WISC PATTERNS AND READING ACHIEVEMENT

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CURRICULUM STUDIORUM

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INTRODUCTION

In our present society the ability to read well is both important and necessary. A poor reader will encounter difficulties in many areas of everyday living. Examples of the all-pervading influence of reading ability are too numerous for presentation.

The need to acquire reading skills is relatively new. Moreover, reading is now considered a complex process involving the total personality. Such a trend ranks reading as an object of many divergent disciplines. Philosopher and educator as well as neurologist and psychologist have studied the problem. The interest of the psychologist is revealed by the great number of researchers who have directed their scientific endeavours upon the reading process. The new importance of reading has biased their approach. Their efforts are overly concerned with the multiple causes and effects of poor reading. This is detrimental in as much as the determinants of normal reading become the product rather than the aim of their studies.

This apparently illogical approach is comprehensible when reading is viewed in its historical development. The widespread and serious repercussions of poor reading achievement are the products of our modern civilisation where literacy is a necessity. As a consequence, the individual who

cannot read requires help and becomes the object of research. In the study of the retarded reader, psychometrics are the most widely employed of the psychological techniques. This is not a contention that intelligence furnishes the full explanation of reading difficulties. Rather it represents an attempt to delimit the influence of a factor known to be correlated to reading, namely intelligence.

Psychometrics were first employed to establish the minimum mental age required for reading. Such studies revealed that poor intelligence accounted for only a small percentage of poor readers. As a consequence, other lines of attack evolved. It was thought that poor reading was perhaps the result of poor adjustment. The psychometric test patterns of poor readers were therefore compared to those of disturbed individuals. On the basis of such studies many authors contended that poor reading was one effect of personality disturbances. ther researchers hypothesised that the poor reader's approach to and understanding of reality was different from that of the good reader. He could not form or retain abstractions; his approach to reality was concrete. Thus he was handicapped in reading which requires abstractions and their retention. To check this hypothesis, the test patterns of poor readers were examined and found to reveal weaknesses

in the sub-tests requiring abstractions and retentive memory. In the literature these findings have not been critically assessed. Nevertheless it is evident that, if they prove to be right, they have serious educational and psychological implications.

This writer will study whether there is a relationship between reading achievement and WISC patterns. The first chapter will explain why poor readers have been so extensively studied. It will survey the literature concerning the causes of reading retardation. The second chapter will present the ways in which psychometric test patterns have been employed in the study of the poor reader. The interpretations offered to explain poor reading achievement will be given and the experimental designs of such studies critically assessed.

On this basis the need for further research will be evidenced and the hypothesis formulated. The third chapter will describe the sample and the experiment and explain the statistical analysis of the data. The final chapter will deal with the presentation and discussion of results. The obtained results will be given and discussed in terms of past and future researches.

CHAPTER I

CAUSES OF READING DIFFICULTIES

The theories offered to explain what reading essentially consists of are legion. The literature reveals that reading is no longer regarded as a simple process isolated from the total personality but as a very complex achievement involving the whole of personality[1].

Such a trend may be found in all the experimental sciences. New research always adds complexity to the object studied by raising new and controversial hypotheses. These in turn lead to more objective findings and to greater understanding of the object studied.

Although much insight has been gained into the factors that can prevent the acquisition of reading, we are still far removed from a complete definition of the reading process. The main reason for this is twofold: on the one hand the historical development of psychology and on the other the complexity of the reading process. The early considerations and beliefs concerning the reading process were based upon common rather than special observation. Theories evolved

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1 Guy Bond and Miles A. Tinker, Reading Difficulties, Their Diagnosis and Correction, New York, Appleton Century-Crofts, 1957, p. 18.

without recourse to scientific observation. The various definitions of the reading process did not originate in isolation. They were primarily philosophical conceptions about the nature of man from which psychological assumptions, theories of learning, and methods and definitions of reading were derived.

To delve into such considerations would too easily cause deviation from the purpose of the study. Nevertheless the present dilemma concerning definitions of reading and the bent of present researches into the causes of reading difficulties are, in part, attributable to this. Definitions of reading were derived primarily from philosophical constructs, ultimate explanations of reality. This meant that they were based upon broad conceptions of man and, in the main, deduced from empirical rather than experimental evidence. They focussed upon the overall aspect of reading rather than the elements required for reading and the role of each of these.

The definitions offered were too broad and general to cast much light upon the nature and importance of the factors required for reading. The idealists state that knowledge is limited to psychical reality, with reading an abstract exercise, while the behaviourists claim that learning

is a motor response[2]. Neither readily explains the reading process. The weight of each factor required for reading is not touched upon. History reveals that psychology has become more experimental in as much as recourse to laboratory techniques replaced generalisations derived from simple observation. In spite of this, definitions of reading were not the focus of research. Due to practical necessity the approach to reading dealt more fully with the causes of reading retardation. This approach attempted to show what is lacking in those individuals who cannot read, thus preparing the way for ultimately defining the reading process.

Reading appears to have suffered the same fate and followed the same evolution as the concept of health. In medicine more is known about disease than health, and the latter is defined in terms of the absence of the former. Similarly we are gaining insight into the elements of reading by our growing knowledge of the poor reader. Studies of what is found lacking in the retarded reader will eventually lead to a more thorough knowledge of the requirements for reading and help provide a complete definition of the reading process. A partial justification of the above statements

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2 Lowry W. Harding, "Assumptions Underlying Methods of Beginning Reading", Educational Administration and Supervision, Vol. 37, No. 1, issue of January 1951, p. 25-37.

is found in the 1959 issue of The Annual Review of Psychology[3] where one hundred and seventy nine studies on factors related to reading disability are reported. But none of the research is directly concerned with the normal reading process. Reports such as those of Harris[4] and Robinson[5] emphasize the importance in reading achievement of visual, neurological, auditory, speech, intelligence, emotional and environmental factors.

These studies are representative of the research being done. Retarded readers are the subjects under scrutiny. The emphasis is on the causes of the retardation rather than on the normal reader or reading as such. Although the literature abounds with studies on the importance of the foregoing factors in poor reading achievement, there is little uniformity in ascribing the relative importance of each factor. Few attempts are made to define or classify the elements necessary to the normal reading process.

To the writer this is a healthy and temporary state due to the complexity of the object of study and also, because of his handicap, to the fact that the poor reader

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3 The Annual Review of Psychology, Annual Reviews Inc., Palo Alto, California, Vol. 10, 1959, p. 112.

4 Albert J. Harris and Florence G. Roswell, "Clinical Diagnosis of Reading Ability", The Journal of Psychology, Vol. 36, second half, issue of October, 1953, p. 323-340.

5 Helen Mansfield Robinson, Why Pupils Fail in Reading, Chicago, The University of Chicago Press, 1946, p. 3.

requires closer scrutiny and researeh. Reading consists of three major elements; the subject, the object or reading matter and, lastly, the interaction of both. Each of these three elements is far from being completely understood and there arises, therefore, the difficulty in achieving a clear and complete definition of reading. This also explains why definitions of reading and elements deemed relative to the process are so varied and oftentimes contradictory. The writer accepts that reading is a complex process involving the three previously mentioned elements. The whole of personality enters into reading.

In this study Tinker and Bond's definition of reading is the one accepted. The definition is as follows:

> Reading involves the recognition of printed or written symbols which serve as a stimuli for the recall of meanings built up through the reader's past experience. New meanings are derived through manipulation of concepts already in his possession. The organisation of these meanings is governed by the clearly defined purposes of the reader. In short the reading process involves both the acquisition of the meanings intended by the writer and the reader's own contribution in the form of interpretation, evaluation, and reflection about these meanings[6].

Thus the three main elements of reading, though not defined, are taken into account. These are the subject,

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6 Bond and Tinker, Ibid., p. 19.

the object and the interaction of both. With the variety and incompleteness of definitions of the reading process explained and its complexity stressed, we shall now proceed to a report on the known causes of reading difficulties.

Among the numerous researches concerned with the "why" of reading difficulties, the following factors are deemed causally related to reading retardation: visual, neurological, auditory, speech, emotional, social, environmental and intelligence. Although not exhaustive, this list represents the areas where most of the research has been conducted. This study is concerned with intrinsic factors influencing reading achievement. Thus social and environmental factors will not be touched upon.

1. Visual Factors.

When a reading problem arises the first question concerns possible visual defects. This area has received more than its share of research but, unfortunately, the results of these have blurred rather than clarified the issue[7]. Although most writers agree that visual deficiency may be a factor in specific cases, they are in disagreement concerning

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7 Bond and Tinker, Ibid., p. 65.

the role and weight of visual deficiencies as causative factors in reading retardation. The studies of Robinson and Hueslman[8] and others have found that as many as sixty per cent of pupils of all scholastic levels manifest visual defects, but the correlation between reading and visual tests is not found to be statistically significant. One aspect studied is visual acuity. Robinson defines this as "sharpness or keenness of vision as measured by a standard test - at a standard distance"[9]. The Snellen Chart has been extensively used for such studies.

Inadequate visual acuity, caused by errors of refraction, is often associated with reading difficulties. Hyperopia, according to Farris[10], shows a greater incidence in poor than in unselected or good readers whereas myopia is found more often in good rather than in poor readers. In her study, Robinson[11] found that astigmatism bears less

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8 H.M. Robinson and C.B. Hueslman, Jr., "Visual Efficiency and Progress in Learning to Read", Supplementary Educational Monographs, No. 77, issue of 1953, p. 31-63.

9 Robinson, Ibid., p. 12.

10 L.P. Farris, "Visual Defects as Factors Influencing Achievement in Reading", The California Journal of Secondary Education, No. 10, issue of 1934, p. 50-51.

11 Robinson, Ibid., p. 19.

relationship to reading difficulty than either hyperopia or myopia. She also states that astigmatism is conducive, in some instances, to good reading.

The usual procedure in the study of the relationship between visual factors and reading achievement is to compare the visual characteristics of good and poor readers. Results of these vary widely. Some findings reveal a large number of poor readers to have visual defects; other research finds few differences of visual characteristics between both groups. In a study of sixty-four good and poor readers and, by means of the Telebinicular screening tests and optometrical examinations, Fendrick[12] found trends in both groups but little to suggest differentiation of the groups on the basis of their visual characteristics. With subjects chosen from a college population, Swanson and Tiffin[13] came to similar conclusions. In her extensive study of twenty-two cases, Robinson[14] found visual difficulties to be partial factors of their reading difficulties

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12 Paul Fendrick, Visual Characteristics of Poor Readers, New York, Columbia University, 1935, p. 47.

13 D.E. Swanson and J. Tiffin, "Betts Physiological Approach to the Analysis of Reading Disabilities as Applied to the College Level", The Journal of Educational Research, Vol. 29, No. 6, issue of February 1936, p. 433-448.

14 Robinson, Ibid., p. 223-224.

whereas Witty and Kopel[15] stated that visual characteristics of good and poor readers were not significantly different.

Strabism, the lack of binocular co-ordination, may bear some relationship to reading achievement. While Robinson and Hueslman[16], Witty and Kopel[17], and Edson[18] found that ocular imbalance could be a factor in poor reading, Swanson[19] came to the opposite conclusion. Witty and Kopel[20] minimised the importance of fusion of objects of both eyes in reading problems.

Dearborn and Anderson[21] found statistically significant differences between the good and poor readers. The

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15 Paul Witty and D. Kopel, "Factors Associated with the Etiology of Reading Disability", The Journal of Educational Research, Vol. 29, No. 6, issue of February, 1936, p. 449-459.

16 Robinson and Hueslman, Ibid.

17 Witty and Kopel, Ibid.

18 W.H. Edson, A Study of the Relationship between Visual Characteristics and Specific Silent Reading Abilities, unpublished Ph.D. thesis, Minneapolis, University of Minnesota, 1950.

19 Swanson, Ibid.

20 Witty and Kopel, Ibid.

21 A.F. Dearborn and I.H. Anderson, "Aniseikonia as Related to Disability in Reading", The Journal of Experimental Psychology, Vol. 26, issue of December, 1938, p. 559-577.

basis of this differentiation was whether or not the ocular images of an object were equal in size and shape for both eyes. The good reader was superior to the poor. The conclusion of all studies of vision in good and poor readers shows that although visual defects may contribute to reading difficulties, the extent and importance of these is highly controversial. Nevertheless factors such as myopia, hyperopia, binocular un-coordination, fusion difficulties and aniseikonia appear to be concomitant factors in reading achievement.

2. Neurological Factors.

Neurological factors judged causal in reading problems include damage to or lack of development or function of the brain, and lack of dominance, i.e. inconsistent preference of one cerebral hemisphere[22]. According to Head[23] it was postulated, as early as the nineteenth century, that local brain injury could disturb the use of language. Studies of the relationship between certain areas of the brain and certain functions led to formulation of the term "word-blindness". A sufferer from this condition is unable to

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22 Robinson, Ibid., p. 34.

23 Henry Head, Aphasia and Kindred Disorders of Speech, Vol. I, New York, Macmillan, 1926, xvi-549 p.

remember word forms. Word-blindness may be either acquired or innate.

Hinshelwood[24] believed this condition to be caused by disorders in the visual centres of the brain. Although word-blindness is accepted as a symptom, there is to date no definite and accepted proof that it results from damage in a definite area of the brain. Hinshelwood is duly criticized for his statement that word-blindness in children, their inability to learn to read by ordinary methods, is of the same nature as acquired word-blindness, the loss of ability to read because of injury to the brain. Tinker[25] believes that although many children receive minor birth injuries, they betray no clinical signs of these[26] and it is probable that reading disability due to brain injury is relatively rare.

