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FORD, June Brooks, 1920-
IDENTIFICATION OF A SPECIFIC LANGUAGE DISABILITY (Dyslexia).

The University of Oklahoma, Ph. D., 1965
Speech-Theater

University Microfilms, Inc., Ann Arbor, Michigan

THE UNIVERSITY OF OKLAHOMA

GRADUATE COLLEGE

IDENTIFICATION OF A SPECIFIC LANGUAGE DISABILITY (DYSLEXIA)

A DISSERTATION

SUBMITTED TO THE GRADUATE FACULTY

in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

BY

JUNE BROOKS FORD

Norman, Oklahoma

1965

IDENTIFICATION OF A SPECIFIC LANGUAGE DISABILITY

(DYSLEXIA)

APPROVED BY

DISSERTATION COMMITTEE

ACKNOWLEDGMENTS

Numerous individuals have played an important role in the planning and completion of this research. To these persons, I owe a debt of gratitude.

Dr. Kennon H. Shank, director of this research, gave invaluable guidance, counsel, and encouragement.

Collection and analysis of the data was made possible under Grant No. MH 244-05 from the United States Public Health Service under the direction of Dr. Sylvia O. Richardson. For this the writer is indeed grateful.

The other members of my Graduate Committee, Drs. Alfred F. Glixman, Charles P. Green, and Roger E. Nebergall, gave helpful suggestions and support when needed.

Dr. M. Clinton Miller, Assistant Professor of Biostatistics, gave invaluable assistance on the analysis of the data.

The writer also wishes to thank the principals of the schools from which the subjects came, the teachers, the subjects, and their parents for much patience, understanding, and cooperation.

I owe a debt of gratitude to all these people.

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IDENTIFICATION OF A SPECIFIC LANGUAGE DISABILITY

(Dyslexia)

CHAPTER I

INTRODUCTION

A problem of serious proportion in our nation is the loss of potential contribution by persons of normal or above-normal intelligence, who, because of poor reading ability, are doomed to frustration and a feeling of worthlessness. It is estimated that from 10% to 35% of the school children are unable to read at the level one would expect from their performance on tests of general intelligence.[1,2,3] Many persons interested in the problems of reading retardation have noted that a large percentage of juvenile delin-

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[1]Ralph D. Rabinovitch, Arthur L. Drew, Russell N. DeJong, Winifred Ingram, and Lois Withey, "A Research Approach to Reading Retardation," Neurology and Psychiatry in Childhood, XXXIV (1956), 1.

[2]B. Hallgren, "Specific Dyslexia ('Congenital Word-blindness'): A Clinical and Genetic Study," Acta Psychiatrica et Neuroligica Scandinavica, Suppl. 65, (1950), p. 1.

[3]John J. Deboer and Martha Dallman, The Teaching of Reading, (rev. ed. New York: Holt, Rinehart, and Winston, 1964), p. 5.

quents are poor or non-readers.[1,2]

In the population of retarded readers of normal intelligence, there are those who perform inadequately because of a sensory defect, those who have had insufficient instruction, and those who fail on the basis of motivational and emotional factors. There is still another group which concerns this investigator: those children without peripheral sensory defect, having had adequate instruction, yet retarded in reading despite normal or above-normal intelligence. The members of this group wear various labels, such as: dyslexia,[3] specific dyslexia,[4] strephosymbolia,[5] alexia,[6] word-blindness,[7] and immaturity.[8]

Eisenberg says, "Since our public-school system is

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[1]J. B. Margolin, M. Roman, and C. Harari, "Reading Disability in the Delinquent Child: A Microcosm of Psychosocial Pathology," American Journal of Orthopsychiatry, XXV (1955), 25-35.

[2]Joseph M. Wepman, "Dyslexia: Its Relationship to Language Acquisition and Concept Formation," Reading Disability: Progress and Research Needs in Dyslexia, ed. John Money (Baltimore: The Johns Hopkins Press, 1962), p. 185.

[3]Ibid., p. 179.

[4]Leon Eisenberg, "Introduction," ibid., p. 4.

[5]S. T. Orton, Reading, Writing and Speech Problems in Children (New York: W. W. Norton and Co., Inc., 1937), p. 214.

[6]Ibid., p. 37.

[7]Hallgren, Acta Psychiatrica et Neuroligica Scandinavica, Supp. 65 (1950), p. 1.

[8]Lauretta Bender, "Problems in Conceptualization and Communication in Children with Developmental Alexia,"

overcrowded and remedial reading is costly and often unavoidable, it has become customary to delay the institution of corrective programs until the third grade or later when the true dyslexic will have segregated himself from the 'late bloomer'."[1] A child who has experienced failure will likely tend to react "successively with anger, guilt feelings, depressions, and finally, resignation, and compromise with their hopes and aspirations."[2] This investigator believes that if it were possible for the first-grade teacher to know which children are "late bloomers" and which are dyslexic, she could employ the correct procedures for each group.

Schiffman states that the most success in remediating the reading problem is obtained in the early lower grades.[3] It seems, therefore, that special training techniques instituted early, certainly before the third year in school, would be more effective and would help to avoid the pain and subsequent problems related to reading disability.

Definition of Terms

For purposes of this study, a subject will be called

Psychopathology of Communication, ed. P. H. Hoch and J. Zubin (New York: John Wiley and Sons, 1955), p. 5.

[1]Eisenberg, p. 5.

[2]Ralph D. Rabinovitch, "Dyslexia: Psychiatric Consideration," Reading Disability: Progress and Research Needs in Dyslexia, p. 5.

[3]Gilbert Schiffman, "Dyslexia as an Educational Phenomenon: Its Recognition and Treatment," ibid., p. 59.

dyslexic if he is of normal intelligence and is one or more years retarded in reading achievement at the end of his third year in school. A child will be called immature if he is judged to be so by his kindergarten teacher at the end of his kindergarten year in school. Specific requirements for the subjects, criteria for judgment of reading achievement, and the kindergarten teachers description of the immature child will be discussed later.

Hereafter, the Wechsler Intelligence Scale for Children will be called the WISC. The Illinois Test of Psycholinguistic Abilities will be referred to as the ITPA.

Statement of the Purpose

Early identification of children who will be unable to learn to read by routine teaching techniques, is critical in order to institute appropriate educational procedures which will allow these children to succeed in this area. Early institution of preventive educational measures could help the child to avoid the problems secondary to reading failure.

The purpose of this study is to attempt to discover ways to identify, while they are in the first grade, the children who will be dyslexic. Some of the psychological correlates which investigators have found in older children who are already failing in reading will be examined to see if they are present early in the first year of school of the children who will later be designated as dyslexic. The cor-

relates chosen for investigation are: (1) immaturity; (2) specific abilities as measured by the WISC subtests, Verbal and Performance tests; (3) specific and global psycholinguistic abilities as measured by the Illinois Test of Psycholinguistic Abilities.

Discussion

"Communication means that information is passed from one place to another."[1] According to this definition of communication, reading is a part of the communication complex and thus of language. Language, man's unique tool for communication, is first received auditorially and expressed vocally. Later, as the individual matures, language is also received visually and expressed motorically. In reading, information is passed from the page, via graphic symbols, to the mind of the perceiver. The visual symbols must be perceived and decoded, associated with past experience, and the response must be encoded through writing or speech, or the information must be stored. In order to do this, the child must have a firm basis of verbal language. He must have developed the ability to generalize and categorize in conformity with the non-linguistic environment and the language culture to which he was born. This requires recognition of attributes that are criterial to a categorization.[2]

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[1]George A. Miller, Language and Communication (New York: McGraw-Hill Book Co., Inc., 1951), p. 6.

[2]Roger Brown, Words and Things (Glencoe, Ill.: The Free Press of Glencoe, Inc., 1958), p. 10.

The child must be able to apply a verbal symbol to the category and to recognize new instances of a category.[1] He must transfer the knowledge gained from past experiences to new instances. In this manner, he enlarges his vocabulary without having to experience each new verb in all of its tenses, or each noun as both singular and plural.

By the time he enters school, the average child has developed many skills which he will transfer to reading. He has acquired the vocabulary through the experience with his environment. He has learned to form categories, to generalize, and to estimate the probability of certain language occurrences from contextual clues; these skills have been acquired effortlessly during the pre-school years. A sequence similar to that of learning verbal language will now be repeated as he learns to read.

In reading, the child must learn that there are visual categories (visual symbols) corresponding to auditory categories, which in turn correspond to non-linguistic categories. He must learn that the smaller graphic symbol, a letter, corresponds to a sound, and the larger graphic unit, a word, corresponds to the spoken word.

The skills used in learning verbal language (categorization, generalization, formation of a mental set, and anticipation of probabilities of occurrence) are basic to the learning of reading. It appears that reading problems

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[1] Ibid., p. 15.

are later manifestations of earlier problems in learning the verbal language.

Hardy states that, though it is not commonly considered as such, dyslexia would have to be included as a language disorder.[1] Rabinovitch has noted that other language deficits are present among dyslexics and that a reading disability may be an extension of an earlier language disability.[2]

Langman says of poor readers, "They frequently display social behavior and emotional adjustment extremely immature for chronological age and inappropriate to group situations in school and at home. It is possible that the origin of this immaturity lies in inability to understand and internalize not only the generalizations related to learning to read . . . but also the general rules of social and cultural deportment which it is the function of the school and society to inculcate."[3] This investigator hypothesizes that the social and emotional immaturity which Langman observed in the poor reader was present when the child began school.

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[1]William G. Hardy, "Dyslexia in Relation to Diagnostic Methodology in Hearing and Speech Disorders," Reading Disability: Progress and Research Needs in Dyslexia, p. 172.

[2]Ralph D. Rabinovitch, "Dyslexia: Psychiatric Considerations," ibid., p. 76.

[3]Muriel Potter Langman, "The Reading Process: A Descriptive, Interdisciplinary Approach," Genetic Psychology Monographs, LXII (1960), 35.

