediation. However, identification procedures based on these factors have been complex and time consuming.

Research attention has been shifting from an etiological approach toward an approach which regards the learning disabled child as possessing cognitive deficits and seeks characteristics which distinguish him from the normal learner and the traditional categories of handicapped children. Recent reports indicate that there is a central symptom of defective attention which is basic to the specific disability exhibited by the child (Dykman, Ackerman, Clements, and Peters, 1971) and that there is a cardinal strength of verbal fluency. With the isolation of basic deficits and strengths, a method of differentiation based upon universal characteristics may be possible.

Attentional Deficit

William James (1890) stated the following concerning Attention:

> _My experience is what I agree to attend_ to . . . . Only those items which I notice shape my mind (p. 402) . . . . Focalization, concentration of consciousness are of its (attention's) essence. It implies withdrawal from some things in order to deal, effectively, with others (p. 404) . . . . The immediate effects of attention are to make us: (a) perceive; (b) conceive; (c) distinguish; (d) remember--better than otherwise we could--both more successive things and each time more clearly. It also (e) shortens reaction time . . . . Most people would say that sensation attended to becomes stronger than it would otherwise be (pp. 424-425) . . . . Clearness, so far as attention produces it, means distinction from other things and internal analysis or subdivision. These are essentially products of intellectual discrimination, involving comparison, memory, and perception of various relations. The attention _per se_ does not distinguish and analyze and relate. The most we can say is that it is a condition of our doing so (pp. 426-427).

Attention is a prerequisite for learning, and any deficit in the ability to attend will have an effect on a child's classroom behavior. Short attention span and/or distractability have long been clinically conceptualized as one of the core symptoms of learning disabilities children (Strauss and Lehtinen, 1947; Clements and Peters, 1962; Birch, 1964). There is also extensive research evidence in support of the viewpoint of defective attention as central to children with learning disabilities (Senf and Freundl, 1971; Dykman, Walls, Suzuki, Ackerman, and Peters, 1970; Stevens, Boydstun, Dykman, Peters, and Sinton, 1967; Luria, 1961).

In studies of the child with cerebro-asthenic syndrome, Luria (1961) found, with the massing of trials, reaction time increases over trials and these children may stop responding to positive stimuli altogether. Luria holds that in the excitatory child response latencies to positive stimuli decrease over trials because the accumulating excitation disrupts inhibitory constraints, and in the inhibitory child, inhibition is assessed to be strong and excitation weak. Luria suggested that the end effect of excessive excitation or inhibition on school performance is the same (i.e., children of both subtypes fail to keep pace with their classmates), and that inattention and susceptibility to fatigue of attention are responsible for the poor performance of children with learning disabilities.

Other investigators have observed results consistent with this viewpoint. Stevens et al. (1967) investigated the performances of normal and learning disabled children on tasks involving auditory discrimination, motor coordination, motor impulsivity, and ability to follow verbal instructions and found that children with learning disabilities could not respond as rapidly or as accurately as normal children. They concluded that disorders of attention (i.e., attentional impersistence and lack of attentional focus) were particularly implicated in the inferior performance of the children with learning disabilities. Boydstun, Ackerman, Stevens, Clements, and Dykman (1968) studied skin resistance changes, heart rate, and muscle action potentials, which have been considered relatively good measures of arousal, anxiety, or generalized drive. They found that, while children with learning disabilities did not differ from controls in resting physiological levels, they were less reactive physiologically to meaningful stimuli. According to Boydstun et al., children with learning disabilities are lacking in those specific arousal or emotive supports necessary for sustained attention and learning. Using procedures similar to Luria's, Dykman et al. (1970) contrasted 20 hyperactive, 19 hypoactive, and 34 normoactive learning disabilities boys with 34 normal boys and found appreciably slower response times in children with learning disabilities than controls. They hypothesized that organically based deficiences in attention explain the poorer performance and the slower reaction times of learning disability children in learning situations. Dykman et al. further postulated that children with learning disabilities have an incapacity to process information at the same rate as normal students and that the source of this incapacity involves some fundamental property of neural organization of the brain-stem reticular formation which either has not been acquired or has been disrupted. Dykman et al. also indicated, just as Luria, that hyperactive learning disability children appear to be over-attentive to their environment whereas hypoactive ones are under-attentive and that the net effect of over- and under-attention on performance is the same.