The role of lateral dominance in reading achievement is a hotly disputed topic. Much that has been written is

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24 James Hinshelwood, Congenital Word-Blindness, London, Lewis, 1917, ix-112 p.

25 Bond and Tinker, Ibid., p. 98.

26 F.R. Ford, Diseases of the Nervous System in Infancy, Childhood and Adolescence, Springfield, Charles C. Thomas, 1944, p. 877-886.

highly conflicting. The theory of cerebral dominance was first propounded by Orton[27]. Tinker[28] summarises his theory as follows: Orton suggests that memory images or records of letters and words exist in the brain in both right and left orientations, one in each hemisphere like mirror images. Orton claims that learning to read involves selecting the memory images in one hemisphere, the dominant one.

Where there is marked cerebral dominance, usually manifested by either dominant right or left handedness, the child ordinarily has no difficulty in learning to read. However, if the child has not developed either right or left dominance at the time he has begun to read, conflict between both sides of the brain will arise. Either right or left orientation of letter sequences may be aroused upon looking at a word, according to which hemisphere happens to take the lead. The result is a tendency to make reversals in reading.

Jastak[29] criticized Orton because he had explained the cause from the symptom rather than by experimental proof.

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27 Samuel Orton, Reading, Writing and Speech Problems in Children, New York, W.W. Norton, 1937, 215 p.

28 Bond and Tinker, Ibid., p. 100.

29 Joseph Jastak, "Interference in Reading", The Psychological Bulletin, Vol. 31, No. 4, issue of April, 1934, p. 244-272.

Among the studies which found support for Orton, are those of Dearborn[30], Eames[31], and Monroe[32]. On the other hand these of Gates and Bond[33], and Witty and Kopel[34] find little to substantiate the relationship of dominance and reading problems.

The conclusion of this survey is that although dominance may be a contributing factor in reading problems, the extent of its relevance to reading retardation is far from established.

3. Auditory Factors.

Since learning to read depends upon the development of speech, a hearing impairment, by contributing to a speech retardation, appears to readily lead to reading difficulties.

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30 F.W. Dearborn, "The Nature of Special Abilities and Disabilities", School and Society, Vol. 31, issue of May, 1930, p. 632-636.

31 T.H. Eames, "The Anatomical Basis of Lateral Dominance Anomalies", The American Journal of Orthopsychiatry, Vol. IX, No. 3, issue of July, 1939, p. 524-528.

32 Marion Monroe, Children Who Cannot Read, Chicago, University of Chicago Press, 1932, p. 90.

33 A.I. Gates and G.L. Bond, "Relation of Handedness, Eye Sighting and Acuity Dominance to Reading", The Journal of Educational Psychology, Vol. 27, No. 6, issue of September, 1936, p. 450-456.

34 Paul Witty and D. Kopel, "Sinistrad and Mixed Manual-Ocular Behavior in Reading Disabilities", The Journal of Educational Psychology, Vol. 29, No. 6, issue of February, 1936, p. 119-134.

Likewise the failure to discriminate sounds, which are basic to reading obviously interferes with the normal acquisition of reading.

Kennedy[35], Henry[36] and Robinson[37] found that where difficulties in the discrimination of high frequencies were encountered the reading achievement tended to be poor.

In general the hearing ability of school children does not tend to be correlated with reading ability[38]. The lack of research is most evident in cases of children who are unable to distinguish fine differences in sounds or to blend component sounds of a word into a word unit although no hearing deficiency is measurable by tests[39].

In conclusion it may be stated that poor readers differ from good readers in high tone discrimination rather than in gross hearing as such[40].

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35 A.H. Kennedy, "A Study of Children's Hearing as it Relates to Reading", The Journal of Experimental Education, Vol. 10, No. 2, issue of June, 1942, p. 238-251.

36 S. Henry, "Children's Audiograms in Relation to Reading Attainment", The Journal of Genetic Psychology, Vol. 71, first half, issue of September, 1947, p. 3-63.

37 Robinson, Ibid., p. 51.

38 Monroe, Ibid., p. 95.

39 Bond and Tinker, Ibid., p. 93.

40 Bond and Tinker, Ibid., p. 93.

4. Motor and Speech Disturbance.

An appreciable number of retarded readers exhibit poor motor coordination as manifested by their awkwardness in writing, walking, running and other related activities[41]. Monroe[42] noted that some of her cases showed a lack of precision in motor control and suggested that this may be an important concomitant of reading retardation. This statement is representative of the literature concerning the role of motor control in reading.

Speech defects are a form of motor un-coordination[43] and Monroe[44] notes a reciprocal relation between speech and reading. The elements are common to both and, therefore, faulty articulation may lead to reading difficulties. The literature is not univocal in ascribing a relation between reading and speech difficulties. Although Monroe[45] and Robinson[46] see such a relation, they interpret it as due to the inability to discriminate the sounds of words rather than to speech handicap.

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41 Bond and Tinker, Ibid., p. 95.

42 Monroe, Ibid., p. 99.

43 Monroe, Ibid., p. 99.

44 Monroe, Ibid., p. 99.

45 Monroe, Ibid., p. 95.

46 Robinson, Ibid., p. 145.

5. Emotional Factors.

Opinion is much divided as to whether reading retardation causes emotional problems or whether problems cause reading retardation. It is nevertheless agreed that, in the majority of cases, both are closely interrelated and to ascribe causality or effect to one or the other is extremely difficult. The views vary from those of Gates[47] to Gann[48] to Fernald[49]. Gates believes that emotional problems are the cause while Gann holds the opposite view and Fernald an intermediate one.

As a conclusion it may be said that although studies such as those of Sornson,[50] Robinson[51] and Blanchard[52] show poor readers to have greater personality disturbances than good readers, little statistical proof for their contentions is offered.

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47 Arthur G. Gates, "The Role of Personality Maladjustment in Reading Disability", The Journal of Genetic Psychology, Vol. 59, first half, issue of September, 1941, p. 82-89.

48 Edith Gann, Reading Difficulty and Personality Organization, New York, Kings Crown Press, 1945, p. 131-132.

49 Grace M. Fernald, Remedial Techniques in Basic School Subjects, New York, McGraw-Hill, 1943, 349 p.

50 H.H. Sornson, A Longitudinal Study of the Relationship between Various Child Behaviour Ratings and Success in Reading, unpublished Ph.D. thesis, University of Minnesota, Minneapolis, 1950.

51 Robinson, Ibid., p. 225-226.

52 P. Blanchard, "Reading Disabilities in Relation to Maladjustment", Mental Hygiene, Vol. 12, No. 4, issue of October, 1928, p. 772-788.

This brief summary has presented the factors judged to be causally related to reading achievement. In their selection the writer limited himself to reports on those factors to which the greatest amount of research and importance had been ascribed. Other factors, such as glandular disturbances, sex, home conditions, methods of teaching, temporal perception and others, were not given but this in no way implies limitations in their importance.

As the factor of intelligence is the one upon which the study is focussed, it was deemed appropriate to present it in a separate chapter.

CHAPTER II

INTELLIGENCE AND READING

The interest of researchers into the causes of reading retardation is of long standing and the paths followed in the discovery of factors linked to reading disabilities are many. Although numerous factors, whether singly or collectively, have been judged relevant to reading achievement, there is a semblance of accord among the theories propounded. The factors known to influence reading are given varying weights according to the author's school of thought but the same factors keep recurring in the literature.

Evident in all listings is the factor of intelligence with which all investigators agree there is a positive relationship. The literature shall now be surveyed to study the various ways in which intelligence and intelligence test patterns are judged causally related to reading achievement. From this analysis will be seen the need for further studies and a specific research hypotheses will be drawn up.

1. Intelligence Test Results and Reading Achievement.

The literature reveals four major ways in which the relationship between intelligence test results and reading achievement has been studied. They are: the minimum intelligence required for reading, intelligence test patterns as predictors of potential literacy, test patterns of poor readers as indices of personality deviations, and test patterns as revealing specific mental make-up.

The minimum intelligence required for reading:- As early as 1922 McCall[1] and Gray[2] gave subnormal intelligence as a definite cause of reading failure. In 1937 Monroe and Backus[3] seconded this finding. The summary of their findings is that pupils who are retarded in general intellectual development are also retarded in reading achievement.

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1 William A. McCall, How to Measure in Education, New York, Macmillan, 1922, p. 109-111.

2 William S. Gray, et al, "Remedial Cases in Reading: Their Diagnosis and Treatment", Supplementary Educational Monographs, No. 22, issue of 1922, p. 12.

3 Marion Monroe and Bertie Backus, Remedial Reading: A Monograph in Character Education, Boston, Houghton Mifflin, 1937, xi-171 p.

Most investigators[4] found that a mental age of six is required for learning to read. Progress will be limited to a level of achievement equal to their respective mental ages.

These findings had limited use as they explained the reading difficulties of only a small percentage of poor readers, those intellectually limited. Further research among poor readers found that the distribution of intelligence in retarded readers corresponded to that of children of the same age in the general population[5]. Thus low intelligence accounts for only a small proportion of retarded readers. Such a conclusion has given impetus to the search for other means of employing intelligence tests to identify poor readers. If intelligence test scores as such do not give a complete answer, could psychometric test patterns reveal any further insights into the causes of reading retardation?

Three avenues of attack have evolved in answer to this question. The hypotheses were as follows: Are intelligence test patterns predictive of potential literacy?

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4 Robinson, Ibid., p. 71

5 Robinson, Ibid., p. 68.

Can intelligence test patterns of poor readers be indicative of specific types of personality deviations? Do intelligence test patterns of good and poor readers reveal differences in specific abilities?

Intelligence test patterns; indices of potential literacy:- In his first study Altus[6] attempted to predict potential literacy on the basis of psychometric test patterns. The subject of his study were illiterate candidates in an Army Training Centre. From their results on the Wechsler Bellevue Mental Ability Scale, Form B, he concluded that high scores on information, arithmetic and digit symbol were useful in predicting the ability to reach a fourth grade level of literacy in a period of six weeks. Later he investigated this same finding from the opposite point of view[7]. Whereas he had previously passed from test pattern to achievement, now he went from achievement to test pattern. He analysed the WISC profiles of twenty-five poor readers consisting of twenty-four boys

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6 T. Grace Altus, "The Differential Validity and Difficulty of Subtests of the Wechsler Mental Ability Scale", Psychological Bulletin, Vol. 42, No. 4, issue of April, 1945, p. 238-249.

7 T. Grace Altus, "A WISC Profile for Retarded Readers", The Journal of Consulting Psychology, Vol. 20, No. 2, issue of April, 1956, p. 155-156.

and one girl all of whom had a mean I.Q. of 86. His results confirmed his previous findings.

These two studies are the only ones reported to have considered this aspect of the relationship between reading and intelligence test patterns. The results obtained are open to serious question. In considering the experimental design, Altus should have controlled all factors capable of influencing test patterns with the exception of reading achievement, the variable to be systematically varied. This was not done. In no way did he attempt to control age, sex, I.Q., or any other factor known to influence test patterns.

The next group of studies to be reported attempted to link intelligence test patterns of poor readers with those which Wechsler ascribes to the psychopath and to the hysteric[8].

Test patterns of poor readers; indices of personality deviations:- Foremost among those who studied this aspect of test patterns are Coley[9], Herst and Portimer[10],

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8 David Wechsler, The Measurement of Adult Intelligence, Baltimore, Williams and Wilkins, 1944, p. 146-167.

9 H.T. Coley, A Statistical Study of the Wechsler Bellevue Pattern for Poor Readers, unpublished Master's thesis, University of Denver, 1949.

10 Wilma E. Herst and Lillian G. Portimer, "The Wechsler Scale as a Diagnostic Tool for Cases of Reading Disability", Journal of the Colorado and Wyoming Academy of Science, Vol. 4, issue of 1951, p. 77.

and Graham[11]. These authors found that Wechsler Bellevue patterns of poor readers, of adolescent age, were similar to those which Wechsler ascribes to the adolescent psychopath[12].

This reported similarity was overly stressed. What they really found is that poor readers rate higher on performance than on verbal tests. Although this finding is in some ways similar to the psychopath's pattern, it cannot be interpreted as equivalent.

In a later study Graham[13] found that, with the exception of similarities, the patterns of poor readers of adolescent age showed weaknesses in the verbal scale. He interpreted this profile as due to repression and thus equivalent to that of an hysteric.

The common conclusion from all these reports is that as a group the poor readers, in the adolescent age group, do achieve higher on the performance than with the verbal items of the Wechsler Bellevue Intelligence Scale.

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11 E.E. Graham, An Exploration of a Theory of Emotional Basis for Reading Failure, unpublished Ph.D. thesis, University of Denver, 1951.

12 David Wechsler, Ibid., p. 151, 155-156.

13 E. Ellis Graham, "Wechsler Bellevue and WISC Scattergrams of Unsuccessful Readers", The Journal of Consulting Psychology, Vol. 16, No. 4, Issue of August, 1952, p. 268-271.

All these studies are highly questionable. They have overly emphasised the personality deviations possible in poor readers, basing their results solely on poor readers of the adolescent age group and acceptance per se of Wechsler's diagnostic signs of psychopathy. Nevertheless these are not the main weaknesses of the reports.