That kindergarten teachers are reliable in their ability to predict failure or poor achievement of children going into the first grade has been supported in a recent study. In this study, each immature child (teacher's judgment) was paired with a mature child for age, sex, intelligence, socio-economic level; was free of peripheral sensory defect; and was not premature at birth. On the Metropolitan Achievement Test given at the end of the first year in school, the immature group scored significantly lower on all four subtests.[1] This is the only study the investigator could find on this subject.

There are some children who make a slow beginning but who catch up with their peers in reading skill. Of the children called immature by their kindergarten teachers, some probably will be such "late bloomers." However, others may not catch up in reading skill and may comprise the group that are retarded readers at the end of their third year and later in school. The social and emotional immaturity of the poor reader and the underachievement of the immature first-grader lead this investigator to postulate that children who are retarded in reading at the end of the third year of school will come from the group that the kindergarten teachers label immature.

Kass found differences between retarded readers'

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[1]Sylvia O. Richardson, Philip N. Hood, and June B. Ford, A Study of Immaturity, Unpublished Study, Child Study Center, University of Oklahoma Medical Center, 1961-62.

scores and the norms of the Illinois Test of Psycholinguistic Abilities.[1] Her findings, which will be reviewed in the next chapter, and evidence that dyslexia is a language disorder, led this investigator to believe that the young child who will be dyslexic will score lower on the ITPA. A delineation of the specific psycholinguistic abilities and disabilities could serve to identify these children before they experience failure and could form a basis for selection of preventive educational procedures.

Rabinovitch and others have found differences in patterning on the Wechsler Intelligence Scale for Children between retarded and non-retarded readers.[2,3,4] These differences will be discussed in the next chapter. They led the investigator to believe that investigation of the WISC patterns of beginning first-graders, in addition to the ITPA patterns, could aid in early identification of the pre-dyslexic child.

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[1]Corrine E. Kass, "Some Psychological Correlates of Severe Reading Disability (Dyslexia)," Selected Studies on the Illinois Test of Psycholinguistic Abilities (Madison, Wisconsin: Photo Press, Inc., 1963), p. 87-95.

[2]Rabinovitch, Drew, DeJohn, Ingram, and Withey, Neurology and Psychiatry in Childhood, XXXIV (1956), 1.

[3]Mildred C. Robeck, "Subtest Patterning of Problem Readers on the WISC," California Journal of Educational Research, XI (1960), 110-115.

[4]Donald Neville, "A Comparison of the Wisc Patterns of Male Retarded and Non-retarded Readers," Journal of Educational Research, LIV (1961), 195-197.

The findings of the above-mentioned investigators and clinicians led the investigator to postulate that dyslexic children, as identified at the end of the third year in school, will come from a group which the kindergarten teacher calls immature; that these children, at the beginning of their first year in school, will exhibit some disabilities in psycholinguistic function; and that the WISC subtests scores will differ from those of children who will be adequate readers.

CHAPTER II

A REVIEW OF THE LITERATURE

Much of the research in the area of reading retardation deals with suspected etiology. A more recent trend is to report the accompanying behavioral characteristics believed to be related to the disorder. The purpose of this review is to report the behavioral correlates of reading disorders found both by authors concerned with etiology and those reporting accompanying behavioral factors.

Since 1922, when McCall listed subnormal intelligence as a cause of failure to learn to read, few surveys on reading failure neglect to mention intelligence as a factor.[1] Witty and Kopel have stated, "Idiots (IQ below 25) and imbeciles (IQ between 25-50) cannot learn to read."[2] They also pointed out that morons (IQ 50-70) seldom achieve more than fourth grade level reading. Kirk also points out the reading limitations of the slow-learning child.[3] Sub-

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[1]William A. McCall, How to Measure Education (New York: Macmillan Co., 1922), pp. 109-111.

[2]Paul Witty and David Kopel, Reading and the Educative Process (Boston: Ginn and Co., 1939), p. 226.

[3]Samuel A. Kirk, Teaching Reading to Slow Learning Children (Boston: Houghton Mifflin Co., 1940).

normal intelligence then is accompanied by decreased reading ability.

There remain, however, many retarded readers of average or above-average intelligence. Witty and Kopel reported that ninety per cent of poor readers of both elementary and high school ages had IQ's from 80 to 110 with about an equal number in each interval of ten between these two scores.[1] Preston reported a distribution of 90 to 140 in the IQ scores of 100 reading disability cases.[2] Witty and Kopel reported a correlation of about .60 between reading tests and Binet intelligence test scores.[3] It seems evident that, though intelligence is a factor in learning to read, other factors are operative.

Betts recommended a mental age of at least six and one-half years for success in the first grade reading program.[4] Harrison stated, ". . . that in order to make any progress in reading, a child must have attained a mental age of at least six years and that a mental age of six and one-half years more nearly insures success."[5] Gates considered

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[1]Witty and Kopel, p. 228.

[2]Mary I. Preston, "The Reaction of Parents to Reading Failures," Child Development, X (1939), 173-79.

[3]Witty and Kopel, p. 226.

[4]Emmett Albert Betts, The Prevention and Correction of Reading Difficulties (Evanston, Ill.: Row, Peterson, and Co., 1936), pp. 24-25.

[5]M. Lucille Harrison, Reading Readiness (Boston: Houghton-Mifflin Co., 1936), p. 6.

statements concerning the necessary mental age for beginning reading essentially meaningless. He found that under some conditions a mental age of five was sufficient.[1] Harrington found that mental age has little influence on success in learning to read.[2]

The lack of agreement concerning the mental age and intelligence quotient necessary for reading success suggests that some factor or factors other than intelligence are prerequisite to reading success.

Dominance factors have received the attention of many investigators. Orton posits failure to establish a unilateral hemispheric dominance as the cause of deficient visual memory. While this has led some to relate left-handedness to reading disability, this is not the problem according to Orton. He says, "It is only those in whom the tendency toward some measure of left-sidedness is present, but not in sufficient strength to assure complete unilateral superiority of the right hemisphere of the brain, in whom trouble may ensue and who form a fertile soil for the disturbing effects of misguided training."[3]

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[1]Arthur I. Gates, Elementary School Journal, XXXVII (1937), 497-508.

[2]Sister Mary James Harrington and Donald Durrell "Mental Maturity versus Perception Abilities in Primary Reading," Journal of Educational Psychology, XLVI (1955), 380.

[3]Orton, p. 130.

Delacato believes that neurological development and organization of the human organism is the key to language and reading difficulties. Mixed hand and eye dominance figure strongly in his theory of the causality of reading retardation.[1] Stevenson and Robinson found no significant differences in the problems encountered in learning to read or in reading achievement at the end of Grade I or at the beginning of Grade III between the consistent right group and those who were inconsistent.[2] McConville found no significant correlation between handedness and reading skill.[3] Richardson, Hood, and Ford found mixed hand-eye-foot preference patterns equally in their mature and immature first graders, though the immatures scored significantly lower on the reading subtest of the Metropolitan Achievement Test.[4] Evaluation of research regarding the dominance theory reveals no clear-cut evidence to support it.

Smith and Carrigan constructed a synaptic transmission model to explain reading disabilities. From the results of their study, they concluded that abnormalities of synaptic

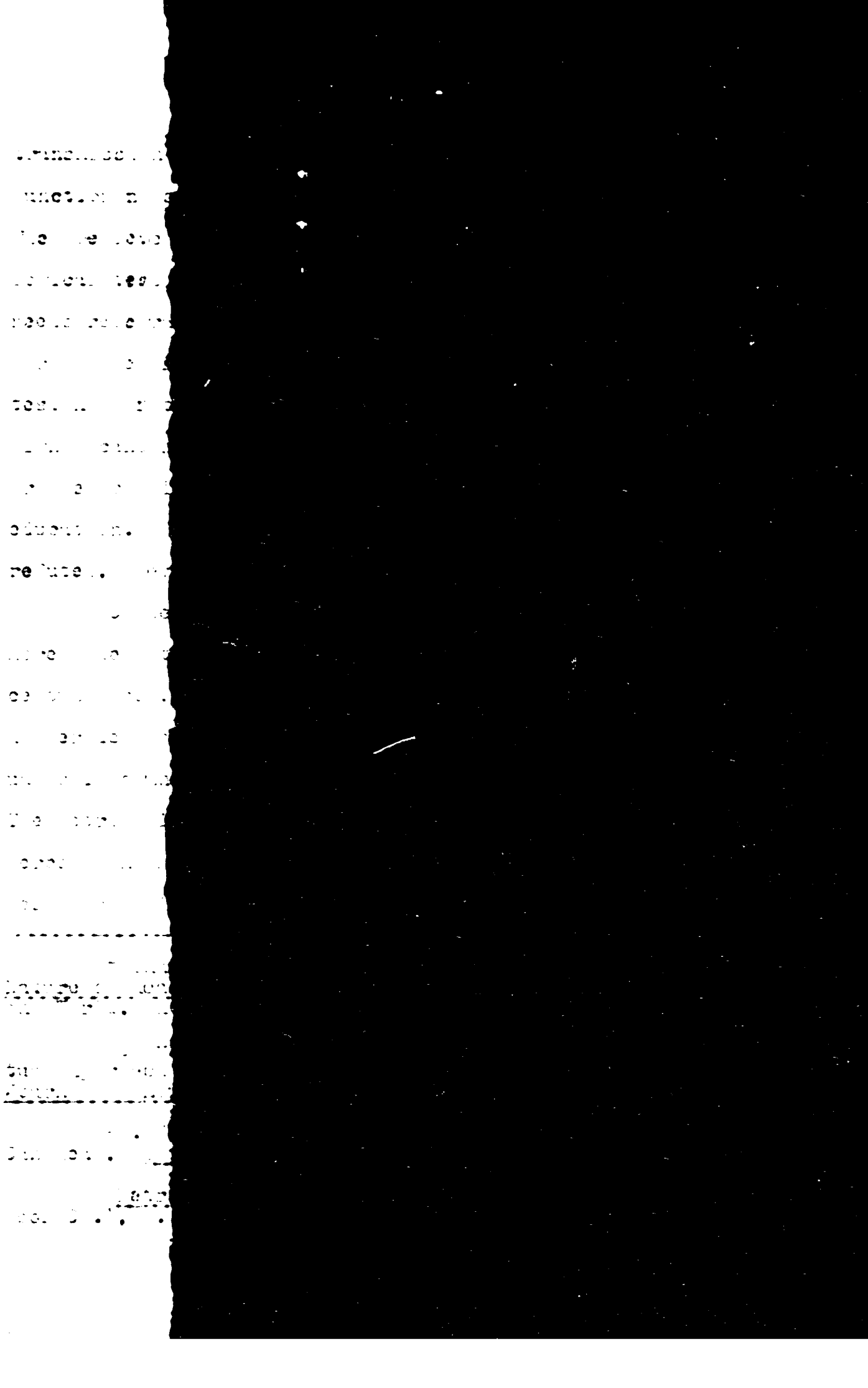
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[1]Carl H. Delacato, The Treatment and Prevention of Reading Problems (Springfield, Ill.: Bannerstone House, 1959), p. 109.