Additional evidence of attentional deficits may be deduced from the frequently depressed scale scores on the subtests of the Wechsler Intelligence Scale for Children (WISC) that best differentiate children with learning disabilities: digit span and arithmetic (Ackerman, Peters, and Dykman, 1971). These subtests demand close attention and freedom from distraction.

Deficiencies in attention have also been attributed to the mentally retarded from at least the time of Ribot (1890) to the present. As fast reaction time requires maintaining good attention or an appropriate set, this measure has been most often used to detect the extent of the attention and/or inhibition deficit of the retardate. However, when using normal controls of the same chronological age as the mentally retarded subjects, one must be aware of a possible confounding in the results. Specifically, reaction time is functionally related to intelligence within the retarded population (Ellis and Sloan, 1957; Scott, 1940; Ordahl and Ordahl, 1915), and in virtually every recent study in which normal and retarded subjects have been compared, the retardates have been markedly slower. However, the relationship between speed and intelligence only holds with a certain range of ability. Scott (1940) indicated that beyond some level of ability (e.g., an MA of 6 or 7) further increases in intelligence are not associated with improvement in reaction time.

Berkson and Baumeister (1967), in examining variability in reaction times of bright and dull subjects, found retardates were not only slower, but variability between and within individuals was greater. They observed that the retardates were not able to maintain consistent performance, and that the lack of consistency may be more descriptive of their inferiority than a particularly depressed level of performance. Baumeister and Kellas (1968) offer one possible explanation for the inconsistency--retardates cannot sustain a preparatory set or state of alertness over many trials. Therefore, it appears, regardless of the reason--mental age or attentional deficit, the overall performance of the mentally retarded child on a task requiring sustained mental effort would be similar to that of a learning disabled child.

Verbal Fluency

The identifying characteristics of children with learning disabilities are their strengths as well as their weaknesses. There are indications that children with learning disabilities generally attain scores on the WISC vocabulary subtest which are in line with their predicted level of academic achievement. Ackerman et al. (1971) matched 29 pairs of children with learning disabilities and normal controls on chronological age and mental age as estimated from the Full Scale WISC IQ. Despite the fact that the normal controls were significantly higher than the learning disability children on the verbal scale IQ, the learning disabled children had a mean scale score of 13.4 on the vocabulary subtest, whereas the normal group's mean scale score was 12.3.

Along this line, Sabatino and Hayden (1970) used the WISC to classify 472 elementary children who had failed in a county school system as to being either educable mentally retarded or children with learning disabilities. Using four of the verbal subtests (arithmetic was omitted), the criterion for subject division was an IQ of 80. The mean scale scores attained on the WISC vocabulary subtest by the educable mentally retarded group (N=287) was 4.0 and by the learning disability group (N=185) was 8.6. Considering the low criterion IQ, the mean scale score of the children with learning disabilities does not appear to be reflecting a specific deficiency but more the general level of ability.

Wechsler (1958) indicates that the vocabulary subtest on the WISC is a good measure of general intelligence and that it also indicates the amount of verbal information that the subject possesses and the range of his ideas based upon experience and education. Rapaport, Gill, and Schafer (1968) feel that the test is quite dependent upon the cultural wealth of early education and environmental experiences and is quite resistant to improvement by later schooling and experience. Thus it would seem that a child's performance on the vocabulary subtest would reflect his general intellectual abilities and his verbal fluency. Yet, it would not reflect his ability to adequately perform verbal skills, such as reading or spelling, in the classroom. It would appear that the learning disabled child's expressive vocabulary, just as with the normal child, is commensurate with his intellectual abilities.

A Method of Discrimination

In order to differentiate children with learning disabilities from other populations, it seems that one must utilize their assets as well as their liabilities. However, the particular strength and weakness chosen must be characteristic of the entire population, although the degree to which each child possesses the particular characteristic may vary. It appears that attentional deficits and verbal fluency are cardinal attributes of the learning disability population and meet these requirements.

The task that is used to measure the learning disabled child's attentional deficit must be such that the performance of each child reflects this basic deficiency and is not affected by any of the various specific disabilities, such as perceptual-motor or psycholinguistic defects, that he might possess. The required response must be within the capabilities of the child, preferably within the area of his strength, and the stimuli for a response must minimize perceptual, visual, auditory, or motor abilities. However, the structure of the task must be such that the basic deficit of the learning disabled child will affect his behavior in performing the task; that is, it should be of sufficient difficulty to require sustained, independent mental effort. It is the author's contention that the word-naming task meets these requirements.