In no study done with the Wechsler Bellevue are attempts made to control any of the many factors known to influence either test patterns or reading achievement. Many factors including age, years of schooling, home background, sex and intelligence level, are either disregarded or not mentioned. One conclusion is evident on the basis of the above: the results obtained in studies of the poor readers which employ the Wechsler Bellevue need to be rejected or seriously questioned. The last reported studies of intelligence test patterns of poor readers are those of Triggs[14], Burks and Bruce[15]. In these the psychometric tools employed are the Stanford Binet Test and the Wechsler Bellevue Intelligence Scale for Children.

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14 Francis Triggs, et al, "The Relationship between Specific Reading Skills and General Ability at the Elementary and Junior High School Levels", The Journal of Educational and Psychological Measurement, Vol. 14, No. 1, issue of Spring, 1954, p. 176-185.

15 F. Harold Burks and Paul Bruce, "The Characteristics of Poor and Good Readers as disclosed by the Wechsler Intelligence Scale for Children", The Journal of Educational Psychology, Vol. 46, No. 8, issue of December, 1955, p.488-493.

Test patterns of good and poor readers, indices of specific abilities:- A fourth area of research attempts to ascertain whether the test patterns of poor or good readers reveal any specific patterns. When such are found, they are interpreted to be the effect of the lack, or presence, of certain specific abilities, discernible by psychometrics, which influence reading achievement.

All these studies were done with children and emphasised the possible lack of specific abilities rather than personality disturbances. This particular aspect of study is not new. It is in accordance with a statement of Robinson's: "Although the general intelligence of the poor reader is adequate, many investigators have felt that they may have specialised mental weaknesses"[16].

Grace Arthur[17] was the first to name such mental weaknesses. In a study of twelve readers and fourteen non-readers, he found that when vocabulary scores on the Stanford Binet are translated into I.Q. ratings, those of the poor reader fall below his Binet I.Q. Added to this he found that poor readers performed better on the Kulhman

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16 Robinson, Ibid., p. 72.

17 Grace Arthur, "An Attempt to sort Children with Specific Reading Disability from other Non-Readers", The Journal of Applied Psychology, Vol. XI, No. 4, issue of August, 1927, p. 251-263.

Performance Scale than on the Binet. On the basis of these findings he concluded that one might wonder whether non-readers are not "essentially non-verbalists". Monroe and Backus[18] also studied the performance of poor readers on the Binet.

They found that vocabulary scores were below mental age level and that difficulty was experienced with tests involving forms as well as with digit and sentence repeating tests of the Binet. As with Arthur's[19] group, the poor readers obtained higher mental ages on performance rather than on verbal items.

In the search for trends it appears that the studies done with the Binet are in accord with those conducted with the Wechsler Bellevue. Both groups report the poor reader's weakness on verbal items and apparent superiority on performance tests. A close scrutiny of the experimental designs of these researches renders acceptance of such a trend highly questionable. A study done by Bond and Fay[20] came to

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18 Marion Monroe and Bertie Backus, Remedial Reading: A Monograph in Character Education, Boston, Houghton Mifflin, 1937, p. 21.

19 Arthur, Ibid.

20 Guy Bond and Leo Fay, " Comparison of the Performance of Good and Poor Readers on the Individual Items of the Stanford Binet Scale, Forms L and M", The Journal of Educational Research, Vol. 43, No. 6, issue of February, 1950, p. 475-479.

conclusions that reject Arthur's[21] assumption that, on the basis of their Binet results, the poor reader could be described as a "non-verbalist". They analysed the Binet responses of good and poor readers of grades four to six. From this analysis they found that good readers performed significantly better on items dependent upon use of words while poor readers were superior on non-verbal and memory items.

They rejected the assumption that good readers were superior on verbal items and poor readers superior on performance items. They ascribed this apparent superiority of the good reader to the fact that the Binet subtests required reading achievement which the poor reader did not possess. Thus the poor reader did not achieve on verbal items of the Binet because these items required reading ability and not because of any "mental weaknesses"[22]. The basis of their criticism is clear and simple. This test is too dependent upon reading achievement and unamenable to pattern analysis. Thus the conclusion is evident: results used in previous studies employing the Binet cannot be accepted. They suggested that in order to compare good and

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21 Arthur, Ibid.

22 Robinson, Ibid., p. 72.

poor readers an intelligence test less dependent upon reading achievement should be used.

Recent researches have taken these arguments into account. The greater part of the latter work done in the area of intelligence test patterns and reading achievement employs the WISC. From these studies a trend similar to that found with the Binet and Wechsler Bellevue is evident; non-readers or poor readers rate higher on performance than on verbal items while the contrary is characteristic of the good reader.

The first study conducted with the WISC is that of Graham[23]. His conclusions are compatible with those previously reported. He analysed the WISC patterns of thirty-seven children classified as unsuccessful readers. He found all performance tests, save digit symbol, to be above the mean of all subtests and all verbal tests, save comprehension and similarities, below the mean. Arithmetic was significant at the one per cent level of confidence while digit symbol and vocabulary were significant at the five per cent level of confidence. Similarities was above the mean at the one per cent level of confidence. He arrived at the

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23 E. Ellis Graham, "Wechsler Bellevue and WISC Scattergrams of Unsuccessful Readers", The Journal of Consulting Psychology, Vol. 16, No. 4, issue of August, 1952, p. 268-271.

same conclusion as he did in his study of the poor reader of the adolescent age group. The pattern of the poor reader is comparable to that of a psychopath. Criticism against Graham is similar to that attributed to the previously reported studies. In no way did he attempt to control the variables known to influence WISC results.

The next reported study employing the WISC is that of Triggs[24]. She attempted to determine the relationship between specific reading skills and two aspects of intelligence: verbal and non-verbal. It was believed that if any relationship were found it could help in the development of teaching methods utilising non-verbal capacities.

Her reasons for this study were that the literature, especially studies reported by Strang[25] and Wheeler[26], showed reading to be closely related to verbal and non-verbal abilities. The subjects of Trigg's study were thirty-six students in grades seven to twelve and forty students in grades four

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24 Frances Triggs, et al., "The Relationship between Specific Reading Skills and General Ability at the Elementary and Junior and Senior High School Levels", The Journal of Educational and Psychological Measurement, Vol. 14, No. 1, issue of Spring, 1954, p. 176-185.

25 Ruth Strang, "Relationships between Certain Aspects of Intelligence and Certain Aspects of Reading", The Journal of Educational and Psychological Measurement, Vol. 3, No. 4, issue of Winter, 1943, p. 355-359.

26 Lester R. Wheeler, "The Relation of Reading to Intelligence", School and Society, Vol. 70, No. 1816, issue of October 8, 1949, p. 225-227.

to six. They were assessed by means of the Wechsler Bellevue or the WISC and the Diagnostic Reading Tests, Survey Section. She found that the reading skills measured, word recognition, comprehension, vocabulary and rate of reading, showed greater correlation to verbal than to non-verbal abilities. The trend of Trigg's findings is in accord with the literature. Reading achievement is more highly correlated with verbal than with non-verbal ability, as measured by the Wechsler Bellevue and WISC. This study did not attempt to explain the "why" of its findings but merely to assess and verify previous findings. It suggests that methods of teaching reading should consequently be developed which would take into account the poor reader's lack of verbal ability. Unfortunately the study did not control the variables capable of influencing test patterns and thus the sample employed could have unduly biased the obtained results, rendering her conclusions false.

The next study encountered is that of Burks and Bruce[27]. They hypothesised that poor readers may be relatively weak in those parts of intelligence tests which resemble vital characteristics inherent in written language; these

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27 Harold F. Burks and Paul Bruce, "The Characteristics of Poor and Good Readers as disclosed by the Wechsler Intelligence Scale for Children", The Journal of Educational Psychology, Vol. 46, No. 8, issue of December, 1955, p. 488-493.

are the ability to use long or short term symbolic memories and retentive memory. The subjects of the study were eleven good readers, consisting of five boys and six girls with a mean I.Q. of 117 and thirty-one poor readers, five girls and twenty-six boys, with a mean I.Q. of 101. In terms of months' deviation from average WISC M.A.[28], the poor reader revealed a pattern differing from that of the good reader. The poor reader was below his average WISC M.A. at the one per cent level of confidence on information and coding, and at the five per cent level for arithmetic, while picture arrangement, block design and comprehension were above at the one per cent level. The good reader's score on similarities was above his average WISC M.A. at the five per cent level of confidence while picture arrangement was his lowest score.

The results were interpreted in terms of Goldstein and Scheerer's[29] concepts of the concrete and abstract "attitude". By "attitude", they imply a capacity level of the total personality in a specific plane of activity.

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28 David Wechsler, Wechsler Intelligence Scale for Children, New York, The Psychological Corporation, 1949, p. v-114.

29 Kurt Goldstein and Martin Scheerer, Abstract and Concrete Behaviour, An Experimental Study with Special Tests, American Psychological Association, Inc., Northwestern University, Evanston, Illinois, 1941, 151 p.

By definition the concrete attitude implies that one acts without reflection, conceptualising or symbolising. The abstract attitude leaves the immediate stimuli and, with the use of symbols as tools, forms concepts and generalisations about the experience. On the basis of these definitions the patterns of each group were explained. The poor reader obtained high scores on comprehension, block design and picture arrangement because these tests give immediate structural stimuli without requiring long or short term symbolic memories. Abstract behaviour or retentive memory are not demanded. The poor reader was unsuccessful on information, arithmetic and digit symbol for the opposite reasons: these tests require memory functions and a given stimulus does not remain immediately available. The picture arrangement subtest rates highest for the poor reader and lowest for the good reader because it calls for concrete behaviour. The authors were unable to explain why the poor reader did so well on similarities which is a measure of verbal concept formation or what Wechsler calls abstract thinking[30]. The pattern of the good reader showed no particular profile of significant deviations with the exception

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30 David Wechsler, The Measurement of Adult Intelligence, Baltimore, Williams and Wilkins, 1944, p. 155.

of similarities which was the highest score but not to a significant degree.

The authors accept as proven their hypothesis that WISC patterns of good readers show good retentive memory and an ability to use abstractions; whereas poor readers approach the learning situations in a concrete manner because of their inability to handle abstractions and of their poor retentive memory. Thus the poor reader is handicapped in reading, a process which consists of abstractions dependent upon memory.

Although the study of Burks and Bruce is one of the few where the instrument seems acceptable and where attempts are made to offer theoretical explanations of the results, the experimental design reveals many shortcomings. Their sample included eleven good readers, one or more years above grade level on the Wide Range Achievement Test, and thirty-one poor readers, one or more years below this same criterion. The good readers consisted of six girls and five boys with an average I.Q. of 117 whereas the poor readers consisted of five girls and twenty-six boys with an average I.Q. of 101. The grade range, for both groups, was from grades three to eight. Thus this study did not control many of the factors capable of influencing WISC patterns, namely sex, age, intelligence, grade level and number of years of schooling.

Thus it appears that although we are now offered a theoretical explanation of the poor reader's WISC pattern, we must proceed to repeat the experiment before accepting the results of Burks and Bruce's study.

This last study of Burks and Bruce has been more fully presented because of its originality. This originality lies not so much in their ascribing specific test patterns to poor and good readers as in their attempts to offer a theoretical explanation of these differences. Theirs is the only study which the writer found to give a hypothetical explanation for pattern differences. On the basis of WISC patterns they concluded that the poor readers are weak in abilities inherent in reading; that is a good retentive memory and an ability to use abstractions. The good reader, on the other hand, shows superiority in these same areas. Although it was not a new discovery that the poor and good readers showed pattern differences on intelligence tests, a new vista was opened in the interpretation of these differences. Other authors found similar significant differences but offered limited explanations of these.

2. Need of the Study.

A critical review of the literature has brought out one blatant fact. All the reported studies on psychometric

test patterns of good and poor readers reveal weaknesses in experimental design. In the study of test patterns of the good and poor reader the control of all factors, except reading level, known to influence test results is overlooked. When they proceed to analyse their obtained results they are, therefore, unjustified in attributing pattern differences to reading achievement. It could very well be that other factors known to affect test results, for example age, sex, personality disturbances, could wholly or partially account for the differences found. Thus any conclusions which they may have reached remain highly questionable. The need for further study in this area is evident.

3. Formulating the Hypothesis.

Most of the studies of the handicapped reader posit the multi-causal aspect or interpretation of reading difficulties. Few deny that in individual cases where gross physical, intellectual or personality limitations exist there may be a unitary cause fully capable of explaining the reading handicap. Nevertheless the most widely accepted view attributes the majority of reading difficulties not to one but to a variety of causes, the respective weight of each factor varying according to the individual case.

To date the weight of each factor known to influence reading achievement is given varying importance according to the author's point of view and particular school of thought. It is hoped that as each causative factor becomes better known and more rigidly isolated, the respective weight of each will be more readily and objectively assessed and its particular influence more easily delimited. Intelligence, which all authors agree exerts an influence on reading achievement, is a factor of particular interest to the psychologist.

Intelligence tests measure the higher levels and abilities required for reading. Thus a study of the psychometric test patterns of matched individuals of varying levels of reading achievement may cast light upon the relationship of intelligence and reading. These patterns may show the varying presence of a common characteristic or characteristics in each group according to their reading level. To date no acceptable research is reported showing if and why intelligence test patterns of good and poor readers differ. Although, in the reported studies, not all factors known to influence test patterns are kept constant, the literature contends that psychometric test patterns may vary according to reading achievement.

This variability needs to be substantiated by experimentation. If such exists, it may offer a partial explanation of reading handicaps. The underlying rationale of this contention is that there may exist in all poor readers a common basis or bases for their handicap which psychometrics may measure, delimit and explain. This statement does not aim at discrediting other factors as causative to reading difficulties. Rather it aims at focusing our attention upon one of the causes of reading difficulties, i.e. intelligence. The aim is to ascertain if intelligence, as revealed by psychometric test patterns, can discriminate between the good and poor reader.