[2]Lillian P. Stevenson and Helen M. Robinson, "Eye-hand Preference, Reversals, and Reading Progress," Clinical Studies in Reading II, ed. Helen M. Robinson LXXVII (1953), 83-88.

[3]Carolyn B. McConville, "Handedness and Psychomotor Skills," Journal of Developmental Reading, IV (1960), 152.

[4]Richardson, Hood, and Ford, p. 22.



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[3]Carolyn B. McConville, "Handedness and Psychomotor Skills," Journal of Developmental Reading, IV (1960), 152.

[4]Richardson, Hood, and Ford, p. 22.

transmission and neural activity influenced by endocrine functioning suggest therapy must be at the glandular level. They believe that eventually reading symptoms and psychological test behavior may be used as evidence that a child needs referral to a physician.[1] This study is significant for its demonstration of the usefulness of psychodiagnostic testing for the detection of latent language disorders. Significant also, is the multi-disciplinary approach to the problem combining the knowledge of medicine, psychology, and education. However, until their hypotheses are verified or refuted, preventive educational measures must be devised.

Catterall and Weise feel that reading problems are more likely to occur when there is a disturbance in the perceptual area, no matter what educational approach is used.[2] Radler demonstrates a substantial relationship between visual skills and school achievement at the kindergarten level.[3] The Metropolitan Readiness Tests list visual and auditory perception among the chief factors that contribute to readiness for beginning school work.[4] Harrington and Durrell,

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[1]Donald E. P. Smith and Patricia M. Carrigan, The Nature of Reading Disability (New York: Harcourt, Brace, and World, Inc., 1959), p. 91.

[2]Calving D. Catterall and Phillip Weise, "A Perceptual Approach to Early Reading Difficulties," California Journal of Educational Research, X (1959), 212-19.

[3]D. H. Radler, "Visual Training Hopeful--Now Johnny Can Read," Horizon, III (1956), 1.

[4]Metropolitan Readiness Tests (New York: World Book Co.), p. 1.

in studying the relative influence of mental age and the various perceptual factors on reading, concluded that auditory and visual discrimination of word elements have high importance in acquiring a primary grade reading vocabulary, that phonics instruction is clearly important, but that mental age has little influence on success in learning to read.[1] Goins found a multiple correlation of .825 between reading success at the end of the first school year and fourteen different visual perception group tests given to the children at the beginning of the first grade.[2] Two of the three primary symptoms which Smith and Carrigan observe in children with severe reading disability are in the perceptual area: (1) severe blending deficiency; and (2) deficient discrimination of sounds and visual symbols.[3]

Auditory memory is also reported to be poorer in children with reading problems than in the general population.[4,5] Others report significant differences between the performances of poor and good readers on the WISC Digit Span

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[1]Harrington and Durrell, Journal of Educational Psychology, XLVI (1955), 380.

[2]J. T. Goins, "Visual Perception Abilities and Early Reading Progress," Supplementary Education Monographs, LXXXVII (1958), 109.

[3]Smith and Carrigan, p. 5.

[4]G. L. Bond, Auditory and Speech Characteristics of Poor Readers, (New York: Columbia University Press, 1935) pp. 35-36.

[5]Dorothy L. Poling, "Auditory Deficiency of Poor Readers," Clinical Studies in Reading II, 107.

subtest which measures auditory memory.[1,2]

Lack of precision in discrimination of speech sounds might impede progress in reading. Bond and Wolfe found significant differences in auditory discrimination between good and poor readers.[3,4] Wepman says:

> In these studies with intelligence held constant, it was found that some 27 per cent of eighty children in the first grade showed inadequate auditory discrimination and reading scores significantly below the reading level of the children with adequate auditory discrimination.[5]

The WISC differences have also been studied between retarded and good readers, and between retarded readers and Wechsler's norms. Neville, studying male retarded and non-retarded readers, found that the retarded readers were significantly low in information, digit span, and arithmetic.[6]

Callos and others in a study of disabled readers of normal intelligence found no difference between Verbal and

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[1]Robeck, California Journal of Educational Research, XI (1960), 110-15.

[2]Neville, Journal of Educational Research, LIV (1961), 195-97.

[3]Bond, p. 42.

[4]Lillian S. Wolfe, "Differential Factors in Specific Reading Disability, II. Audition, Vision, Verbal Association, and Adjustment," Journal of Genetic Psychology, LVIII (1941), 69.

[5]Joseph M. Wepman, "Dyslexia: Its Relationship to Language Acquisition and Concept Formation," Reading Disability: Progress and Research Needs in Dyslexia, p. 184.

[6]Neville, Journal of Educational Research, LIV (1961), 195-97.

Performance IQ's but found the disabled readers to be significantly high in Block Design and low in Information, Coding, and Arithmetic.[1]

In studying the WISC patterns of problem readers, Robeck found them to be significantly higher than Wechsler's standardization group on Block Design, Comparison (Similarities), Picture Completion, Vocabulary, and Object Assembly. They scored significantly low on Digit Span, Arithmetic, Information, and Coding.[2]

Burks and Bruce, in a study of WISC patterns of 31 poor readers and 11 good readers found: (1) The poor readers were significantly low on the Information, Arithmetic, and Coding subtests; (2) The poor readers were significantly high on the Picture Arrangement, Block Designs, and Comprehension subtests; (3) The good readers were significantly high on the Similarities subtest.[3]

Abrams found non-readers significantly low on the Verbal Scale of the WISC and that low performance on the Arithmetic and Information subtests made the most contribution to the differences on the Verbal test; however, the

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[1]George L. Callos, John M. Grabow and Eugene A. Guarino, "The WISC Profile of Disabled Readers," The Personnel and Guidance Journal, XXXIX (1961), 476-78.

[2]Robeck, California Journal of Educational Research, XI (1960), 110-15.

[3]Harold F. Burks and Paul Bruce, "The Characteristics of Poor and Good Readers as Disclosed by the Wechsler Intelligence Scale for Children," Journal of Educational Psychology, XLVI (1955), 488-93.

Vocabulary test results of the poor readers were also low.[1]

In Zedler's study, she found that underachievers scored significantly higher than Wechsler's standardization population on the subtest Comprehension but significantly lower, as a group, in the abilities required for normal success in the Arithmetic, Information, Block Design, and Picture Arrangement subtests.[2]

The WISC findings are surprisingly consistent considering the different ways of defining the population to be studied. The most consistently low findings are Information and Arithmetic. Information involves storage or memory of facts received both auditorily and visually. This deficit supports other findings of poor auditory and visual memory. It is surprising to find Arithmetic so consistently low in view of some reports of higher achievement test scores in arithmetic than in reading for the poor reader.[3] It may be that the poor reader does well enough on computational problems presented visually, whereas the problems on the WISC Arithmetic subtest are presented orally and require auditory

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[1]Jules C. Abrams, "A Study of Certain Personality Characteristics of Non-readers and Achieving Readers," Dissertation Abstracts, XVI (1956), 377-78.

[2]Empress Y. Zedler, An Investigation of Relations Between WISC Results and Neurological Findings in Underachievers, Report of research completed under Neurological and Sensory Disease Service Project, Grant No. N4607A63 (Southwest Texas State College, San Marcos, Texas, 1964), p. 52.

[3]Leon Eisenberg, "Office Evaluation of Specific Reading Disability in Children," Pediatrics, XXIII (1959), 1000.

decoding, memory of the information, and abstract reasoning. The low Coding scores may be accounted for by poor visual memory and/or fine motor incoordination.

Many writers have commented on the Verbal-Performance score discrepancy on the WISC. As Wechsler points out, in appraising the significance of differences between Verbal and Performance scores, allowance must be made for variability even among normal subjects. He states:

> The standard deviation of the mean difference between Verbal and Performance for the normal population is 10.02. This means that a V-P difference greater than 10 points will be encountered in less than 32 cases in 100, a V-P difference of 15 points in 13 cases in 100, . . . and so on. Depending upon one's criteria of abnormality, one can set cut-off points at different levels of deviancy. In most instances a difference of 15 or more points may be interpreted as diagnostically significant.[1]

Eisenberg says that a non-reader, penalized by his handicap, is likely to show a discrepancy between verbal and performance scores on the WISC with the latter 15 to 20 points higher.[2] Abrams also found non-readers low on the Verbal Scale.[3] Katrina deHirsch finds that strephosymbolic youngsters do significantly better on the performance section of a given test than they do on the verbal area.[4] She

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[1]David Wechsler, Measurement and Appraisal of Adult Intelligence, (Baltimore: Williams and Wilkins Co., 1958), p. 160.