The Word Naming task is the fifth subtest at the ten year age level of the Stanford-Binet Intelligence Scale, Form L-M (Terman and Merrill, 1960). It is a free response task that requires the child to name as many words as he can. Based upon factor-analytic studies of the Stanford-Binet, Lutey (1966), Sattler (1965), and Valett (1965) have evolved methods of grouping the items according to the different abilities involved. Lutey places the Word Naming task under the vocabulary grouping, which measures the ability to use words to indicate meaning and/or definitions in response to words. Sattler states that Word Naming measures the quality of vocabulary, and he places it in the language category. Valett classifies Word Naming as vocabulary and verbal fluency. The indications are that this task requires the same mental processes that a vocabulary task requires.

However, the structure is different. Rather than the environment providing the stimuli for each response, after the instructions are understood and the initial response given, the child provides the stimuli for each succeeding response. Any lag in attention will affect the productivity of responding.

The word-naming task, as a measure of the learning disabled child's basic deficit, combined with the vocabulary subtest of the WISC, as a measure of strength, should provide a basis for the discrimination of children with learning disabilities from the normal and retarded populations. It is expected that the normal child will perform well on both these tasks, whereas the retardate will perform poorly.

APPENDIX B

DISCUSSION OF CORRELATIONS

Regardless of the group combination, total words correlated significantly with total time, pause $\overline{X}$, and vocalization-pause ratio. It appears that the more words given by a subject the longer his response time, the shorter his mean pause time, and the higher his productivity--and vice versa. This relationship is to be expected if each of these variables is measuring a common factor--attention. It is possible that this relationship is a reflection of a child's verbal fluency, but this seems doubtful as the only significant correlation between WISC vocabulary and the word-naming task variables was with pause $\overline{X}$. The performance of the EMH group seems to be a strong influence, for the correlation between these two variables was strongest in those matrices which include the EMH group.

Although total vocalization time was the numerator and total pause time the denominator of the vocalization-pause ratio and both were the numerators of vocalization $\overline{X}$ and pause $\overline{X}$ respectively, it does not necessarily follow that a significant relationship exists between them. Thus the consistent negative correlation between vocalization-pause ratio and pause $\overline{X}$ appears to be indicative of the attentional factor measured by these variables. A lag in attention resulted in a longer pause time and lower productivity.

The positive correlations between the vocalization $\overline{X}$ and vocalization-pause ratio are best understood when viewed with the group means and standard deviations. The vocalization $\overline{X}$ was expected to be fairly stable across subjects unless there were articulation problems. It appears that the EMH group ($\overline{X}$=.612) has a high incidence of immature speech (omissions), whereas, the CLD ($\overline{X}$=.740) and normal ($\overline{X}$=.709) groups have a similar articulation time. A similar relationship exists with the vocalization-pause ratio. The EMH ($\overline{X}$=.158) are consistently unproductive and the CLD ($\overline{X}$=.328) and normal ($\overline{X}$=.353) are equally productive. Thus it would seem that the relationship between short articulation time and low productivity would occur within all combinations in which the EMH were included. However, this was not the case. There was no significant positive correlation within the EMH and normal groups. The significant correlations occurred only in those matrices in which the CLD were members. This is perhaps best explained by analyzing the standard deviations. It appears that there is homogeneity (restricted variability) within the normal group on vocalization time (S.D.=.064) and within the EMH group on the vocalization-pause ratio (S.D.=.062), whereas the CLD group varies more on both these variables (Vocalization S.D.=.136; Vocalization-pause ration S.D.= .160). Thus, the significant positive correlations result from the variability within the CLD group. This suggests, as in the EMH, some of the CLD have significant articulation problems and some are unproductive on the word-naming task, although the means are comparable to the normal group.

The significant positive correlations between latency and total words and total time within the CLD and normal groups are suggestive of the inability of the CLD child to control his cognitive tempo. The relationship between short latencies and fewer words and shorter total time indicates impulsive responding and the inability to concentrate on the task at hand.