Now the hypothesis may be formulated: "When all factors known to affect WISC patterns are controlled, there are no significant differences between the WISC patterns of good, average and poor readers which warrant positing a common denominator or denominators, relative to intelligence, which can partially explain the level of reading achievement".

The review of the literature has been presented and critically surveyed, the need of the study given, and the hypothesis formulated. Now we can proceed to the presentation of the experimental design.

CHAPTER III

THE EXPERIMENTAL DESIGN

This chapter will describe the sample, the experiment and the statistical tools employed in the study.

The study of the hypothesis required a population whose reading achievement and I.Q. were known. From this an experimental and a cross-validation group would be selected. With these groups, for which grade, sex, I.Q., and other factors were controlled, WISC patterns would be compared. The factor to be systematically varied was reading achievement.

Since the literature is not too definite on the role of the sex factor in reading achievement, the groups were made up of equal numbers of boys and girls. Thus if significant differences were found, it would be possible to determine if these were related to reading achievement or to the influence of the sex factor on WISC patterns. The study required individuals who were similar in age, I.Q. and sex but who differed in reading achievement. In limiting the sample to grades 5 and 6, age and sex would be automatically controlled. In order to control I.Q. and reading, tests were given. These were the WISC and the Dominion Tests, Achievement in Silent Reading.

1. The Sample.

Selection of the sample:- The population from which the sample was to be selected was made up of 517 pupils of grades five and six of the Ottawa Schools, English Section. The subjects were selected over a period of two scholastic years: 1956-57 and 1957-58.

The selection of the sample was done on the basis of results obtained on the WISC and the Dominion Silent Reading Tests. The groups selected were matched for variables known to influence WISC profiles. These were full scale I.Q., age, sex, number of years of schooling, unilinguality, absence of referal for personality problems and, lastly, absence of gross physical handicaps discernible by tests employed in the school system. Reading achievement was the factor to be systematically varied. Thus three groups, matched on the above variables, were chosen on the basis of their achievement on the vocabulary and paragraph tests of the Dominion Silent Reading Tests.

In the selection of an intelligence test for the study, the Wechsler Intelligence Scale for Children[1] was chosen. It was preferred to the Binet because it is less dependent upon reading achievement and more amenable to pattern analysis. Moreover the WISC was employed in the

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1 David Wechsler, Wechsler Intelligence Scale for Children, New York, The Psychological Corporation, 1949, p. v-114.

Table I.- The Distribution of Subjects in the Study as to School, Grade, Year of Testing and Sex.

School	Grade	Year	Boys	Girls	Total
1	5	56-57	18	12	30
	5	57-58	13	10	23
2	5	56-57	17	13	30
3	5	56-57	13	19	32
	5	57-58	13	12	25
4	5	56-57	21	19	40
5	5	56-57	15	9	24
	5	57-58	16	15	31
6	5	57-58	19	13	32
	5	57-58	19	16	35
	6	57-58	16	18	34
	6	57-58	7	9	16
	6	57-58	14	18	32
7	5	57-58	19	17	36
	5	57-58	20	16	36
	6	57-58	18	13	31
	6	57-58	17	13	30
7	12 5	5 10	275	242	517

study of hypotheses similar to the writer's.

The WISC was published in 1949. Although it grew from the Wechsler Bellevue Adult Intelligence Scale, it is a distinct and independently standardized test. It innovated the abandoning of the concept of mental age and the derivation of I.Q. by comparing the score obtained with one's own age group rather than with a composite age group. The WISC is adaptable to a population of from five to fifteen years of age.

Seashore's[2] report on the standardisation of the WISC[3] reveals the test to be well standardized. The WISC was standardised over a five year period on a sample of 100 boys and 100 girls at each age from five to fifteen years. There were 1,100 boys and 1,100 girls in the eleven age groups. The selected cases met sampling requirements based on the U.S. Census Bureau data for 1940.

The WISC consists of twelve tests divided into two groups, verbal and performance. The verbal scale consists of tests of information comprehension, arithmetic, similarities, vocabulary and one alternate test digit span. The

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2 Harold Seashore.-Wesman Alexander.-Dopplet Jerome., "The Standardization of the Wechsler Intelligence Scale for Children", The Journal of Consulting Psychology, Vol. 14, No. 2, issue of 1950, p. 99-110.

3 Wechsler, Ibid., p. 7-16.

performance scale consists of tests of picture completion, picture arrangement, block design, object assembly, coding and one alternate mazes. Answers given to subtests are converted into scaled scores and the totals of verbal and performance tests into I.Q's. The total of these latter two are then converted into a global I.Q.[4].

Of great usefulness for this study is Wechsler's equivalent test ages for the WISC[5]. This table permits arriving at mental ages for the respective subtests and at a mean mental age.

In the comparison of the groups this table was used because the extent of the deviation is easily seen and slight differences in average mental ability, between the groups of "good, average and poor" readers, are held constant. Thus a comparison can be made in like terms on the basis of their deviations from their respective mean mental ages.

The reading tests employed were from part of the Dominion Tests, Achievement in Silent Reading. They were Type I Vocabulary, Form A, for grades four to six[6], and

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4 Wechsler, Ibid., p. 5-6.

5 Wechsler, Ibid., p. 112-113.

6 Ontario College of Education, Toronto, Ontario, The Dominion Tests, Achievement Tests in Silent Reading, Type I Vocabulary, Grades 4-6, Copyright, 1946, Canada. (see Appendix

Type II Diagnostic Tests in Paragraph Reading, Form A, for grades five to six[7]. The main reason for the selection of these tests, aside from their being a good measuring instrument, was the fact that they had been standardized on an Ontario population. The new norms for both tests were obtained by a wide scale testing programme in 1952 which resulted in the 1953 Revision.

The administration of the Vocabulary Test requires about thirty minutes, of which twenty minutes are actual testing time. The test consists of seventy-five questions. In each question a word is given and is followed by a series of four other words. The subject must choose the word which goes best with the first, that is, which has a similar meaning. His selection is then underlined. The correction consists of comparing given answers to those presented in a key. Correct answers are added up and the total obtained compared to a table of norms where a corresponding grade score is given.

The administration of the Paragraph Test requires about forty minutes of which thirty are actual testing time. A series of seven paragraphs is presented. Every paragraph

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7 Ontario College of Education, Toronto, Ontario, The Dominion Tests, Achievement Tests in Silent Reading, Diagnostic Tests in Paragraph Reading, Grades 5-6, Copyright, 1948, Canada. (see Appendix

is followed by four questions for each of which five answers are given, one only to be underlined. The answers selected are compared with those of a key. The correct responses are then added up and the total compared with a table of grade norms where a corresponding grade score is presented.

Description of the sample:- The sample was composed of an experimental group and a cross-validation group. The experimental group consisted of three groups each of which contained ten boys and ten girls[6]. The members of each group had been matched on the previously mentioned variables. The groups were divided according to their achievement on the two reading tests.

The good reader was one whose reading age was one or more years above the norms of his class as well as those of the test. The poor reader was one or more years below this double criterion whereas the average reader fell between these two groups.

The three groups of boys and the three of girls comprising the experimental group were compared. The comparison, as all others to follow, was made between the good and average reader, the good and poor reader, and between

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6 See Appendix, p. 95-96.

the average and poor reader. The object of this comparison was to determine whether differences in age and I.Q. would be found significant. No significant differences were found. The raw data from which t were derived are presented in the Appendix[9]. The formula employed was the t test for differences between correlated pairs of means[10].

To obtain the t ratio we must divide the mean of the differences by the standard error of the mean of the differences. Thus the formula reads: $t = \frac{Dm}{\sigma Dm}$

To obtain the mean of the differences we sum the differences (D) and divide by N. This is equal to the difference between the means. The standard error of the mean of these differences is calculated by the formula:

$$1\ \sigma D = \sqrt{\frac{\Sigma D^2}{N} - \left(\frac{\Sigma D}{N}\right)^2}$$

$$2\ \sigma m D = \frac{\sigma D}{\sqrt{N-1}}$$

An illustration of the statistical method used in the study follows, employing the data in Table II.

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9 See Appendix, p. 95-96.

10 J.P. Guilford, Fundamental Statistics in Psychology and Education, New York, McGraw-Hill, 1950, p. 216-218.

Table II.- The WISC I.Q.'s of Good and Average Readers of the Control Group

Pairs	I.Q.'s		(D)	D
	Good Reader	Average Reader		
1	106	106	0	0
2	103	98	5	25
3	108	108	0	0
4	117	111	6	36
5	111	106	5	25
6	118	114	4	16
7	114	113	1	1
8	96	101	-5	25
9	96	100	-4	16
10	102	102	0	0
	1,071	1,059	12	144
	M 107.1	M 105.9	Md 1.2	

1. $\sigma_D = \sqrt{\frac{\Sigma D^2}{N} - \left(\frac{\Sigma D}{N}\right)^2}$

$= \sqrt{\frac{144}{10} - \left(\frac{12}{10}\right)^2}$

$= \sqrt{14.4 - 1.44}$

$= \sqrt{12.96}$

$= 3.6$

2. $\sigma_{Dm} = \frac{\sigma_D}{\sqrt{N-1}}$

$= \frac{3.6}{3}$

$= 1.2$

3. $t = \frac{Dm}{\sigma_{Dm}}$

$= \frac{1.2}{1.2}$

$= 1.$

Table III.- t Values of Age Differences of the Three Groups of Boys.

Groups	Dm	σ Dm	Obtained t Values
Good and Average	1.3	1.58	.82
Good and Poor	.1	.86	.12
Average and Poor	1.0	1.9	.53

Table IV.- t Values of I.Q. Differences for the Three Groups of Boys.

Groups	Dm	σ Dm	Obtained t Values
Good-Average	1.19	1.13	1.59
Good-Poor	.30	1.19	.25
Average-Poor	2.20	1.55	1.42

Table V.- t Values of Age Differences for the Three Groups of Girls.

Groups	Dm	σ Dm	Obtained t Values
Good-Average	.90	1.11	.81
Good-Poor	.30	1.68	.18
Average-Poor	.60	1.13	.52

Table VI.- t Values of I.Q. Differences for the Three Groups of Girls.

Groups	Dm	σ Dm	Obtained t Values
Good-Average	1.6	.81	1.97
Good-Poor	1.6	1.16	1.38
Average-Poor	.0	1.05	.00

The cross-validation group was made up of three groups each consisting of five boys and five girls. The members of each group were matched on the same variables as those of the experimental group.

The "good, average and poor" readers were compared to determine if any significant differences in age or I.Q. could be found[11]. No significant differences were found.

The raw data from which the t tests were derived are to be found in the appendix[11].

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11 See Appendix, p. 97.

Table VII.- t Values of Age Differences for the Three Groups in the Cross-Validation Group.

Groups	Dm	σ Dm	Obtained t Values
Good-Average	1.00	1.11	.90
Good-Poor	.10	1.27	.09
Average-Poor	1.10	1.20	.92

Table VIII.- t Values of I.Q. Differences for the Three Groups in the Cross-Validation Group.

Groups	Dm	σ Dm	Obtained t Values
Good-Average	1.20	1.23	.97
Good-Poor	.90	1.02	.88
Average-Poor	.30	1.11	.27

Table IX.- Range and Mean of Ages and I.Q.'s of the Sample Population.

	Experimental	Control
Age		
Range	9-3-11.11	9-3-11.6
Mean	10-3.3	10-4.1
I.Q.		
Range	90-125	94-120
Mean	111.5	106.4

2. The Experiment.

A contact was first made with the School Board which approved of and permitted undertaking the research. This consent secured, the writer met the school principals and classroom teachers in order to set up the testing programme. The permission was granted that all testing could be done during regular school hours without the presence of either principal or teacher. Thus all testing was done during school hours and conducted solely by the writer.

The presentation of tests was similar for all classes. The students, left to the examiner, were told that the research was undertaken in order to find what factors helped or hindered reading achievement. It was stated and explained that intelligence was not the sole factor. Later, examples of how people differed in their abilities were given with the importance of proper hearing and vision in reading enlarged upon. The examiner admitted that this was a private research and the results would in no way affect or be embodied in their report cards. The students were told that, within a few weeks, the examiner would return and, on a chance basis, select some of the class members for a further test. With these explanations given the prescribed administration of the tests followed.

When the results of the reading tests were compiled and the groups to be studied selected, the writer returned to the schools for the administration of the WISC. This second visit followed the reception of report cards and thus the students could be assured that test results would not appear on their report cards. The WISC was given according to the directions contained in the manual although, as is customary, the digit span test was substituted for the vocabulary test.

3. The Statistical Analysis of Results.

The analysis was conducted in two steps. First, when WISC results were obtained the raw scores of each subtest were converted into equivalent test ages; these are mental ages given for each of the subtests. The subtest mental ages thus obtained were then added up and the total divided by the number of tests. The result was then a mean mental age for all subtests. The mental ages of each subtest were then compared to the total or mean mental age and the deviations, in terms of months, computed for each subtest.

This procedure aside from showing the extent of the deviations of each test, holds constant the slight differences in age and average mental ability of each group so

that a comparison can be made on the basis of deviations from respective mean mental ages[12].

Individuals of each group were then compared in terms of months' deviation of subtests from their obtained mean mental age. The differences in months' deviation were then submitted to a test of significance.

The second step:- The purpose of this second step was to find if the groups differed significantly. The t test for differences between correlated pairs of means was used. This formula has been previously presented[13].