[2]Eisenberg, Pediatrics, XXIII (1959), 1000.

[3]Abrams, Dissertation Abstracts, XVI (1956), 377-78.

[4]Katrina deHirsch, "Prediction of Future Reading Disabilities in Children with Oral Language Disorders," Folia Phoniatrica, VII (1955), 235-49.

does not, however, say which test or tests she uses.

Only one study was found in which the psycholinguistic abilities as measured by the ITPA were investigated in relation to reading disability. Kass found differences in performance on this test of reading retarded children 7 years to 9 years, 11 months of age, in these subtests:

1. The children with reading disabilities were better than normal in Visual Decoding.
2. They were poorer than normal in:
   a. Auditory-Vocal Association at the representational level
   b. Auditory-Vocal Automatic at the integrational level
   c. Visual-Motor Sequential at the integrational level

She used the Maze subtest from the WISC as a measure of visual prediction with a motor output and found the disabled readers to be significantly poorer on this test which she says is at the integrational level.[1]

Richardson, Hood, and Ford found that "immature" first-graders (kindergarten teacher's judgment) paired with "mature" first-graders on the basis of sex, age, occupational level of their fathers and the Full-Scale WISC, were inferior to the matures on every subtest of the Metropolitan Achievement Test. The Visual-Motor Sequencing Test of the

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[1]Kass, p. 66.

ITPA (subtest #9) was significantly different with a superiority of the "matures."[1]

Minor neurological abnormalities have been mentioned in children with developmental dyslexia. Rabinovitch and his co-workers report frequent left and right confusion. They state, ". . . observation of gait and the performance of motor acts such as dressing, opening and closing doors, and the handling of psychological test materials led to the definite impression of a nonspecific awkwardness and clumsiness in motor function."[2]

Bakwin and Bakwin said, "A considerable proportion of affected children are abnormally clumsy. Their movements are jerky, uncoordinated and bungling . . . The condition is evident in early childhood, but becomes more prominent during the school year."[3]

Cohn, in a recently published study of a group of 46 children having reading and writing difficulties found striking differences between groups in right-left orientation, in the evaluation of double simultaneous tactile stimuli, the knee-jerk reflexes, the Babinski sign, the motor

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[1]Richardson, Hood and Ford, 29.

[2]R. D. Rabinovitch, A. L. Drew, R. N. DeJong, W. Ingram, and L. Withey, "A Research Approach to Reading Retardation," Research Publications of the Association for Research in Nervous and Mental Disease, XXXIV (1954), 363-69.

[3]H. Bakwin and R. M. Bakwin, Clinical Management of Behavior Disorders in Children (2nd ed. Philadelphia-London: W. B. Saunders Co., 1960).

coordination, the mechanics of speech and the electroencephalogram.[1]

The behavioral evidence of the above mentioned authors certainly supports the thesis of neurological dysfunction. Evidence has been found relating to: (1) Poor auditory memory; (2) Poor auditory discrimination; (3) Severe blending deficiency; (4) Inadequate visual memory; (5) Visual-perceptual problems; (6) Left-right confusion; and (7) Motor incoordination. Catterall and Weise have stressed the importance of the inter-relationship between the physical factors of motor development and visual-auditory perception.[2]

These studies reflect differences in the child's ability to attach meaning to sensory input (perception), association of sensory input to previous input (memory and association), and output functions (expression).

It appears that it is in these areas (perception, association and memory, and expression) that the first-grader who will be a reading retardate may differ from the first-grader who will read adequately.

Developmental factors have been observed in relation to reading disorder. Olson's "organismic hypothesis" refers to a developmental status. He says that reading

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[1]R. Cohn, "Delayed Acquisition of Reading and Writing Abilities in Children: A Neurological Study," Archives of Neurology, IV (1961a), 153-64.

[2]Catterall and Weise, California Journal of Educational Research, X (1959), 212-19.

ability is a function of the total development of the child. A fast growing child will be above average in reading and a slow developing child may be retarded in reading.[1]

Smith and Carrigan, using a cluster analysis to differentiate groups of children with reading disabilities into psychological syndromes, found that the group who exhibited perceptual retardation also showed symptoms of developmental retardation. They were significantly retarded in bone growth.[2] However, Kausmeier and Check found that neither low level of physical development or uneven physical development accompanied low achievement in reading and arithmetic in the groups they studied.[3]

At this time the relationship of physical development to reading achievement is unclear.

It has often been demonstrated that children with reading disabilities make a poorer emotional adjustment than achieving readers.[4,5]

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[1]W. C. Olson, Child Development (Boston: D. S. Heath and Co., 1949).

[2]Smith and Carrigan, p. 37.

[3]H. J. Klausmeier and J. Check, "Relationships: Physical, Mental Achievement, and Personality Measures in Children of Low, Average, and High Intelligence at 113 Months of Age," American Journal of Mental Deficiency, LXIII (1959), 1059-68.

[4]Charles George Mathews, Doctor's Thesis, Dissertation Abstract, XIX (1958), 878.

[5]Helen M. Robinson, "Emotional Problems Exhibited by Poor Readers," Clinical Studies in Reading, (Chicago: University of Chicago Press, 1959), I, 114-22.

Eisenberg states:

> There are many who hold that specific reading disability is in large part an emotional disorder. They argue for this thesis on the basis of clinical observations of dyslexic children who for the most part show definite evidence of such disorder. But it should be clear that emotional disorder is almost inevitably a consequence of the repeated frustration entailed in trying, but being unable, to learn to read. The disentangling of causes and effect once the problem is well set is quite complex, if not impossible. Again, an a posteriori judgment may sometimes be made with confidence on the basis of the response to specific corrective measures. In the experience of most clinicians, the child whose reading deficit is secondary to an emotional problem is likely to show a rather rapid gain in reading skills once an effective treatment for the emotional disorder has been introduced. I would add only that in my experience even such children seem to require remedial reading instruction before they can make up for their deficit, though the rapidity of their response distinguishes them sharply from children with specific dyslexia.[1]

Solomon, who administered the Rorschach Test to 45 first graders at the beginning of the term and again at the beginning of the third grade to 40 of the original 45, concluded that potentially unsuccessful readers cannot be identified by the Rorschach alone.[2] This was the only study found which attempted to predict reading disability.

Catterall and Weise said, "It has been frequently observed that the non-reading child continually subjected to failure and/or censure will often develop rather marked

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[1]Leon Eisenberg, "Introduction," Reading Disability: Progress and Research Needs in Dyslexia, p. 5.

[2]Ruth Solomon, "Personality Adjustment to Reading Success," Clinical Studies in Reading II, ed. Helen M. Robinson, LXXVI (1953).

secondary emotional problems."[1]

Though the retarded reader often shows evidence of emotional maladjustment and immaturity, the relationship of cause or effect is not at this time clear. It is possible, as Langman says, that the origin of the inappropriate social behavior and immature emotional adjustment stem from the inability not only to internalize the generalizations related to learning to read but also inability to generalize the rules of social and cultural deportment.[2]

Lack of environmental stimulation, both from the home and from the school, has received its share of attention. Sir James Pitman, who regards a reading problem as a linguistic defect, says:

> There is every indication that these non-linguistic children form a considerable proportion of reading failures in my country, [England] and we may assume that they constitute a very real problem in teaching reading in classes in other countries of the English-speaking world. In your country [United States], they are frequently described as "culturally deprived"; we shall see however, that cultural deprivation and linguistic deprivation may very well be the same thing.
>
> . . . They come from homes that are truly underprivileged (though not necessarily economically so), in which the parents have neglected to exploit the opportunities presented to teach language or, as language develops, to talk with them about the family and happenings in the neighborhood, to read them stories and, above all, to listen patiently to the children's tenta-

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[1]Catterall and Weise, California Journal of Educational Research, X (1959), 212-19.

[2]Langman, Genetic Psychology Monographs, LXII (1960), 35.

> tive and improving efforts to convey their own news and the lively imaginings of childhood.[1]

Though Pitman sees the home as a contributing factor to reading disability through lack of stimulation, Robinson views the home in some instances as a damaging influence in learning to read. She found that maladjusted homes and poor interrelationships were contributing factors in 54.5% of the cases she studied.[2]

Eisenberg states:

> Frequent and prolonged absences from school, conspicuously poor teaching, or lack of motivation from the home for academic achievement may, singly or in combination, account for failure to learn despite normal intellectual endowment.[3]

Helen Robinson says that since a large number of severely retarded readers in her study did improve substantially, it seems logical to assume that a better adaptation of methods of teaching reading to deviating children is required.[4]

That lack of opportunity for learning language skills, lack of motivation from the home, and actual interference because of maladjusted homes are detrimental to the learning of reading goes undisputed.

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[1]Sir James Pitman, The Future of the Teaching of Reading, Paper presented at the 28th Educational Conference by the Educational Records Bureau in the City of New York: Oct. 30th and 31st, and Nov. 2, 1963, p. 20.

[2]Helen M. Robinson, Why Pupils Fail in Reading (Chicago: University of Chicago Press, 1946), p. 284.

[3]Eisenberg, "Introduction," Reading Disability, p. 5.

[4]Robinson, p. 24.

Conclusions

The following conclusions were drawn from the preceding review of the literature.

It was concluded that though reading achievement and general intelligence are positively correlated, the correlation is not great enough for reliable prediction. Children of sub-normal intelligence seldom learn to read well; yet, there are many children of average or above-average general intelligence who are severely retarded in reading.

These low abilities, which might be viewed as symptoms of neurological dysfunction, were reported. Dominance factors were reported including: (1) lack of or weakly established dominance; (2) laterality and directionality problems; and (3) left-right confusion.

Other symptoms of neurological dysfunction, sensory, motor, and sensory-motor functions, were reported: (1) poor auditory memory; (2) poor auditory discrimination; (3) poor sound blending; (4) poor visual memory; (5) poor visual discrimination; (6) inadequate visual sequencing ability; (7) fine motor incoordination; (8) non-specific awkwardness; and (9) hyperkinesis and attention defect. The interrelationship of the motor factors with visual and auditory factors were also noted.