There was also evidence of an apparent decline in vocabulary skills as a function of age (negative correlation between WISC vocabulary and age within the CLD and normal groups). Since scores on intelligence tests given after school entry reflect achievement as well as innate ability, it appears probable that CLD do not benefit from their school experiences and are unable to keep pace with normal children. Another possible explanation is that the CLD were slightly older than the normals, yet were in the same grade. Thus, similar raw scores would yield a lower scaled score for the CLD.

TABLE II

WITHIN GROUPS CORRELATION MATRIX FOR CLD, EMH, AND NORMAL GROUPS

Variable	Age	Latency	Total Words	Total Time	Vocal. $\overline{X}$	Pause $\overline{X}$	V-P ratio	WISC Vocab.
Age	1.000							
Latency	-0.151	1.000						
Total Words	0.058	0.192	1.000					
Total Time	0.004	0.209	0.834**	1.000				
Vocalization $\overline{X}$	-0.007	0.209	0.022	0.200	1.000			
Pause $\overline{X}$	-0.081	-0.147	-0.557**	-0.240	0.136	1.000		
Vocal.-Pause ratio	0.077	0.192	0.617**	0.272	0.402*	-0.589**	1.000	
WISC Vocabulary	-0.183	-0.016	0.170	0.115	0.159	-0.398*	0.176	1.000

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

TABLE III

WITHIN GROUPS CORRELATION MATRIX FOR
CLD AND EMH GROUPS

Variable	Age	Latency	Total Words	Total Time	Vocal. $\overline{X}$	Pause $\overline{X}$	V-P ratio	WISC Vocab.
Age	1.000							
Latency	-0.046	1.000						
Total Words	0.226	0.147	1.000					
Total Time	0.276	0.074	0.852**	1.000				
Vocalization $\overline{X}$	0.050	0.229	0.090	0.346	1.000			
Pause $\overline{X}$	-0.132	-0.170	-0.592**	-0.358	0.111	1.000		
Vocal.-Pause ratio	0.156	0.303	0.779**	0.658**	0.534*	-0.509*	1.000	
WISC Vocabulary	-0.202	-0.038	0.220	0.173	0.147	-0.413	0.189	1.000

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

TABLE IV

WITHIN GROUPS CORRELATION MATRIX FOR
CLD AND NORMAL GROUPS

Variable	Age	Latency	Total Words	Total Time	Vocal. $\bar{X}$	Pause $\bar{X}$	V-P ratio	WISC Vocab.
Age	1.000							
Latency	-0.021	1.000						
Total Words	0.029	0.470*	1.000					
Total Time	-0.053	0.606**	0.825**	1.000				
Vocalization $\bar{X}$	-0.036	0.394	-0.002	0.177	1.000			
Pause $\bar{X}$	0.005	-0.099	-0.695**	-0.252	0.165	1.000		
Vocal.-Pause ratio	0.079	0.314	0.601**	0.227	0.404*	-0.773**	1.000	
WISC Vocabulary	-0.561**	0.004	0.140	0.048	-0.045	-0.284	0.102	1.000

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

TABLE V

WITHIN GROUPS CORRELATION MATRIX FOR
NORMAL AND EMH GROUPS

Variable	Age	Latency	Total Words	Total Time	Vocal. $\overline{X}$	Pause $\overline{X}$	V-P ratio	WISC Vocab.
Age	1.000							
Latency	-0.378	1.000						
Total Words	-0.067	0.035	1.000					
Total Time	-0.137	0.052	0.846**	1.000				
Vocalization $\overline{X}$	-0.057	0.059	-0.018	0.128	1.000			
Pause $\overline{X}$	-0.084	-0.145	-0.501*	-0.189	0.157	1.000		
Vocal.-Pause ratio	-0.026	-0.025	0.498*	0.063	0.232	-0.619**	1.000	
WISC Vocabulary	0.220	-0.002	0.168	0.152	0.386	-0.463*	0.272	1.000

$^{**}p < .01$ $^{*}p < .05$

APPENDIX C

F TO ENTER AT STEP NUMBER 0

Variables	CLD, EMH, & Normal 2,32 d.f.	CLD–EMH 1,18 d.f.	CLD–Nor 1,23 d.f.	Nor–EMH 1,23 d.f.
WISC Vocabulary	36.9545**	29.2419**	0.4686	82.2841**
Word-naming latency	3.6192*	1.2099	2.8826[b]	6.6772*
Total Words	9.0008**	7.4197*	1.8555[b]	20.2948**
Total Time	4.4433*	3.7740[a]	1.4276[b]	8.1280**
Vocalization $\overline{X}$	4.0383*	4.8536*	0.5904	6.6323*
Pause $\overline{X}$	6.8041**	5.1325*	0.7530	10.7477**
Vocalization-pause Ratio	9.1343**	9.7771**	0.2188	25.7919**