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12 Harold F. Burks and Paul Bruce, "The Characteristics of Poor and Good Readers as Disclosed by the Wechsler Intelligence Scale for Children", The Journal of Educational Psychology, Vol. 46, No. 8, issue of December, 1955, p. 488-493.

13 Chapter II, p. 24-27.

CHAPTER IV

PRESENTATION AND DISCUSSION OF RESULTS

The previous chapter has explained how the experiment was set up and elaborated upon the methods by which the results of the study were to be analysed. The presentation of the results obtained and their relevance to the hypothesis under study will follow.

1. Presentation of Results.

Out of the 60 comparisons that were made, 3 for each subtest in both groups, only 9 gave t values that were acceptable on the basis of the chosen criterion, i.e. P.05. The discussion will be limited to these significant results. The two groups will first be dealt with separately and then compared. The influence of the sex factor will be examined in assessing these results. For both groups there was no subtest that showed increasing or decreasing significant differences from good to average to poor, or vice-versa, and none on which the average reader was above or below the good and poor reader at a significant level of confidence.

The experimental group:- The good reader's scores on information and similarities were found to be above the poor reader's at a significant level of confidence: for

information at the 3% level and for similarities at the 1% level of confidence.

The poor reader's scores on picture completion and block design were found to be above the average reader's at a significant level of confidence: for picture completion at the 5% level and for block design at the 5% level of confidence.

The data from which Table X is derived, showing *t* values and levels of confidence of significant differences in subtest results, is found in the Appendix[1].

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1 See Appendix, p. 100-104.

Table X.- t Values and Levels of Confidence of Significant Differences in Subtest Results of the Experimental Group.

Sub-Test	Groups	Dm	σ Dm	Obtained t Values	P
Information	Good above Poor	9.39	3.57	2.63	.03
Similarities	Good above Poor	16.92	5.85	2.89	.01
Picture Completion	Poor above Average	16.68	7.33	2.27	.05
Block Design	Poor above Average	14.27	6.77	2.11	.05

The cross-validation group:- The good reader's scores on information were above the average and poor reader's at the 5% and 3% levels of confidence.

The average reader's scores on picture arrangement were above the good reader's at the 3% level of confidence while the poor reader was above the good at the 1% level of confidence.

The digit symbol test revealed the poor reader to be above the good at the 3% level of confidence.

The raw data from which Table XI is derived, showing t values and levels of confidence of significant subtest results, is found in the Appendix[2].

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2 See Appendix, p. 105-110.

Table XI.- t Values and Levels of Confidence of Significant Differences in Subtest Results of the Cross-Validation Group.

Sub-Test	Groups	Dm	σDm	Obtained t Values	P
Information	Good above Average	15.60	6.59	2.36	.05
	Good above Poor	19.72	6.78	2.91	.03
Picture Arrangement	Average above Good	25.20	8.89	2.83	.03
	Poor above Good	28.24	5.44	5.19	.01
Digit Symbol	Poor above Good	15.46	5.44	2.84	.03

On the basis of Tables X and XI it appears that the only subtest showing a significant difference in both groups is Information. In the experimental and cross-validation groups the good reader was found to be above the poor reader at a significant level of confidence. The WISC patterns seemed to differentiate between different reading levels but there was no consistency in the subtests showing significance. This inconsistency needed to be accounted for since it, apparently, pointed to a lack of equivalence between the experimental and cross-validation groups.

Trends:- To study this problem the following procedure was decided upon. The subtests found to have significant differences for the experimental group were compared to trends of these same tests in the cross-validation group. This same procedure was then employed to compare trends in the experimental group to subtest results with significant differences in the cross-validation group. The trends were found to be similar and on this basis the groups were accepted as equivalent.

The four subtests with significant differences in the experimental group, information, similarities, picture completion and block design, gave the same trend in the cross-validation group.

Table XII.- Sub-Tests with Significant t Values in the Experimental Group Compared to Trends of these same Sub-Tests in the Cross-Validation Group.

Sub-Test	Groups	
	Experimental	Cross-Validation
Information	Good above Poor	Good above Poor
Similarities	Good above Poor	Good above Poor
Picture Completion	Poor above Average	Poor above Average
Block Design	Poor above Average	Poor above Average

The three subtests with five significant differences in the cross-validation group, information, picture arrangement, digit symbol, gave a similar trend in the experimental group for four of these.

The raw data from which these trends were found are given in the Appendix[3,4].

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3 See Appendix, p. 111-115.

4 See Appendix, p. 116-121.

Table XIII.- Sub-Tests with Significant t Values in the Cross-Validation Group compared to Trends of these same Tests in the Experimental Group.

Sub-Test	Groups	
	Cross-Validation	Experimental
Information	Good above Average Good above Poor	Good above Average Good above Poor
Picture Arrangement	Average above Good Poor above Good	Average above Good Good above Poor
Digit Symbol	Poor above Good	Poor above Good

Sex differences:- It will be recalled that in the experimental design the groups selected for study were made up of equal numbers of boys and girls. This procedure was followed in order to control, if possible, the role of sex differences on WISC patterns. Thus we would not ascribe WISC patterns to reading achievement when, in fact, they were due to sex differences. Striking differences were found between the WISC profiles of the two sexes in the experimental group. A study of trends in the cross-validation group revealed these differences to be consistent. The subtests with significant differences for boys were similarities, block design, object assembly and digit symbol. Those with significant differences for girls were information and picture completion.

The result of the study of sex differences showed that the only subtest found significant for both groups, information, was the product of sex differences rather than reading achievement.

The following tables will give the t values and levels of confidence of significant differences in WISC subtest results of each sex. The trends of the cross-validation groups will be compared to these. The data from which these tables were derived is found in the Appendix[5,6].

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5 See Appendix, p. 122-130.

6 See Appendix, p. 131-137.

Table XIV.- t Values and Levels of Confidence of Significant Differences in WISC Sub-Tests of Boys in the Experimental Group.

Sub-Tests	Groups	Dm	σ Dm	Obtained t Values	P
Similarities	Good above Poor	27.22	8.04	3.39	.01
Block Design	Poor above Average	27.62	11.24	2.46	.05
Object Assembly	Poor above Good	23.10	7.60	3.04	.02
Digit Symbol	Average above Good	13.46	3.46	3.60	.01

Table XV.- WISC Sub-Tests with Significant t Values for Boys in the Experimental Group compared to Trends of these Sub-Tests for Boys of the Cross-Validation Group.

Sub-Tests	Groups	
	Experimental	Cross-Validation
Similarities	Good above Poor	Good above Poor
Block Design	Poor above Average	Poor above Average
Object Assembly	Poor above Good	Poor above Good
Digit Symbol	Average above Good	Average above Good

Table XVI.- t Values and Levels of Confidence of Significant Differences in Sub-Test Results of Girls in the Experimental Group.

Sub-Test	Groups	Dm	σ Dm	Obtained t Values	P
Information	Good above Poor	10.88	3.24	3.36	.01
	Average above Poor	13.82	4.62	3.51	.02
Picture Completion	Poor above Average	19.52	7.71	2.53	.04

Table XVII.- Sub-Test Results with Significant t Values for Girls in the Experimental Group compared to Trends of these Sub-Tests for Girls in the Cross-Validation Group.

Sub-Test	Groups	
	Experimental	Cross-Validation
Information	Good above Poor	Good above Poor
	Average above Poor	Average above Poor
Picture Completion	Poor above Average	Poor above Average

As is shown the subtests found to have significant differences for the boys in the experimental group gave a similar trend for the boys in the cross-validation group. This applied also to the subtests which had shown significant differences for the girls of the experimental group. Thus it appeared that although the WISC does not discriminate reading achievement levels when both sexes are taken together, if each sex were taken separately WISC patterns might discriminate between different reading levels. Although this last hypothesis could not be fully answered by the study, the research could be a preliminary attack on this problem and suggestive of further studies. In order to assess if the subtests would maintain significant differences between reading achievement levels for each sex, the boys of the experimental and cross-validation groups were joined to form one group. A similar procedure was employed for the girls.

It was found that different subtests gave significant differences according to the sex under study. The subtests with significant differences for boys were similarities, block design, object assembly and digit symbol; for girls, information and picture completion. Thus it appears that WISC patterns can discriminate between reading achievement levels in as much as each sex is studied separately. The following tables will give the t values and levels of confidence of significant differences in WISC subtests for each sex.

Table XVIII.- t Values and Levels of Confidence of Significant Differences in Sub-Test Results for all Boys.

Sub-Tests	Groups	Dm	σ Dm	Obtained t Values	P
Similarities	Good above Poor	18.71	6.84	2.74	.03
Block Design	Poor above Average	23.93	8.57	2.79	.02
Object Assembly	Poor above Good	20.69	8.74	2.37	.04
Digit Symbol	Average above Good	15.03	3.94	3.81	.01

Table XIX.- t Values and Levels of Confidence of Significant Differences in Sub-Test Results for all Girls.

Sub-Tests	Groups	Dm	σ Dm	Obtained t Values	P
Information	Good above Poor	12.98	4.10	3.17	.01
	Average above Poor	11.53	4.52	2.54	.04
Picture Completion	Poor above Average	14.09	5.95	2.37	.04

2. Discussion of Results.

The study has shown that the subtests of information, similarities, picture completion, picture arrangement, block design and digit symbol seem to discriminate between various reading achievement levels. Nevertheless this discrimination is evidenced only if trends rather than significant t values are taken into account. Thus the level of the differences are statistically non-acceptable.

Information was the only subtest which gave significant t values for the experimental and cross-validation groups. A closer scrutiny of this finding showed that it was due to sex differences rather than to reading achievement level.

WISC patterns of individuals whose reading levels differ are not found to be significantly different. The Null Hypothesis needs be accepted. "When all factors known to affect WISC patterns are controlled there are no significant differences between the WISC patterns of good, average and poor readers which warrants positing a common denominator or denominators, relative to intelligence, which can partially explain the level of reading achievement". Although the literature may state that poor readers reveal specific test patterns, this study renders this belief hypothetical rather than certain. This applies also to theoretical assumptions derived from this belief. Thus Arthur's description of the poor

reader as a "non-verbalist" or Burkes and Bruce's contention that he be a "concrete type" (in terms of Goldstein and Scheerer's description of such) receive no direct support from our results.

The findings of this study lead to the formulation of further hypotheses that need be answered before our results can be fully interpreted and our hypothesis definitely rejected.

Before submitting that WISC patterns cannot differentiate significantly between various levels of reading achievement, it seems that the influence of sex differences on WISC patterns needs be assessed. Although the population of our research be limited in numbers and age range, it warrants this undertaking. An important corollary of the study infers that WISC patterns cannot discriminate reading achievement unless patterns of each sex are studied separately. The study found that groups composed solely of boys, or of girls, reveal WISC patterns that discriminate between different reading achievement levels. Further study of the hypothesis should take this finding into account. Further it is possible that, since girls mature earlier than boys, the abilities required for success in reading may be different at various age levels. This difference, if such exists, would be accidental as opposed to substantial. The strong sex differences in our groups justifies this assumption.

SUMMARY AND CONCLUSIONS

The purpose of this study was to investigate whether or not a difference in WISC patterns could be found between three groups of grades five and six pupils who differed in reading achievement level. Previous studies of the problem were found sorely lacking in experimental design. Although the majority of reported studies had been conducted with the Stanford-Binet or Wechsler-Bellevue as the measuring instrument few had employed the WISC as the psychometric instrument.

Past researchers had found the poor reader to rate high on performance tests whereas the good reader rated higher on verbal tests. This widespread contention had led to theoretical considerations on the poor reader's "type of intelligence". The writer wished to ascertain if psychometrics could readily reflect reading achievement level when a more objective experimental design than those found in the literature was set up.

The conclusions of the study are: (1) although WISC patterns of poor, average and good readers differ, these differences lack statistical significance; (2) when each sex is studied separately, WISC patterns are found to discriminate significantly between different reading achievement levels. Thus unless the effect of the sex factor on WISC patterns is controlled, the WISC does not appear to be a valid instrument to gain insight into the hypothesis. It readily follows

that previous researchers who have classified the poor reader as a "non-verbalist" or as a "concrete type" are questionable.

Since our study found that WISC patterns of boys or girls, taken separately, discriminate significantly between different reading achievement levels, further research should be done in terms of this finding. Differences in patterns of both sexes should likewise be investigated.

BIBLIOGRAPHY

Bond, Guy and Leo C. Fay, "A Comparison of the Performance of Good and Poor Readers on the Individual Items of the Stanford-Binet, Forms L and M", The Journal of Educational Research, Vol. 43, No. 6, issue of February, 1950, p. 475-479.

A study of the responses of good and poor readers to individual test items of the Stanford-Binet. Good readers performed significantly better on items dependent upon knowledge and use of words whereas the poor reader was superior on non-verbal and memory items. These differences are attributed to the fact that the Stanford-Binet is too dependent upon reading achievement. They review and reject previous definitions of the poor reader, derived from Stanford-Binet performance, as a non-verbalist.

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Presents the principles of reading instruction including the description of reading growth and the importance of instruction adapted to individual differences. This is followed by a presentation of the nature, causes, diagnosis and remedial treatment of reading difficulties. A final section is devoted to the specially handicapped child and to illustrative case studies. Contains an extensive bibliography. Useful in summarising past and present studies on the causes of reading difficulties.

Burks, F. Harold and Paul Bruce, "The Characteristics of Poor and Good Readers as Disclosed by the Wechsler Intelligence Scale for Children", The Journal of Educational Psychology, Vol. 46, No. V, issue of December 1955, p. 488-493.