Though the retarded reader often shows evidence of emotional maladjustment and immaturity, the relationship of cause of effect is not clear.

Others have noted that poor teaching or lack of motivation from the home may each or in combination account for failure to read well despite normal intellectual endowment.

Discussion

It appears that ascribing the cause of reading retardation to a single factor--intellectual, neurological, emotional, pedagogic, or environmental--is not helpful in planning a preventive educational program for potential reading retardates. Rather, a description of behavioral correlates of the children who will have reading problems would provide a better basis on which to devise preventive training procedures.

There is little research on the abilities and disabilities of these children prior to failure. Though it would appear that the behavioral correlates would be the same for the potential reading retardate as for the already disabled reader, this has not been demonstrated.

Since the correlation between reading ability and general intelligence is not great enough for reliable prediction, it appears likely that low specific intellectual abilities would better predict reading disability. The WISC studies reviewed most often reported low test performance on the Information, Arithmetic, Digit Span, and Coding subtests. Although the subjects were seven years, eleven

months and older and already failing in reading, it seems probable that the pre-dyslexic six-year-old would perform poorly on these subtests. The reports that dyslexics show a greater Verbal-Performance discrepancy on the WISC than non-dyslexics lead this investigator to believe that the same would be true of the pre-dyslexics.

Some of the symptoms of neurological dysfunction, poor visual and auditory memory, poor visual and auditory discrimination, and inadequate sequencing ability may be similar to the psycholinguistic abilities measured on the ITPA. They seem especially related to the integrative functions measured on the ITPA. Kass' findings of poorer performance of retarded readers on the ITPA subtests, Auditory-Vocal Association, Auditory-Vocal Automatic, and Visual-Motor Sequential lead this investigator to postulate that the pre-dyslexic six-year-old will score lower than the non-dyslexic on these tests.[1] The abilities measured on the ITPA have been shown to be sensitive to training and thus show promise as a basis for preventive educational programs.[2]

The social and emotional immaturity which Langman observed in poor readers and the low first-grade achievement of immatures reported by Richardson lead this investi-

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[1]Kass, p. 66.

[2]James O. Smith, "Effects of a Group Language Development Program upon the Psycholinguistic Abilities of Educable Mental Retardates," Peabody College Special Education Monograph Series, (1961), 27.

gator to postulate that immaturity is a predictor of dyslexia.[1]

It is hypothesized that: (1) significantly more children who are retarded in reading one year or more at the end of their third year in school will come from the group judged to be immature by their kindergarten teachers; (2) when the dyslexic children are identified, the analysis of their ITPA scores (administered during their first year in school) will reveal psycholinguistic abilities significantly different than the adequate reading group; (3) the analysis of the WISC Verbal, Performance, and subtests (administered during their first year in school) will reveal significant differences on some tests between the two groups (dyslexic and non-dyslexic); and (4) the dyslexics will have a significantly greater difference between their Verbal and Performance scores on the WISC with the Performance scores higher than the Verbal.

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[1]Richardson, Hood, and Ford, p. 66.

CHAPTER III

SUBJECTS, MATERIALS AND PROCEDURE

For purposes of this study, a subject was called dyslexic if: (1) he was without peripheral sensory defect; (2) he was within the normal range of intelligence; (3) he had had approximately equivalent instruction (instruction in first, second, and third grade classrooms in three northwest Oklahoma City schools; (4) he was retarded one year or more in reading at the end of his third year in school. Those subjects scoring at grade level or above in reading but who met the other above-mentioned criteria were called non-dyslexic.

A longitudinal study was carried out to answer the following questions:

1. Are there significantly more dyslexics among those who had been judged to be immature at the end of their kindergarten year than among those who were judged to be mature?

2. Do the first year test scores of the dyslexics differ significantly from the first year test scores of the non-dyslexics on the following tests: (1) WISC Full Scale;

(2) WISC Verbal; (3) WISC Performance; (4) WISC subtests; (5) Differences between WISC Performance and Verbal IQ; (6) ITPA Total; (7) ITPA subtests?

3. Does the group of dyslexics differ from the group of non-dyslexics in age, sex, and occupational level of their fathers?

Subjects

Eight kindergarten teachers from three Oklahoma City elementary schools were asked to select from their classes children who they judged to be of normal intelligence but immature (with a poor prognosis for success in the first grade).

So that other kindergarten teachers might be able to select immature children by the same criteria, the eight kindergarten teachers and several first-grade teachers were asked to list the major characteristics of an immature child. They describe him as hyperactive with a purposeless activity. He spends much of his time on the floor and prefers to crawl rather than walk. He is untidy or disorderly in appearance. He is described as somewhat "clumsy or awkward," with motor behavior similar to that of a younger child.

Slight changes in routine bother the immature child. He seems to need more attention and approval than his mature peers. He is impulsive in his behavior, tending to act first and think of the consequences later.

He seems to put forth maximum effort but his atten-

tion span is short; inconsequentials distract him. He is slow in learning new materials and needs much repetition to insure retention.

The immature child is described as almost a compulsive talker, and is often difficult to control in the classroom. Often his talk is pure fabrication. His sentences are frequently incomplete and he is not always able to "tell things back" in orderly sequence.

Although of normal intelligence, the immature child gives the impression of being about a year behind his mature classmates in appearance, activity, peer relations, and learning.

From this group, forty-six children met the criteria which was set for the selection of subjects: (1) birthweight over 5 lbs; (2) normal auditory and visual acuity; (3) normal neuromotor function; (4) normal speech mechanisms; (5) normal intelligence; (6) cooperative parents; and (7) considered by eight kindergarten teachers to be immature (not likely to be academically successful in the first grade).

In the sample of forty-six immature children, fifty-three per cent were males and forty-seven per cent were females. By the Minnesota Scale,[1] which considers only the occupation of the father, eighty per cent of the families were found to be in the upper three socio-economic levels.

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[1]F. L. Goodenough and J. E. Anderson, The Minnesota Scale for Paternal Occupations, (Minneapolis: University of Minnesota, Institute of Child Welfare, No date).

By choosing from the upper occupational levels, culturally based mental subnormality and cultural deprivation were avoided.

For each immature child, a control child was paired on the following bases: (1) age, ± 3 months; (2) race; (3) sex; (4) occupational level of father; (5) ± 8 points on the Full Scale WISC; (6) mature (judged by the same eight kindergarten teachers to have a good prognosis for success in the first grade). Thus there were forty-six pairs of children.

Of the original forty-six pairs, only fifteen pairs were available for testing at the end of the third year. The results of the Metropolitan Achievement Test (Elementary) on these fifteen pairs provided the data by which one might determine if more dyslexic children come from the group called immature than from among the group called mature. Although only fifteen of the original forty-six pairs were available for testing at the end of the third year, fifty-eight subjects who were in the original mature and immature groups were available. Of these fifty-eight, forty-three were from the immature group and fifteen from the control or mature group.

Of the total fifty-eight subjects, thirteen proved to be dyslexic, eighteen borderline (less than one year retarded in reading), and twenty-seven non-dyslexic. In order to maintain greater differences of reading ability between

the two groups, the borderline subjects were eliminated from the statistical analysis. Thus, thirteen dyslexics and twenty-seven non-dyslexics were available for final analysis of the WISC and ITPA data. The dyslexic and non-dyslexic group were no longer equated for age, sex, intelligence, and socio-economic levels, so tests of significance were done to determine if they were equivalent for these factors.

Materials

The following tests were initially used to select the subjects:

1. Sensory screening: The visual and hearing acuity of each child was tested by the Keystone Tests of Telebinocular Skills and by pure-tone audiometry. Subjects were eliminated who had less than a -15 binaural average on the pure-tone audiometric screening.

2. Medical History and examination: Each child was examined individually by one of three pediatricians on the staff of the Child Study Center, University of Oklahoma Medical Center. From the results of these examinations, it was possible to eliminate the children who had abnormal neuromotor function and abnormal speech mechanisms.

3. Intelligence: The Wechsler Intelligence Scale for Children was used for matching of pairs and for the elimination of children of subnormal intelligence. Those scoring less than a WISC Full Scale IQ 85 were eliminated.

4. Occupational Level of the Fathers: The Minnesota

Scale for Paternal Occupations was used for pairing of the immatures and matures.[1]

5. Reading Level: The Metropolitan Achievement Test (Elementary), given during the last month of the third year was used to determine reading level.[2] An average of the four tests, Word Knowledge, Word Discrimination, Reading, and Spelling, was used to assign the children to either the dyslexic or non-dyslexic group. A score of 2.9 (grade level) or less was chosen as a criterion for dyslexia.

The Metropolitan suited the purpose of the investigator because of its careful standardization using a norm group representative of the national school population with respect to characteristics known or assumed to be related to achievement. "These characteristics include size of school system, geographical location, type of community (rural or urban), intelligence level of pupils, and type of system (segregated or non-segregated)."[3]

The following tests were used for measures of differences of test performance between groups:

The Wechsler Intelligence Scale for Children

The Wechsler Intelligence Scale for Children has grown out of the Wechsler-Bellevue Intelligence Scales used

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[1]Goodenough and Anderson.

[2]Walter N. Durost, ed. Metropolitan Achievement Tests Manual, (New York: World Book Co., 1959).

[3]Ibid., p. 23.

with adolescents and adults. It differs from other individual tests in that it completely renounces the concept of mental age as a measure of intelligence. Each person tested is assigned an IQ, which at his age represents his relative intelligence rating. This is a deviation IQ as it indicates the amount by which a subject deviates above or below the average performance of individuals of his own age group.