**$p < .01$ *$p < .05$ [a]$p < .10$ [b]$p < .25$

APPENDIX D

PROBABILITIES OF CLASSIFICATION

Frequency Distribution of Probabilities of Classification for CLD, EMH and Normal Groups

Probability of Classification	C-C	C-N	C-E	E-E	E-C	E-N	N-N	N-C	N-E
.95 - 1.00				6					
.90 - .94									
.85 - .89				2					
.80 - .84									
.75 - .79									
.70 - .74									
.65 - .69									
.60 - .64		1							
.55 - .59		2							
.50 - .54	2	2	1	2			12	3	
.45 - .49	2								
Totals	4	5	1	10	0	0	12	3	0

C-C - CLD S classified CLD (correct classification)
C-N - CLD S classified Normal (misclassification)
C-E - CLD S classified EMH (misclassification)
E-E - EMH S classified EMH (correct classification)
E-C - EMH S classified CLD (misclassification)
E-N - EMH S classified Normal (misclassification)
N-N - Normal S classified Normal (correct classification)
N-C - Normal S classified CLD (misclassification)
N-E - Normal S classified EMH (misclassification)

Frequency Distribution of Probabilities

of Classification for CLD

and EMH Groups

Probability of Classification	Frequency C-C	C-E	E-E	E-C
.95 - 1.00	5		4	
.90 - .94	1		2	
.85 - .89				
.80 - .84	1			
.75 - .79			2	
.70 - .74				
.65 - .69				
.60 - .64	2			
.55 - .59		1	2	
.50 - .54				
Totals	9	1	10	0

C-C - CLD S classified CLD (correct classification)
C-E - CLD S classified EMH (misclassification)
E-E - EMH S classified EMH (correct classification)
E-C - EMH S classified CLS (misclassification)

Frequency Distribution of Probabilities

of Classification for CLD

and Normal Groups

Probability of Classification	Frequency C-C	C-N	N-N	N-C
.95 - 1.00	1		1	
.90 - .94	1		1	
.85 - .89			1	
.80 - .84	2		2	
.75 - .79		1		
.70 - .74				
.65 - .69	1			1
.60 - .64	1	1	2	
.55 - .59	1		3	1
.50 - .54	1		3	
Totals	8	2	13	2

C-C - CLD S classified CLD (correct classification)
C-E - CLD S classified Normal (misclassification)
N-N - Normal S classified Normal (correct classification)
N-C - Normal S classified CLD (misclassification)

Frequency Distribution of Probabilities
of Classification for EMH
and Normal Groups

Probability of Classification	Frequency N-N	N-E	E-E	E-N
.95 - 1.00	15		8	
.90 - .94				
.85 - .89				
.80 - .84				
.75 - .79			2	
.70 - .74				
.65 - .69				
.60 - .64				
.55 - .59				
.50 - .54				
Totals	15	0	10	0

N-N - Normal S classified Normal (correct classification)
N-E - Normal S classified EMH (misclassification)
E-E - EMH S classified EMH (correct classification)
E-N - EMH S classified Normal (misclassification)

VITA

Patricia Leigh Morgan

Candidate for the Degree of

Master of Science

Thesis: THE DISCRIMINATION OF CHILDREN WITH LEARNING DISABILITIES, RETARDATES, AND NORMALS ON WORD-NAMING AND VOCABULARY ABILITIES

Major Field: Psychology

Biographical:

Personal Data: Born in Cushing, Oklahoma, on November 22, 1931, the daughter of Mr. and Mrs. J. P. Beiland. Married Thomas Clifton Morgan on March 9, 1951; divorced on October 31, 1973. Mother of one son, Cliff.

Education: Graduated from Cushing High School, Cushing, Oklahoma, in May, 1948; attended the University of Oklahoma, Norman, Oklahoma, receiving Bachelor of Business Administration degree in the field of Accounting from that institution in January, 1952; attended the University of Oklahoma in 1971 as unclassified in the Graduate College; completed requirements for the Master of Science degree at Oklahoma State University in May, 1974.