An experimental study of 31 poor readers and 11 good readers in which the authors attempt to link WISC patterns of each group to Goldstein and Scheerer's concepts of the concrete and abstract attitude. One of the few studies giving a theoretical explanation of reading achievement on the basis of psychometric test patterns.

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Wechsler Bellevue subtest patterns of 97 children classified as poor readers and 37 WISC patterns of these same children were examined for significant variance. Results of the study equate the poor reader's profile to that which Wechsler ascribes to the adolescent psychopath. The author gives the literature on WISC patterns of poor readers as indicative of emotional problems.

Harding, Lowry W., "Assumptions Underlying Methods of Beginning Reading", Educational Administration and Supervision, Vol. 37, No. 1, issue of January 1951, p. 25-37.
The author shows the link between philosophy and education. He gives the main theories in psychology, the basic assumptions in pedagogy and the methods of beginning to read. Theories of reading are revealed to be ultimately derived from schools of philosophy.

Harris, Albert J. and Florence G. Roswell, "Clinical Diagnosis of Reading Ability", The Journal of Psychology, Vol. 36, second half, issue of October 1953, p. 323-340.
A good summary of the causes of reading retardation is followed by presentation of means by which these can be assessed. An informal reading lesson is urged as a diagnostic technique. A good bibliography is included.

Monroe, Marion, Children Who Cannot Read, Chicago, University of Chicago Press, 1932, xvi-206 p.
An extensive study of average and poor readers. Both groups are compared and described from a quantitative and qualitative point of view. Gives a broad presentation of causative factors in reading difficulties followed by a detailed explanation of the influence of these on reading achievement. The selection of remedial methods based upon the individual's difficulties are given and the results of these exemplified by the means of case studies. A limited bibliography is given.

Orton, Samuel, Reading, Writing and Speech Problems in Children, New York, W.W. Norton, 1937, 215 p.
Reviews how language losses in adults may lead to an understanding of these same symptoms in children. He then describes the symptoms of delay or disorders in language developments of children. This is followed by a neurological interpretation of these and their treatment. The theory of cerebral dominance is presented and its causal relation to reading difficulties given.

Robinson, Helen Mansfield, Why Pupils Fail in Reading, Chicago, University of Chicago Press, 1946, xiii-257 p.
An extensive study by specialist of 30 poor readers. The author summarizes and evaluates the causes of reading retardation. She identifies and interprets these in the study of her cases linking her findings to those of previous researches. She concludes that retarded readers display many anomalies but the exact causal relation of these to reading achievement is yet to be defined. Implications for further study are given. An extensive bibliography is presented.

Triggs, Francis, et all, "The Relationship Between Specific Reading Skills and General Ability at the Elementary and Junior High School Levels", The Journal of Educational and Psychological Measurement, Vol. 14, No. 1, issue of Spring 1954, p. 176-185.

A study to determine the relationship between specific reading skills and two aspects of intelligence, verbal and non-verbal. They found higher correlations between verbal I.Q. and reading achievement than for performance I.Q. and reading achievement for both the Wechsler Bellevue and the WISC. This finding is in keeping with the trend in the literature. Limited but comprehensive bibliography of studies on WISC or Wechsler verbal I.Q.'s and reading achievement.

APPENDIX I

THE DOMINION TESTS, ACHIEVEMENT TESTS IN SILENT READING

1. Type I - Vocabulary.

2. Type II- Diagnostic Test in Paragraph Reading.

THE DOMINION TESTS

ACHIEVEMENT TESTS IN SILENT READING

Grades 4, 5 and 6

CAT. NO. 816 **TYPE I—VOCABULARY** Form A

Name (In Capitals) Last First Boy or Girl

Birthdate Month Date Year Age Grade

School Teacher Today's Date

City, Town, or Municipality Province

DIRECTIONS: Look at the row of words below:

A.	red	boy	girl	colour	table

The first word in this row is **red**. The word which goes best with **red** is colour, so a line has been drawn under **colour**.

Now look at this row:

B.	small	long	sharp	pretty	little

The first word in this row is **small**. **Little** means the same as **small**, so take up your pencils and draw a line under **little**.

Now look at the following rows. In each row, draw a line under the word which goes best with the first word in the row. Put down your pencils when you have finished. Go ahead.

C.	strike	hit	lift	write	come
D.	rose	row	flower	form	land
E.	small	light	full	wide	little
F.	robin	cheer	bird	dress	thief

You are to do the same thing with the rows in the following pages. Remember to look at the **first** word in each row. Find another word in the **same** row which goes best with the first word. Draw a line under this word.

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO

Score

Grade Level

1.	prepared	present	required	rapid	ready
2.	rage	heat	anger	envy	pity
3.	chart	charity	map	world	wagon
4.	less	more	worse	quite	smaller
5.	difficult	far	hard	different	unknown
6.	mayor	official	house	horse	city
7.	dwell	sleep	sit	empty	live
8.	canal	boat	candle	channel	savage
9.	final	last	splendid	small	following
10.	welcome	greet	approach	leave	visit
11.	sketch	pursuit	increase	drawing	frame
12.	skilful	clever	quick	foolish	fancy
13.	magnificent	trusting	pure	wealthy	splendid
14.	loyalty	opportunity	disgrace	friendliness	faithfulness
15.	brave	rough	fast	bold	gentle
16.	gale	wind	ship	valley	festival
17.	crowd	line	bird	mass	hurt
18.	bough	branch	forehead	tie	root
19.	chase	rub	pursue	trap	carry
20.	within	among	without	inside	always
21.	circular	crooked	familiar	careless	round
22.	moisture	thirst	damp	oyster	climate
23.	conquer	beat	crown	quarrel	fail
24.	entire	whole	open	weary	inside
25.	brisk	dangerous	rude	frail	lively

GO ON TO PAGE 2

6.	courteous	polite	coarse	brave	just
7.	sturdy	diligent	eager	strong	kindly
8.	compare	finish	separate	match	cut
9.	hoist	lift	lower	throw	cheat
0.	comment	remark	contract	support	question
1.	boundary	gap	limit	gift	leap
2.	consider	delay	think	deny	help
3.	badge	bait	estimate	tool	token
4.	rouse	drink	waken	rule	shout
5.	unite	write	stand	join	count
6.	refuge	protest	argument	chase	shelter
7.	enlarge	reduce	exceed	increase	improve
8.	tour	spire	journey	boat	world
9.	villain	inhabitant	estate	captain	rascal
0.	coarse	loud	grey	rough	smooth
1.	abandon	desert	divide	collect	happen
2.	approve	consent	show	elect	advance
3.	construct	strike	contract	build	trust
4.	destruction	despair	evil	building	ruin
5.	desire	demand	dislike	delight	wish
6.	peculiar	false	difficult	odd	familiar
7.	cavity	hollow	horseman	dwelling	importance
8.	freedom	play	peace	liberty	rule
9.	resolution	rebellion	problem	decision	meeting
0.	portion	entrance	part	harbour	whole

GO ON TO PAGE 3

51.	forcible	excited	humble	powerful	imprisoned
52.	behaviour	possession	goodness	behalf	conduct
53.	prohibit	prevent	reproach	advance	dwell
54.	communication	belief	settlement	bargain	message
55.	ancient	history	ruined	old	last
56.	insult	offense	temper	scolding	advice
57.	patient	evident	poor	rude	enduring
58.	annual	daily	usual	ancient	yearly
59.	interior	door	inside	parlour	inferior
60.	costly	comfortable	strange	dear	beautiful
61.	observation	portion	notice	rule	conversation
62.	barbarous	vacant	gorgeous	bearded	savage
63.	doubt	direct	question	try	change
64.	friar	monk	author	traveller	prophet
65.	delude	drench	mislead	strip	guide
66.	laughter	daughter	sport	scream	mirth
67.	surrender	conquer	yield	surround	flee
68.	bewail	beware	mourn	fail	hurt
69.	flaw	plant	jewel	blemish	rule
70.	bolster	support	abridge	consume	fasten
71.	dubious	stupid	deceitful	diligent	uncertain
72.	summit	middle	peak	total	harvest
73.	tutor	teacher	artist	tumult	journey
74.	withstand	resist	retreat	halt	unite
75.	verge	pressure	opinion	truth	brink

END OF TEST

LOOK OVER YOUR WORK

THE DOMINION TESTS

ACHIEVEMENT TESTS IN SILENT READING

Grades 5 and 6

Test No. 820 **TYPE II—DIAGNOSTIC TEST IN PARAGRAPH READING** Form **A**

Name..... (First Name) (Last Name)

Boy or Girl..... Age..... Birthdate..... (Date) (Month) (Year)

Teacher..... Grade..... Today's Date.....

School..... City, Town or Municipality.....

SAMPLE:

Jerry and Joan were on their holidays. Both of them could swim well and they were playing in the water. All at once, Joan felt something catch her by the leg. Jerry had gone under the water and was pulling her down to the bottom of the lake. Then he let go and soon she and her brother Jerry came to the top again. They were out of breath, and their mouths were full of water.

1. **The children were**
   running **sailing** **swimming** **fishing** **rowing**
2. **Joan was pulled under the water by**
   her father **her brother** **the weeds**
   a rope **a big fish**
3. **The best name for this story is**
   A Walk in the Country **A Party** **Learning to Swim**
   Joan Catches a Fish **Playing in the Lake**

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO

Analysis of Responses	
Number Correct	.....
Number Omitted	.....
Number Wrong	.....
Grade Level	.....

Analysis of Errors	No.	Level
General Significance	.....	.....
Details	.....	.....
Inference	.....	.....

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Have you ever tried soap carving? Or do you, like so many other people, believe that soap is useful only in the kitchen and laundry? Some years ago a large soap manufacturing company held a carving competition, and since then many people of all ages have become keenly interested in the art, and remarkable carvings have been made. In beginning, do not attempt anything too difficult. You will need a fresh cake of white soap, a small kitchen paring knife, tracing patterns, a soft lead pencil, and thin tracing paper. Trace the pattern on the soap, then hold the cake and knife just like an apple you are peeling, and carve towards you. Keep your knife clean and scrape the carving to make it smooth. The finished article may be painted with water colours — do not scrub with the paints or soapsuds will be the result. Put the colour on smoothly and do not hurry. You will be surprised how easy soap carving is, and how many attractive objects you can make.

1. The best name for this story is

How Soap is Painted **How Soap is Used** **A Child's Hobby**
How Soap is Prepared **An Interesting Hobby**

2. The first thing to do is

trace the pattern **clean the knife** **carve towards you**
mix the paints **scrape the carving**

3. The first carving you attempt should not be

too large **too difficult** **too easy** **too simple** **too fancy**

4. All the tools used in soap carving are

made of metal **expensive to buy** **strong**
easy to get **valuable**

GO ON TO PAGE 2

"Doodle-bug" is the funny name someone gave to oil-finding instruments. There are now many kinds of these instruments which are quite difficult to make, but the first one was very simple. It was copied from an instrument first used long ago to try to find the places where water or minerals were hidden underground; and it was called a "divining-rod," because with it a person was supposed to be able to divine or tell where oil was hidden. This rod was made of a forked branch cut from a peach or willow tree, much like a wish-bone in shape. First the point of the rod was dipped into oil, then the two prongs were held one in each hand, letting the oily point stick upwards. The point would appear to twist and jerk, and in some places point down to the earth. These were chosen as the likely spots to drill for oil. Sometimes the drilling was successful and oil was found, but if this happened it was quite by accident. Even modern oil-finding instruments do not have such powers of choosing one spot rather than another spot nearby.

1. The best name for this story is

History of Oil **The Values of Oil** **Searching for Oil**
Machinery Needs Oil **Drilling an Oil Well**

2. A divining-rod looks like

an oil-can **a fishing rod** **a piece of wire**
a garden fork **a wish-bone**

3. People decided to drill where the divining-rod

twisted its point down to earth **bent in the middle**
turned its point straight up **twisted in all directions**
touched the oil

4. The divining-rod was really

valuable **difficult to make** **useless** **powerful** **necessary**

GO ON TO PAGE 3

Sometimes at night you may see what looks like a bright star shooting across the sky and then disappearing. It often leaves a tail almost like a comet's tail behind it, which fades out in a few seconds. The real name of these "shooting stars" is "meteors." They are not stars at all, they are just bits of rock or iron which have been floating through space and which have suddenly been caught by the pull of our earth's gravitation. When they hit our air and go rushing through it they are moving so fast that the air rubs them into a flame, and they usually burn up before they reach the ground. Once in a while they may be so big that they do not completely burn up but crash to earth and plunge deep down into the ground. When they do this they are called "meteorites." By the time they get to the ground they may not be much bigger than a nut, though sometimes they are large, even as large as a small house. You can see many meteorites in museums.

1. **The best name for this story is**
   Floating Through Space **Why Stars Fall to Earth**
   Meteors and Meteorites **The Sky at Night** **Famous Comets**

2. **Meteors burst into flame because**
   they are floating through space
   they fall to earth **they are like comets**
   they rush through the air **they are made of rock**

3. **Meteorites are different from meteors because**
   they have tails like comets **they are in museums**
   they burn up **they are made of iron** **they fall to earth**

4. **The meteors come towards the earth**
   because the earth attracts them **because they are travelling so fast**
   because they are burning **because of the earth's position**
   because of the earth's movement through space

GO ON TO PAGE 4

Coal became the chief manufacturing fuel about 1800; but before the close of the nineteenth century its place in many industries was challenged by mineral oil or petroleum. Before 1850, mineral oil had been known in small quantities and was used chiefly as a liniment, a rubbing oil for sprains, known as "Seneca Oil." But with the discovery of the first oil well in Western Pennsylvania in 1859, the use of oil for light, heat, and power began. "To strike oil" soon became another word for success — just as a "Ship come home" meant success in the days of the early traders. With the discovery of other oil fields there followed an increase in the number of ways in which oil could be used, and as a result it has now become a very important product in our daily lives. As supplies in the older fields are used up, the great industrial nations have been thinking more and more about the future supply of this greatly needed product. They expect that more will be found in the rich but relatively undeveloped districts of Mexico, Roumania, and Mesopotamia.