The WISC consists of twelve tests which are divided into two sub-groups, Verbal and Performance. Impartial weights have been assigned to each subtest with a mean scaled score of 10 on each and a standard deviation of 3. The mean IQ is arbitrarily set at 100 with a standard deviation of 15. The tests are grouped as follows: Verbal: Information, Comprehension, Arithmetic, Similarities, Vocabulary, Digit Span; Performance: Picture Completion, Picture Arrangement, Block Design, Object Assembly, Coding, and Mazes. The Digit Span and Mazes are considered supplementary but were used in this study.

The WISC subtests could be said to measure specific abilities relating to input, association, memory, and output. Some also measure attention, generalization, and reasoning ability. The parts of the WISC could be described as measuring the following kinds of learning abilities:

Verbal--Auditory input with a vocal output

Information--Auditory and visual memory for facts

Comprehension--Generalization of social attitudes to concrete situations

Arithmetic--Attention, auditory memory, number concepts, and reasoning ability

Vocabulary--Conceptual development; the differential scoring takes into account the concreteness or abstractness of the child's definition

Similarities--Conceptualization and classification

Digit Span--Attention, auditory memory, and sequencing ability

Performance--Visual input and motor output

Picture Completion--Visual analysis and attention to detail

Picture Arrangement--Comprehension of social situations from a visual stimulus

Object Assembly--Synthesis of a whole from parts

Block Design--Analysis of the design and then synthesis from parts

Coding--Visual memory for symbols with motor production

Mazes--A visual prediction with a motor output

The Illinois Test of Psycholinguistic Abilities

Remedial work on linguistic deficiencies has been limited until recently to speech correction. McCarthy and Kirk said, in the manual for the Illinois Test of Psycholinguistic Abilities, "The development of a diagnostic test

for linguistic deficiencies in children has been retarded because of the lack of an adequate method of specifying all essential language abilities for children."[1] Using a theoretical model as a parsimonious device for listing all essential linguistic abilities, they constructed a diagnostic test. They used Osgood's communication model as a psycholinguistic model from which to construct a diagnostic test as a prelude to the designing of remedial programs.[2] "Clinical observations and the practical problems of test construction required several alterations of Osgood's original model."[3]

McCarthy and Kirk postulated three major dimensions to specify a given psycholinguistic ability: levels of organization; psycholinguistic processes; and channels of communication.

The two levels of organization identified as being important for language acquisition and use are the representational and the automatic-sequential levels.

The psycholinguistic processes, the acquisition and use of habits required for normal language usage, are de-

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[1]McCarthy and Kirk, p. 1.

[2]Charles E. Osgood, "A Behavioristic Analysis," Contemporary Approaches to Cognition, (Cambridge, Massachusetts: Harvard University Press, 1957).

[3]McCarthy and Kirk, p. 2.

coding, encoding, and association.

The channels of communication, the sensory-motor path over which linguistic symbols are received and responded to, are divided into mode of reception and response. To test pure decoding or encoding ability, only the mode of reception or response is designated. The entire channel is specified when testing association ability. "Of the various combinations of sensory input and motor output that can be devised, only the auditory-vocal and visual-motor channels have been employed in the present test battery. Thus, like any physical three dimensional object, a psycholinguistic ability must be specified by its three dimensions: level; process; and channel."[1]

McCarthy and Kirk devised this test to isolate as nearly as possible what they called the nine psycholinguistic abilities. They describe the subtests according to the following outline:

I. Tests at the Representational Level--these assess some aspect of the subject's ability to deal with symbols conceptually.
   A. Decoding -- comprehension of symbols
      Test 1. Auditory Decoding
      Test 2. Visual Decoding
   B. Association -- ability to relate symbols or concepts meaningfully

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[1] Ibid., 4.

Test 3. Auditory-vocal Association

Test 4. Visual-motor Association

C. Encoding -- expression of ideas through word or gesture

Test 5. Vocal Encoding

Test 6. Motor Encoding

II. Tests at the Automatic-sequential Level -- these deal with the integrative functions of short term memory of sequence and the highly overlearned or automatic habits for handling the syntactical and inflectional aspects of language without conscious effort.

Test 7. Auditory-vocal Automatic Test -- to assess the ability to utilize the correct morphology of language without conscious effort.

Test 8. Auditory vocal Sequencing -- a modified digit span test of short term auditory memory

Test 9. Visual-motor Sequencing -- the ability to reproduce a sequence of symbols previously seen, short term visual memory

The ITPA was devised to assess the language development of children. Reading achievement, as a continuation of language development, may be dependent upon the psycholinguistic abilities.

The Metropolitan Achievement Test

Four of the areas of achievement on this test were

used to measure the reading ability of the subjects. An average of: Word Knowledge; Word Discrimination; Reading; and Spelling Scores were used as a total reading score.

The tests to be used are:

Word Knowledge--measure of the child's word-recognition ability.

Word Discrimination--a measure of the child's ability to choose an orally presented word from among a group of words of similar configuration. The child must be able to associate the sound of the word with its printed form and to distinguish the printed word from other words similar to it in sound and configuration.

Reading Test--measures various aspects of reading comprehension, obtaining specific information, making inferences, and understanding the general idea.

Spelling Test--measures the ability to respond to the orally presented word with the written symbol. This is one level of difficulty beyond the discrimination test. Now the child must not only recognize but recall the correct letters and their sequence.

The Procedure

In the spring of 1961, eight kindergarten teachers from three northwest Oklahoma City elementary schools were asked to select from their classes children whom they judged

to be of normal intelligence but immature. One important criterion which we asked to be included in the selection was a poor prognosis for success in the first grade. In the fall of 1961, when these children were placed in the first grade, case histories were taken by University of Oklahoma students in social work; audiometric screening was done by a graduate student in speech pathology at the University of Oklahoma, Norman, Oklahoma; physical examinations were made by three staff members of the Child Study Center of the University of Oklahoma Medical Center; telobinocular tests were administered by a graduate student in speech pathology at the University of Oklahoma, Norman, Oklahoma; WISC's were administered by the investigator; and ITPA's were administered by co-director of the research project of which this study is a part.

All of the above-mentioned examinations were used for the selection of the subjects with the exception of the ITPA.

For each of the forty-six immature children, a control child was paired on the following bases; (1) age, $\pm$ three months; (2) race; (3) sex; (4) occupational level of the father; (5) $\pm$ eight points on the Full Scale WISC. In addition, the subject must be mature by the judgment of the kindergarten teacher and must be enrolled in a first-grade classroom of one of the three selected schools. With the forty-six mature subjects, there was then a total of ninety-two subjects.

In May of 1964, fifty-eight of the original ninety-two subjects were available for testing. These children were then completing their third year in school. Arrangements were made to administer the Metropolitan Achievement (Elementary) to the subjects in their own schools or a near school. The test was administered to the subjects by a research assistant of the Child Study Center of the University of Oklahoma Medical Center. The children took the test in small groups of ten or less.

Of the fifty-eight subjects, only fifteen of the original pairs remained. On the basis of a subject's test average on the four reading subtests of the Metropolitan, the subject was called dyslexic or non-dyslexic. This data was then analyzed to answer the question, are there more dyslexics from the immature group than from the mature group.

Because the number of pairs available for testing at the end of the three year period was much smaller than anticipated, all of the data from the fifty-eight subjects tested was used.

The WISC and ITPA data were analyzed to determine if there were statistically significant differences between the dyslexic and non-dyslexic groups on the WISC Full Scale, Verbal Scale, Performance Scale, discrepancy between the Verbal and Performance Scales, the WISC subtests, the ITPA Total, and the ITPA subtests.

Because the dyslexic and non-dyslexic groups were

no longer equivalent for sex, age, socio-economic levels, and intelligence, tests were made to determine if the groups differed on these factors.

CHAPTER IV

RESULTS

An analysis of the data yielded the following results:

Of the fifteen pairs of subjects, eight immature children met the criterion set for the dyslexic group. One of the matures fits this category. The χ^2 was used to test the hypothesis that more dyslexics come from the immature group. Table 1 shows the results of this analysis.

Table 1. Distribution of the Immatures and Matures on the basis of Dyslexic or Non-dyslexic

	Dyslexics	Non-dyslexics	Total
Immatures	8	7	15
Matures	1	14	15
Total	9	21	30

$\chi^2 = 7.76$ Significant beyond the .01 level of confidence

The hypothesis was confirmed that significantly more of the dyslexics would come from the immature group than from the mature group.

To answer the second question, (are there differences between dyslexics and non-dyslexics on the WISC Full Scale; WISC Verbal; WISC Performance; discrepancy between Verbal and Performance; WISC subtest scores; ITPA Total score; ITPA subtest scores?), the WISC and ITPA scores of tests administered during the subjects first year in school were analyzed. The Student's *t* was used when the variances were homogeneous, and the Cochran *t* when the variances were heterogeneous. Of the 58 subjects, 13 were dyslexic and 27 were non-dyslexic. Eighteen were borderline (3.0 to 3.8) and were not included in the analysis. These classifications are shown in Table 2.

Table 2. Classification according to dyslexic and non-dyslexic subjects

Dyslexics	Non-dyslexics	Borderline	Total
13	27	18	58

Examination of the WISC scores revealed that the mean for the dyslexics on the Full Scale was 101.077 and for non-dyslexics 105.111. The *t* value was 1.439. The *t* value required for significance beyond the .05 level of confidence with 38 degrees of freedom is 2.036. Thus on the WISC Full Scale, the null hypothesis was retained, so differences in reading ability are not attributable to differences in global intelligence as measured on the WISC.

In submitting the WISC Verbal IQ to statistical

analysis, the variances were found to be homogenous. The following table summarizes the results of this test.

Table 3. Summary of the WISC Verbal IQ Analysis
Test for Homogeneity of Variance

F = 1.280 df = 26 and 12 $F_{.05}$ = 2.447 Not significant

N	Mean	Variance	Standard Deviation	Individual S.E. Mean	Pooled S.E. Mean
27	102.740	115.046	10.73	2.064	1.991
13	95.000	89.833	9.48	2.629	2.870

Student's t = 2.215 df = 38 $t_{.05}$ = 2.036
Significant beyond the .05 level of confidence

The dyslexics scored significantly lower than the non-dyslexics on the Verbal Scale of the WISC. Reading ability appears to be related to verbal intelligence as measured by the WISC.