1. The best title for this story is

The Discovery of Petroleum **The Loss to Our Coal Mines**
The Oil Market **The Pennsylvania Oil Wells**
The Growth in Importance of Oil

2. The first oil well was discovered in

Texas **Roumania** **Mexico** **Alberta** **Pennsylvania**

3. This story says that the great industrial nations are most interested in

the oil districts of Texas **the decline in our coal production**
the future supply of oil **making liniment from oil**
new uses for oil

4. According to this story it is likely that there is a greater quantity of oil in

England **Mesopotamia** **Belgium** **Norway** **Pennsylvania**

GO ON TO PAGE 5

Canada as a vacation land has scope and variety not met with elsewhere in the New World. Its greatest charm lies in the differences from the ordinary run of attractions. Canada has not as many of the historic stories that have made Europe and Asia the storehouses of civilization's records from ages before America was discovered, but the four hundred years that have passed since Jacques Cartier first landed on its shores have been filled with stirring events. These are recalled by the habitant life of Quebec, and by the old fortifications, monuments, and historic buildings that are scattered from coast to coast. The tremendous expanse of the country, its variety of physical features, its comparatively thinly scattered population, the ease and speed with which almost all parts can be reached, make the Dominion one of the world's greatest and least crowded playground areas. Tourists can enter at numbers of points along its boundaries by highway, rail, air, or water. Even the most distant hunting and fishing areas can be reached with the help of a guide in a way that does not involve too great hardship.

1. The best title for this story is

The Tourist Trade in Canada — **Canada's Tourist Attractions**
Canada's Hunting Grounds — **The Fishing Areas of Canada**
The History of Canada

2. This story tells us that Canada has

many high mountains — **a large number of people**
a vast amount of territory — **many forest fires**
very few attractions

3. Canada delights the traveller most because

it has an ancient history — **its attractions differ from the ordinary**
it is a storehouse of civilization — **it has a large number of guides**
it has many monuments

4. Tourists can enter Canada

at only one point — **by travelling first to Quebec**
only by becoming citizens — **only to visit relatives**
at many points

GO ON TO PAGE 6

We all know that the natives of America are not really Indians. We know that that name was applied to them by Columbus by mistake when he reached these shores and supposed he had found India by sailing west. Then who are they? Scientists generally give us the best answer possible with the evidence they now have, that the ancestors of these American Indians were Mongoloid. This does not mean that these Indians are Chinese nor that they came from China — for the excellent reason that at the supposed period of their arrival in America, China and the Chinese were not yet in existence. Old as they are, the Chinese, by comparison, are recent. It is more nearly true to say that these early Indians probably have ancestors in the far distant past in common with other Asiatic peoples of today. But we do not know what part of Asia was the original home of all these peoples. It was all so very long ago and the various races of mankind—which probably all developed from the same ancestors—have become so different from one another that no one knows what racial mixtures may have occurred during the long ages.

1. **The best name for this story is**
   The Ancestry of the Indians **The Arrival of the Indians**
   The Coming of Columbus **The Chinese and the Indians**
   The People of Asia

2. **This story says that the early Indians probably came from**
   India **China** **Asia** **America** **Egypt**

3. **Scientists say that the racial origin of the Indians is**
   American **Mongoloid** **Chinese** **Anglo-Saxon** **Japanese**

4. **This story tells us that the various races of mankind passed through periods during which they have become**
   more alike **mixed and alike** **unlike and unmixed**
   mixed and less alike **just like their common ancestors**

GO ON TO PAGE 7

The tourist who has made the St. Lawrence River trip will not soon forget the thrill aroused by the sight of Quebec City from the river. This city is the capital of the Province and in it we can find evidence of all the daring deeds surrounding the struggle for the possession of British North America in the eighteenth century. Lanes paved with cobblestones, winding stairway streets, old houses, and fortifications combine with the modern in Quebec. A short distance below the city are the famous Falls of the Montmorency River, and a few miles above the city is one of the amazing engineering triumphs of man —the Quebec Bridge. Its central ironwork span curves one hundred and seventy feet above the water. Both trains and automobiles can cross the bridge. The waters narrow considerably after Quebec City is passed but the river is still one of noble proportions. Cathedral spires and church towers bear witness to the importance of religion in the daily lives of the inhabitants.

1. The best title for this story is

A City in Quebec **A Canadian City** **The Capital of Quebec**
The Cathedrals of Quebec City **A View of Quebec City**

2. This story says that Quebec City

contains many factories **has large proportions**
combines the old and the new **has wide streets**
is an engineering triumph

3. This story tells us that the people of Quebec City

spend most of their time in churches **never go to church**
are religious **like to make spires** **are a lively people**

4. This story tells us that the Quebec Bridge

was very difficult to build **is the largest in the world**
was made by the first settlers
was made by Montmorency **is built over the city**

END OF TEST

LOOK OVER YOUR WORK

Table XX.- The Distribution of Boys in the Experimental Group as to Grade, Age, and I.Q.

Good Reader			Average Reader			Poor Reader		
Grade	Age	I.Q.	Grade	Age	I.Q.	Grade	Age	I.Q.
5	9-11	115	5	9-8	109	5	9-9	112
5	9-9	106	5	9-7	109	5	9-10	104
5	9-9	115	5	9-5	111	5	9-7	112
5	9-4	119	5	9-8	115	5	9-9	125
5	10-0	115	5	10-1	110	5	9-10	112
5	10-9	104	5	10-9	103	5	10-10	104
5	9-7	115	5	9-8	119	5	9-9	120
5	9-4	114	5	9-11	109	5	9-1	115
6	11-11	104	6	11-1	106	6	11-8	101
6	11-4	109	6	10-11	106	6	11-6	114
Means	10-1.1	111.6		10-.09	109.7		10-2.0	111.9

Table XXI.- The Distribution of Girls in the Experimental Group as to Grade, Age, and I.Q.

Good Reader			Average Reader			Poor Reader		
Grade	Age	I.Q.	Grade	Age	I.Q.	Grade	Age	I.Q.
5	9-3	117	5	9-1	112	5	8-11	117
5	9-5	109	5	9-6	110	5	9-11	113
5	9-6	114	5	9-10	113	5	9-8	112
5	10-5	102	5	10-1	101	5	10-7	98
5	10-6	103	5	10-1	107	5	10-0	105
5	11-0	93	5	10-10	90	5	11-1	95
6	10-1	117	6	10-1	114	6	9-11	115
6	10-7	119	6	10-8	115	6	10-4	116
6	11-5	109	6	10-11	107	6	10-9	101
6	10-8	109	6	11-0	107	6	11-5	104
Means	10-3.4	109.2		10-2.5	107.6		10-3.1	107.6

Table XXII.- The Distribution of Subjects in the Cross-Validation Group as to Grade, Sex, Age, and I.Q.

Good Reader				Average Reader				Poor Reader		
Grade	Sex	Age	I.Q.	Grade	Sex	Age	I.Q.	Grade	Sex	Age
5	M	9-7	106	5	M	9-7	106	5	M	9-4
5	M	10-11	103	5	M	10-8	98	5	M	11-
5	M	10-2	117	5	M	9-8	111	5	M	9-8
6	M	10-4	108	6	M	10-3	108	6	M	10-1
6	M	11-3	111	6	M	10-11	106	6	M	11-4
5	F	9-9	118	5	F	10-2	114	5	F	9-9
5	F	9-6	114	5	F	9-1	113	5	F	9-3
5	F	10-	102	5	F	10-2	102	5	F	10-5
6	F	10-7	96	6	F	10-9	101	6	F	10-9
6	F	10-11	96	6	F	10-11	100	6	F	11-6
Means		10-3.6	107.1			10-3.6	105.9			10-3.7

Table XXIII.- Means, in Months' Deviation from Mean WISC Mental Age, of Sub-Tests for the Experimental Group.

Sub-Test	Good Reader	Average Reader	Poor Reader
Information	-5.81	-9.41	-15.40
Comprehension	4.61	1.02	2.19
Arithmetic	2.70	2.07	- 3.86
Similarities	.87	-8.88	-17.79
Digit Span	-2.01	14.22	1.69
Picture Completion	-3.71	.91	17.59
Picture Arrangement	14.63	24.45	11.77
Block Design	- .71	-13.10	1.17
Object Assembly	.31	1.24	6.49
Digit Symbol	-12.31	-5.12	-4.43

Table XXIV.- Means, in Months' Deviation from Mean WISC Mental Age, of Sub-Tests for the Cross-Validation Group.

Sub-Test	Good Reader	Average Reader	Poor Reader
Information	4.94	-10.66	-14.82
Comprehension	15.14	13.76	9.38
Arithmetic	7.40	6.14	5.40
Similarities	- 5.92	- 3.06	-12.22
Digit Span	7.54	7.54	1.80
Picture Completion	.94	-15.04	- 5.02
Picture Arrangement	.74	26.94	28.98
Block Design	- 7.06	-11.06	- 4.42
Object Assembly	-12.86	-12.32	- 4.82
Digit Symbol	-15.28	- 7.46	- 1.80

APPENDIX 7

RAW DATA OF SUB-TESTS SIGNIFICANT FOR THE EXPERIMENTAL GROUP

Table XXV.- Months' Deviation from Mean Wisc Mental Age of the Good and Poor Readers' Scores on Information.

Pairs	Months' Deviation Good	Poor	(D)	D^2
1	-27.0	-37.6	10.6	112.32
2	4.8	- 3.4	8.2	67.24
3	-15.2	-14.6	- .6	.36
4	- 3.2	- 8.2	5.0	25.00
5	-10.4	-28.4	18.0	324.00
6	- 5.8	-22.8	17.0	289.00
7	- 6.2	- 5.2	1.0	1.00
8	1.8	-28.6	30.4	924.16
9	-12.0	-13.6	1.6	2.56
10	12.0	- 7.6	19.6	384.16
11	-21.8	-17.6	- 4.2	17.64
12	5.6	-19.6	25.2	635.04
13	15.8	2.6	13.2	174.24
14	8.8	-18.0	26.8	718.24
15	16.8	-11.6	28.4	806.56
16	2.4	-31.2	33.6	1128.96
17	-14.6	-13.4	- 1.2	1.44
18	-15.6	12.8	-28.4	806.56
19	-40.0	-25.6	-14.4	207.36
20	-12.4	-12.4	0.0	.00
	$\mathcal{E}$ = -116.2	$\mathcal{E}$ = -304.0	$\mathcal{E}$ = 187.8	$\mathcal{E}$ = 6636.84
	M = -5.81	M = -15.40	Md = 9.39	

Table XXVI.- Months' Deviation from Mean WISC Mental Age of the Good and Poor Readers' Scores on Similarities.

Pairs	Months' Deviation		(D)	D^2
	Good	Poor		
1	44.2	2.2	42.0	1764.00
2	-46.4	-23.6	-22.8	519.84
3	-17.2	-29.4	12.2	148.84
4	-27.2	-38.0	10.8	116.64
5	- 7.2	-39.6	32.4	1049.76
6	42.4	-11.2	53.6	2872.96
7	52.4	2.6	49.8	2480.04
8	16.4	-31.2	47.6	2265.76
9	- 8.0	-17.6	9.6	92.16
10	7.6	3.6	4.0	16.00
11	33.0	-17.6	15.4	237.16
12	- 3.2	-11.4	8.2	67.24
13	-26.6	-18.6	- 8.0	64.00
14	-27.2	7.8	-35.0	1225.00
15	14.6	-52.4	67.0	4489.00
16	- 5.8	-26.8	21.0	441.00
17	5.8	2.8	3.0	9.00
18	-18.2	- 8.6	- 9.6	92.16
19	- 4.0	-29.6	25.6	655.36
20	- 8.0	-19.6	11.6	134.56
	Σ = 17.4	Σ = 355.8	Σ = 338.4	Σ = 18,740.48
	M = - .87	M = 17.79	Md = 16.92	

Table XXVII.- Months' Deviations from Mean WISC Mental Age of the Poor and Average Readers' Scores on Picture Completion.

Pairs	Months' Deviation		(D)	D^2
	Poor	Average		
1	6.4	-11.6	18.0	324.00
2	30.6	-36.0	66.6	4435.56
3	53.4	4.4	49.0	2401.00
4	25.8	40.5	-15.0	225.00
5	31.6	18.0	13.6	184.96
6	- 2.8	-37.8	35.0	1225.00
7	-20.6	-20.4	.2	.04
8	-17.6	-20.4	2.8	7.84
9	-11.6	-22.2	10.6	112.36
10	-21.8	-43.0	21.2	449.44
11	2.8	-14.2	17.0	289.00
12	42.4	- 2.6	45.0	2025.00
13	54.6	4.4	50.2	2520.04
14	34.0	-10.2	44.2	1953.64
15	8.4	49.8	-41.4	1713.96
16	52.8	51.8	1.0	1.00
17	38.6	20.2	18.4	338.56
18	34.8	-18.2	53.0	2809.00
19	-29.6	39.6	-69.2	4788.64
20	39.6	25.8	13.8	190.44
	Σ = 351.8	Σ = 18.2	Σ = 333.6	Σ = 26,604.48
	M = 17.59	M = .91	Md = 16.68	

Table XVIII.- Months' Deviation from Mean WISC Mental Age of the Poor and Average Readers' Scores on Block Design.