The group means on the WISC Performance IQ were 106.667 for the non-dyslexics and 107.692 for the dyslexics. This difference was not significant.

Differences beyond the .01 level of confidence were found between the group means on the WISC Information subtest with the non-dyslexics superior in performance to the dyslexics. Thus, the dyslexics performed significantly poorer on the Information subtest than the non-dyslexics. The results are summarized in Table 4.

Table 4. Summary of the WISC Information Subtest Test for Homogeniety of Variance

$F = 2.347$ df = 26 and 12 $F_{.05} = 2.447$ Not significant

N	Mean	Variance	Standard Deviation	Individual S.E. Mean	Pooled S.E. Mean
27	10.630	8.396	2.90	.558	.505
13	8.077	3.577	1.89	.525	.727

Student's $t = 2.884$ df = 38 $t_{.01} = 2.798$
Significant beyond the .01 level of confidence

The mean scaled score for the non-dyslexics on the Arithmetic subtest was 11.296. The mean for the dyslexics was 10.000. The t value for this difference was 2.007. For the difference to be significant at the .05 level of confidence, a t value of 2.112 was required. This difference closely approached significance.

On the Digit Span subtest, the mean scaled score for the non-dyslexics was 10.593 and for the dyslexics was 9.308. The obtained t value was 2.017. The t value required for significance at the .05 level of confidence was 2.023. This difference also closely approached significance. A summary of these analyses may be found in Appendix I.

No other statistically significant differences were found between the dyslexics and non-dyslexics on WISC subtests. A summary of the Analysis is presented in the Appendix.

The mean difference between the Verbal WISC scores of the dyslexics and their Performance scores was 12.7 points. The mean difference between the Verbal and Performance WISC scores of the non-dyslexics was 3.9 points. A Student's t was computed for differences between the mean differences. The test was significant beyond the .001 level of confidence. The results are summarized in Table 5. The dyslexics show a statistically greater Verbal-Performance discrepancy than the non-dyslexics.

Table 5. Summary of Differences between Verbal and Performance IQ's
Test for Homogeneity of Variance

$F = 2.095$ $df = 12$ and 26 $F_{.05} = 2.15$ Not significant

N	Mean Difference	Variance	Standard Deviation
27	3.9	8.32	2.88
13	12.7	17.43	4.17

Student's $t = 7.79$ $df = 38$ $t_{.001} = 3.568$
Significant beyond the .001 level of confidence

On the ITPA Total score and subtests, the null hypothesis was retained. Not only were there no significant differences, there were no strong trends in either direction. The results are summarized in Appendix II.

To answer Question 3 (Are there differences in age; sex; occupational level of the fathers?) the following analyses were made:

There was a mean age difference of only one-half of one month in age. When a Student's t was applied, the difference was not significant.

Males and females were distributed between the two groups in this manner.

Table 6. Summary of the male-female ratio in the dyslexic and non-dyslexic groups

	Dyslexics	Non-dyslexics	Total
Males	8	15	23
Females	5	12	17
Total	13	27	40
$\chi^2 = 1.353$ Not significant	$\chi^2_{.05} = 3.84$		df = 1

The χ^2 test revealed no significant difference in distribution of males and females in the two groups.

The distribution of socio-economic levels as judged by the occupational levels of the fathers is as follows:

Table 7. Summary of the Occupational Levels of the Fathers

Occupational Levels	1	2	3	4	5	6	Total
Dyslexics	6	1	2	0	2	2	13
Non-dyslexics	9	6	10	0	0	2	27
Totals	15	7	12	0	2	4	40

Since some of the expected values of the individual cells in the 2X6 contingency table were less than 5, the occupational classes were pooled as follows:

Table 8. Summary of the Occupational Levels of the Fathers Pooling levels 1 and 2, and levels 3, 4, 5, and 6

Occupational Levels	1 and 2	3, 4, 5, and 6	Total
Dyslexics	7	6	13
Non-dyslexics	15	12	27
Total	22	18	40
$\chi^2 = .0146$ Not significant	$\chi^2_{.05} = 3.84$		df = 1

Analysis of the data, using the χ^2, revealed no significant differences in the occupational levels of the fathers of the subjects between the two groups.

Summary of the Results

A probability level of .05 or less was selected as necessary in order to answer a question in the affirmative.

In answer to question 1: Are there significantly more dyslexics among those who had been judged to be immature at the end of their kindergarten year than among those who were judged to be mature? At the end of three years of school, 8 dyslexic subjects were found among 15 of the original immature group and only 1 among the 15 paired matures.

This difference was statistically significant beyond the .01 level of confidence. The question was answered in the affirmative.

Question 2. Do the first year test scores of the dyslexics differ significantly from the first year test scores of the non-dyslexics on the following tests: (1) WISC Full Scale; (2) WISC Verbal Scale; (3) WISC Performance Scale; (4) Each WISC subtest; (5) Discrepancy between Verbal and Performance Scores; (6) ITPA Total Score; (7) ITPA Subtests? No significant differences were found between the two groups on the WISC Full Scale, the WISC Performance Scale, the ITPA Total Score, or on any ITPA subtest. The non-dyslexics were significantly superior on the WISC Verbal Scale and the Information subtest on the WISC. The superiority of the non-dyslexics on the Arithmetic and Digit Span subtests closely approached significance. All other differences on the WISC subtests were nonsignificant. The mean difference between the dyslexic's Verbal and Performance scores was 12.7 with the Performance scores higher. The mean difference between these two scores for the non-dyslexics was 3.7 with the Performance scores also higher. The difference between these differences was significant beyond the .001 level of confidence.

Question 3. Does the group of dyslexics differ from the group of non-dyslexics in age, sex, and occupational level of their fathers? There were no significant differences in these factors.

CHAPTER V

SUMMARY AND CONCLUSIONS

Eight kindergarten teachers from three elementary schools in a high socioeconomic area of Oklahoma City selected 46 children whom they judged to be of normal intelligence but with a poor prognosis for success in the first grade (immature). The criteria set for the selection of subjects were: (1) birthweight over 5 pounds; (2) normal auditory and visual acuity; (3) normal neuromotor function; (4) normal speech mechanisms; (5) normal intelligence; (6) cooperative parents; and (7) considered by their kindergarten teachers to be immature (not ready for the first grade).

For each immature child, a control child was paired on the following bases: (1) age, $\pm$ three months; (2) race; (3) sex; (4) occupational level of fathers; and (5) $\pm$ 8 points on the WISC Full Scale.

The WISC scores, initially used for matching, were later used for Verbal Scale, Performance Scale, and subtest analysis. The ITPA was administered during the first year to be analyzed after the dyslexics and non-dyslexics had been identified.

At the end of the third year of the study, the Metropolitan Achievement Test (Elementary) was administered and on the basis of the average of the reading tests, each child was assigned to a dyslexic or non-dyslexic group. To study the relationship of immaturity and dyslexia, those who scored 2.9 grade level or below were designated as dyslexic and those who scored 3.0 grade level or above were judged to be non-dyslexic. There were only 15 pairs available for testing at the end of the third year. Eight of the immatures and one of the controls fit the criterion for dyslexia. Seven of the immatures and 14 of the controls did not fit this criterion and were placed in the non-dyslexic group. The χ^2 analysis of this data yielded a value of 7.76 which is significant beyond the .01 level of confidence. Thus, of the children who were judged to be immature by their kindergarten teachers, a significantly greater number became dyslexic than did their mature controls.

The data from 58 subjects still available at the end of the third year was used even though some pairing had been lost because of unavailability of subjects. The subjects, without regard to original grouping (immature or mature), were now placed in two groups, dyslexic and non-dyslexic. The same criterion for dyslexia was used, 2.9 grade level or below in an average of reading test scores. In order to avoid the contamination of the scores of the borderline readers, the criterion for placement in the non-dyslexic

group was 3.9 and above. Tests of significance were made to determine if the groups were equivalent for sex, age, intelligence, and occupational levels of their fathers. The null hypotheses were retained; thus, any differences found on other measurements could not be attributed to these factors.

The results of the WISC Verbal Scale, Performance Scale, and each WISC subtest were analyzed using the Student's t if the variances were homogeneous and the Cochrans t, a weighted t, if the variances were heterogeneous. The WISC Verbal Scale group mean for the dyslexics was significantly lower than that of the non-dyslexics beyond the .05 level of confidence. The dyslexics scored lower on the Information subtest beyond the .01 level of confidence. There was a mean difference of 12.7 IQ points between the Verbal and Performance WISC scores of the dyslexics, with the Verbal score being lower. The mean difference between these two scores for the non-dyslexics was 3.9 IQ points with the Verbal score also lower. The difference between these differences is greater than the .001 level of confidence.

An analysis of the ITPA Total and subtest scores indicated no significant differences. Kass found differences when she studied severely retarded readers between the Auditory-Vocal Association, the Auditory-Vocal Automatic, and Visual-Motor Sequential scores of these subjects and the norms of the test. It may be that these differ-

ences are not present at the beginning of school but that some lack in the instructional program does not allow these children to progress normally in the acquisition of reading skills. The differences may lie, of course, in the test at different age levels.

CONCLUSIONS

The judgment of the eight experienced kindergarten teachers concerning the immaturity of the children in this study was an accurate prognosticator of poor achievement in reading. Slightly more than one-half of the paired subjects who were initially judged to be immature were one or more years retarded in reading at the end of the third year of school attendance. The other seven apparently are the "late bloomers" of which Eisenberg speaks:

> Since our public-school system is overcrowded and remedial reading is costly and often unavailable, it has become customary to delay the institution of corrective programs until the third grade or later when the true dyslexic will have segregated himself from the "late bloomer." This undoubtedly effects an economy from the standpoint of the administrator in that special instructions are not needlessly provided for children who are in any event going to learn. But this economizing is accomplished at a heavy cost to the dyslexic child. For by the time the remedial program is offered to him, he has had several years of failure, with a consequent development of aversion to reading and related activities, as well as of emotional problems related to feelings of inadequacy. Whether or not there may be an additional deficit related to faulty learning or even deviant maturation we do not at this point know. But I would argue in favor of providing extra help and special instruction even for those not actually in need of them in order to be certain that optimal help is provided to those who certainly require it. It is evident, that once

> we have specific methods of diagnosis that are reliable and are applicable in the field, this indiscriminate process of special tutoring will no longer be necessary.[1]

If help and instruction were provided to those described as immature by their kindergarten teachers, it appears that most of those needing help would be reached.

The dyslexics and non-dyslexics were found not to differ on global intelligence as measured on the WISC Full Scale, sex, age, or occupational levels of their fathers. Thus, differences in reading ability could not be considered attributable to these factors.

The relative verbal inferiority of the dyslexics lends credence to the hypothesis that dyslexia is an extension of a language problem. These differences are in agreement with the findings of Eisenberg,[2] Rabinovitch,[3] Abrams,[4] deHirsch,[5] and others who used the WISC with children who have already encountered failure in reading.

The Information subtest of the WISC contributed most heavily to the Verbal difference, the dyslexics scoring lower with a statistical significance greater than .01. This

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[1]Eisenberg, Reading Disability: Progress and Research Needs in Dyslexia, p. 5.

[2]Eisenberg, Pediatrics, XXIII (1959), 1000.

[3]Ralph D. Rabinovitch, et al, Neurology and Psychiatry in Childhood, XXXIV (1956), 1.

[4]Abrams, Dissertation Abstracts, XVI (1945), 377.

[5]deHirsch, Folia Phoniatrica, VII (1955), 235-48.

subtest measures the retention of facts and supports the findings of Burks and Bruce,[1] Abrams,[2] Neville,[3] Callos and others,[4] Robeck,[5] and Zedler.[6] It is also in keeping with the description of immaturity, that "much repetition is necessary to insure retention of new material."

Though Information is the only significant difference found on the Verbal Scale, Arithmetic and Digit Span differences closely approached significance and the trend was that the dyslexics were lower on every Verbal subtest. Significant differences have been found by others on Arithmetic.[1,2,3,4,5,6]

Working with already disabled readers, other investigators have found dyslexics superior to non-dyslexics on some performance subtests. No differences were found in this study.

No differences were found between the ITPA Total or any ITPA subtest scores of the dyslexic and non-dyslexic subjects. This is not in agreement with Kass' findings.

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[1]Burks, Journal of Educational Psychology, XLVI (1955), 488-93.

[2]Abrams, Dissertation Abstracts, XVI (1945), 377.

[3]Neville, Journal of Educational Research, LIV (1961), 197.

[4]Callos, The Personnel and Guidance Journal, (1961), 476-78.

[5]Robeck, California Journal of Educational Research, XI (1960), 110-15.

[6]Zedler, p. 52.

Kass, however, was studying older, more severely retarded readers and comparing them to the normative data on the ITPA rather than against a group of adequate readers.

This study would indicate that the ITPA test results of first graders would not be helpful to predict a specific reading disability. The ITPA will probably be refined until it is a more sensitive instrument and until each subtest measures more precisely the ability it is intended to measure. It has been this investigator's experience that the ITPA is a most useful diagnostic instrument for use with the seven, eight, and nine-year-old severe dyslexics.

The results of this study indicate that most children who will, at the end of their third year in school, be one or more years retarded in reading will come from that group called immature by their kindergarten teachers; that they will score ten or more points lower on the Verbal Scale of the WISC than on the Performance Scale; and that they will score lower on the Information subtest of the WISC than on other subtests.

Suggested Areas for Further Research

1. A study of the sound synthesis and analysis ability of the first grader who later becomes a dyslexic child.

2. A study of the Visual Automatic Ability, as measured by Kass' Visual Automatic Test, of first graders who later become dyslexic.

3. A study of the Visual Perceptual Skills measured on the Frostig Test of first graders who will become dyslexic.

4. A study of the Perceptual Speed as measured by Thurston's Perceptual Speed Test and used by Kass in the study of severely retarded readers.

5. Studies comparing methods of teaching immature first graders, e.g., Getman's physiological methods, Montessori method, perceptual training as used with dyslexics, or special techniques devised by the experimenter.

APPENDIX I

SUMMARY OF THE WISC DATA

Test	Group	N	Mean	Variance	Standard Deviation	Individual S.E. Mean	Pooled S.E. Mean	t value	$t_{.05}$
WISC									
I	N	27	10.630	8.396	2.90	.558	.505	2.884**	2.023
	D	13	8.077	3.577	1.89	.555	.727		
C	N	27	10.148	9.285	3.05	.586	.573	.147	2.023
	D	13	10.000	8.000	2.83	.784	.826		
A	N	27	11.296	6.063	2.46	.474	.428	2.007 a	2.112
	D	13	10.000	2.500	1.58	.439	.616		
S	N	27	10.148	10.593	3.25	.626	.612	1.427	2.023
	D	13	8.615	9.090	3.01	.836	.882		
V	N	27	9.444	8.564	2.93	.563	.628	.403	2.023
	D	13	9.000	15.167	3.89	1.080	.905		
DS	N	27	10.593	3.635	1.91	.367	.363	2.017 a	2.023
	D	13	9.308	3.397	1.84	.511	.523		
PC	N	27	11.519	6.721	2.59	.499	.511	.749	2.023
	D	13	10.846	7.808	2.79	.775	.737		
PA	N	27	11.074	10.302	3.21	.618	.573	-.615	2.023
	D	13	11.692	5.730	2.39	.664	.825		
BD	N	27	11.111	5.179	2.28	.438	.397	.270	2.023
	D	13	10.923	2.244	1.50	.415	.572		

APPENDIX I--Continued

Test	Group	N	Mean	Variance	Standard Deviation	Individual S.E. Mean	Pooled S.E. Mean	t value	$t_{.05}$
WISC									
OA	N	27	10.778	6.795	2.61	.502	.518	-1.091	2.023
	D	13	11.769	8.192	2.86	.794	.746		
Co	N	27	10.000	7.846	2.80	.539	.563	-.155	2.023
	D	13	10.154	10.141	3.18	.883	.812		
M	N	27	10.815	6.311	2.51	.483	.468	-.131	2.023
	D	13	10.923	5.077	2.25	.625	.675		
Verbal	N	27	102.741	115.046	10.73	2.064	1.991	2.215 *	2.023
	D	13	95.000	89.833	9.48	2.629	2.870		
Perform	N	27	106.667	125.462	11.20	2.156	2.093	-.279	2.023
	D	13	107.692	102.564	10.13	2.809	3.016		
Full	N	27	105.111	78.257	8.85	1.702	1.597	1.439	2.023
	D	13	101.077	48.578	6.97	1.933	2.302		
Difference between Verbal and Performance IQ's	N	27	3.9	8.32	2.88			7.79 ***	2.023
	D	13	12.7	17.43	4.17				

See legend on page 66 for symbol explanation

APPENDIX II

SUMMARY OF ITPA DATA

Test	Group	N	Mean	Variance	Standard Deviation	Individual S.E. Mean	Pooled S.E. Mean	t value	$t_{.05}$
ITPA									
#1	N	27	52.559	191.540	13.84	2.663	2.395	.830	2.111
	D	13	49.577	75.345	8.68	2.407	3.451		
#2	N	27	52.848	158.026	12.57	2.419	2.085	.187	2.090
	D	13	52.315	29.230	5.41	1.499	3.005		
#3	N	27	51.222	176.977	13.30	2.560	3.425	.411	2.023
	D	13	49.508	99.328	9.97	2.764	3.425		
#4	N	27	47.481	168.580	12.98	2.499	2.286	-.106	2.023
	D	13	47.908	81.569	9.03	2.505	3.295		
#5	N	27	49.993	227.198	15.07	2.901	2.622	.652	2.023
	D	13	46.992	95.554	9.78	2.711	3.779		
#6	N	27	42.704	153.573	12.39	2.385	2.125	-.694	2.107
	D	13	44.877	53.510	7.32	2.029	3.063		
#7	N	27	49.163	131.656	11.47	2.208	2.906	.987	2.023
	D	13	45.669	62.446	7.90	2.192	2.906		
#8	N	27	51.126	202.563	14.23	2.739	2.507	.577	2.023
	D	13	48.585	98.391	9.92	2.751	3.613		
#9	N	27	44.615	135.948	11.66	2.244	2.033	.291	2.023
	D	13	43.577	58.787	7.67	2.127	2.930		
Total	N	27	50.326	178.866	13.37	2.574	2.339	1.252	2.023
	D	13	45.185	80.358	8.96	2.486	3.371		

ABBREVIATIONS USED IN APPENDICES I AND II

a approaches significance
* Significant beyond the .05 level of confidence
** Significant beyond the .01 level of confidence
*** Significant beyond the .001 level of confidence

I = Information
C = Comprehension
A = Arithmetic
S = Similarities
V = Vocabulary
DS = Digit Span
PC = Picture Completion
PA = Picture Arrangement
BD = Block Design
OA = Object Assembly
Co = Coding
M = Mazes

ITPA #1 = Auditory Decoding
ITPA #2 = Visual Decoding
ITPA #3 = Auditory-Vocal Association
ITPA #4 = Visual-Motor Association
ITPA #5 = Vocal Encoding
ITPA #6 = Motor Encoding
ITPA #7 = Auditory-Vocal Automatic
ITPA #8 = Auditory-Vocal Sequencing
ITPA #9 = Visual-Motor Sequencing

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