Pairs	Months' Deviation		(D)	D^2
	Poor	Average		
1	- 9.8	13.0	-22.8	519.84
2	-11.6	- 2.6	- 9.0	81.00
3	- 5.4	- 7.4	2.2	4.84
4	38.0	1.8	36.2	1310.44
5	20.4	-14.2	34.6	1197.16
6	.8	3.8	3.0	9.00
7	- 1.4	-20.2	18.8	353.44
8	12.8	-30.2	43.0	1849.00
9	30.0	-60.4	90.4	8172.16
10	15.4	- 7.2	22.8	519.84
11	14.4	-19.6	34.0	1156.00
12	-11.4	-40.0	28.6	817.96
13	-18.6	-24.0	5.4	29.16
14	-28.2	4.8	33.0	1089.00
15	31.6	-12.0	43.6	1900.96
16	-14.8	- 1.8	-13.0	169.00
17	-37.2	-16.6	-20.6	424.36
18	- .6	15.6	-16.2	262.44
19	14.4	11.6	2.8	7.84
20	-15.6	-56.2	40.6	1648.36
	Σ = 23.4	Σ = -262.0	Σ = 285.4	Σ = 21,521.80
	M = 1.17	M = 13.10	Md = 14.27	

APPENDIX 8

RAW DATA OF SUB-TESTS SIGNIFICANT FOR THE CROSS-VALIDATION GROUP

Table XXIX.- Months' Deviation from Mean WISC Mental Age of the Good and Average Readers' Scores on Information.

Pairs	Months' Deviation		(D)	D^2
	Good	Average		
1	6.8	-15.2	22.0	484.00
2	-13.8	- .4	-13.4	179.56
3	34.0	- 3.8	37.8	1428.84
4	14.4	-25.2	39.6	1568.16
5	5.0	-16.2	21.2	449.44
6	- 6.4	-19.6	13.2	174.24
7	-15.2	-28.2	13.0	169.00
8	28.0	- 5.4	33.4	1115.56
9	-15.0	9.4	-24.4	595.36
10	11.6	- 2.0	13.6	184.96
	Σ = 49.4	Σ = -106.6	Σ = 156.0	Σ = 6349.12
	M = 4.94	M= - 10.66	Md= 15.60	

Table XXX.- Months' Deviation from Mean WISC Mental Age of the Good and Poor Readers' Scores on Information.

Pairs	Months' Deviation		(D)	D^2
	Good	Poor		
1	6.8	-18.6	25.4	645.16
2	-13.8	- 3.6	-10.2	104.04
3	34.0	8.2	25.8	665.64
4	14.4	-20.2	34.6	1197.16
5	5.0	-33.8	38.8	1505.44
6	- 6.4	-32.8	26.4	696.96
7	-15.2	-25.8	10.6	112.36
8	28.0	-25.2	53.2	2830.24
9	-15.0	-23.0	8.0	64.00
10	11.6	26.6	-15.0	225.00
	Σ = 49.4	Σ = -148.2	Σ = 197.6	Σ = 8046.00
	M = 4.94	M= -14.82	Md= 19.76	

Table XXXI.- Months' Deviation from Mean WISC Mental Age of the Average and Good Readers' Scores on Picture Arrangement.

Pairs	Months' Deviation			
	Average	Good	(D)	D^2
1	40.8	-17.2	58.0	3364.00
2	23.6	-29.6	53.4	2851.56
3	12.2	-34.0	46.2	2134.44
4	58.8	20.4	38.4	1474.56
5	7.8	17.0	- 9.2	84.64
6	14.4	- 2.4	16.8	282.24
7	7.8	30.8	-23.0	529.00
8	30.6	-12.0	42.6	1814.76
9	1.4	3.0	- 1.6	2.56
10	62.0	31.6	30.4	924.16
	Σ = 259.4	Σ = 17.4	Σ = 252.0	Σ = 13,461.92
	M = 25.94	M = 1.74	Md = 25.20	

Table XXXII.- Months' Deviation from Mean WISC Mental Age of Poor and Good Readers' Scores on Picture Arrangement.

Pairs	Months' Deviation		(D)	D^2
	Poor	Good		
1	13.4	-17.2	30.6	936.36
2	- 3.6	-29.8	26.2	686.44
3	22.2	-34.0	56.2	3158.44
4	39.8	20.4	19.4	376.36
5	38.2	17.0	21.2	449.44
6	45.2	- 2.4	47.6	2265.76
7	34.2	30.8	3.4	11.56
8	30.8	-12.0	42.8	1831.84
9	33.0	3.0	30.0	900.00
10	36.6	31.6	5.0	25.00
	$\mathcal{E}$ = 289.8	$\mathcal{E}$ = 7.4	$\mathcal{E}$ = 282.4	$\mathcal{E}$ = 10,641.20
	M = 28.98	M = .74	Md= 28.24	

Table XXXIII.- Months' Deviation from Mean WISC Mental Age of Poor and Good Readers' Scores on Digit Symbol.

Pairs	Months' Deviation		(D)	D^2
	Poor	Good		
1	5.4	- 5.2	10.6	112.36
2	-15.6	-13.8	- 1.8	3.24
3	-13.8	-22.0	8.2	67.24
4	7.8	-33.6	41.4	1713.96
5	-21.8	-55.0	33.2	1102.24
6	- 2.8	13.6	-16.4	268.96
7	-13.8	-23.2	9.4	88.36
8	18.8	- 4.0	22.8	519.84
9	9.0	- 9.0	18.0	324.00
10	28.6	- .6	29.2	852.64
	$\mathcal{E}$ = - 1.8	$\mathcal{E}$ = -152.8	$\mathcal{E}$ = 154.6	$\mathcal{E}$ = 5052.84
	M = .18	M= 15.28	Md= 15.46	

APPENDIX 9

TRENDS IN THE CROSS-VALIDATION GROUP OF SUB-TESTS SIGNIFICANT IN THE EXPERIMENTAL GROUP

Table XXXIV.- Months' Deviation of Good and Poor Readers of the Cross-Validation Group on Information.

Pairs	Good Reader	Poor Reader
1	6.8	-18.6
2	-13.8	- 3.6
3	34.0	8.2
4	14.4	-20.2
5	5.0	-33.8
6	- 6.4	-32.8
7	-15.2	-25.8
8	28.0	-25.2
9	-15.0	-23.0
10	11.6	26.6
	Σ = 49.4	Σ = -148.2

Table XXXV.- Months' Deviation of Good and Poor Readers of the Cross-Validation Group on Similarities.

Pairs	Good Reader	Poor Reader
1	-17.2	1.4
2	18.2	-15.6
3	28.0	22.2
4	-27.6	-32.2
5	-19.0	- 1.8
6	-19.0	-26.8
7	-17.2	-13.8
8	- 4.0	-29.2
9	- 9.0	-15.0
10	7.6	-11.4
	ε = -59.2	ε = -122.2

Table XXXVI.- Months' Deviation of Poor and Average Readers of the Cross-Validation Group on Picture Completion.

Pairs	Poor Reader	Average Reader
1	1.4	16.8
2	26.4	11.6
3	10.2	-11.8
4	-20.2	-17.2
5	16.2	-25.8
6	-26.8	-43.6
7	10.2	- 4.2
8	- 5.2	-27.4
9	- 3.0	-10.6
10	-59.4	-38.0
	Σ = -50.2	Σ = -150.4

Table XXXVII.- Months' Deviation of Poor and Average Readers of the Cross-Validation Group on Block Design.

Pairs	Poor Reader	Average Reader
1	1.4	- 5.2
2	20.4	- .4
3	- 1.8	-11.8
4	- 2.2	14.8
5	6.2	-56.2
6	-14.8	38.4
7	-23.8	-16.2
8	-17.2	-43.4
9	9.0	1.4
10	-21.4	-22.0
	Σ = -44.2	Σ = -110.6

APPENDIX 10

TRENDS IN THE EXPERIMENTAL GROUP OF SUB-TESTS SIGNIFICANT IN THE CROSS-VALIDATION GROUP

Table XXXVIII.- Months' Deviation of the Good and Average Readers of the Experimental Group in Information.

Pairs	Good Reader	Average Reader
1	-27.0	.4
2	4.8	- 8.0
3	-15.6	-16.0
4	- 3.2	.8
5	-10.4	- 8.0
6	- 5.8	2.2
7	- 6.2	.2
8	1.8	3.6
9	-12.0	- .4
10	12.0	- 6.2
11	-21.8	- 7.0
12	5.6	-10.6
13	15.8	-15.6
14	8.8	-10.2
15	16.8	-22.2
16	2.4	-16.4
17	-14.6	-29.8
18	-15.6	-26.2
19	-40.0	- 3.6
20	-12.4	-15.2
	$\mathcal{E}$ = -116.6	$\mathcal{E}$ = -188.2

Table XXXIX.- Months' Deviation of the Good and Poor Readers of the Experimental Group on Information.

Pairs	Good Reader	Poor Reader
1	-27.0	-37.6
2	4.8	- 3.4
3	-15.2	-14.6
4	- 3.2	- 8.2
5	-10.4	-28.4
6	- 5.8	-22.8
7	- 6.2	- 5.2
8	1.8	-28.6
9	-12.0	-13.6
10	12.0	- 7.6
11	-21.8	-17.6
12	5.6	-19.6
13	15.8	2.6
14	8.8	-18.0
15	16.8	-11.6
16	2.4	-31.2
17	-14.6	-13.4
18	-15.6	12.8
19	-40.0	-25.6
20	12.4	-12.4
	$\mathcal{E}$ = -116.2	$\mathcal{E}$ = -304.0

Table XL.- Months' Deviation of the Average and Good Readers of the Experimental Group on Picture Arrangement.

Pairs	Average Reader	Good Reader
1	57.0	34.2
2	-26.6	45.6
3	28.4	27.8
4	25.8	8.8
5	49.8	16.8
6	3.8	-21.6
7	42.4	57.4
8	57.8	- 7.8
9	43.6	40.0
10	52.8	31.6
11	64.4	-19.0
12	64.0	32.8
13	46.0	-26.6
14	-19.2	32.8
15	24.0	-38.0
16	-25.8	6.2
17	71.4	53.8
18	-40.4	45.8
19	-36.4	- 4.0
20	1.8	-24.0
	ε = 484.0	ε = 292.6

Table XLI.- Months' Deviation of the Poor and Good Readers of the Experimental Group on Picture Arrangement.

Pairs	Poor Reader	Good Reader
1.	50.2	34.2
2	12.4	45.6
3	- 5.4	27.8
4	38.0	8.8
5	20.4	16.8
6	-23.2	-21.6
7	-21.4	57.4
8	28.8	- 7.8
9	-37.6	40.0
10	15.6	31.6
11	58.4	-19.0
12	.6	32.8
13	29.6	-26.6
14	19.8	32.8
15	35.6	-38.0
16	9.2	6.2
17	-17.2	53.8
18	43.4	45.8
19	-29.6	- 4.0
20	7.8	-24.0
	$\mathcal{E}$ = 235.4	$\mathcal{E}$ = 292.6

Table XLII.- Months' Deviation of the Poor and Good Readers of the Experimental Group on Digit Symbol.

Pairs	Poor Reader	Good Reader
1	-17.8	-21.8
2	-11.6	-30.4
3	-13.4	-23.2
4	-10.0	-27.2
5	36.4	-19.2
6	-11.2	-21.6
7	-21.4	-14.6
8	.4	- 7.6
9	-25.6	- 4.0
10	- 8.4	-40.4
11	- 5.6	- 3.0
12	-19.4	-15.2
13	-18.6	9.4
14	- .2	-23.2
15	-12.4	37.6
16	21.2	- 9.8
17	2.8	- 2.2
18	3.4	-18.2
19	10.4	8.0
20	12.4	20.0
	$\mathcal{E}$ = -88.6	$\mathcal{E}$ = -246.2

APPENDIX 11

TESTS SIGNIFICANT FOR BOYS IN THE EXPERIMENTAL GROUP AND TRENDS OF THESE SAME TESTS IN THE CROSS-VALIDATION GROUP

Table XLIII.- Months' Deviation from Mean WISC Mental Age of Boys of Good and Poor Reading Achievement in the Experimental Group on Similarities.

Pairs	Months' Deviation		(D)	D^2
	Good	Poor		
1	44.2	2.2	42.0	1764.00
2	-46.4	-23.6	-22.8	519.84
3	15.8	-29.4	45.2	2043.04
4	-27.2	-38.0	10.8	116.64
5	- 7.2	-39.6	32.4	1049.76
6	42.4	-11.2	53.6	2872.96
7	52.4	2.6	49.8	2480.04
8	16.4	-31.2	47.6	2265.76
9	- 8.0	-17.6	9.6	92.16
10	7.6	3.6	4.0	16.00
	Σ = 90.0	Σ = -182.2	Σ = 272.2	Σ = 13,220.20
	M = 9.0	M = -18.22	Md = 27.22	

Table XLIV.- Months' Deviation from Mean WISC Mental Age of Boys of Good and Poor Reading Achievement in the Cross-Validation Group on Similarities.

Pairs	Months' Deviation	
	Good Reader	Poor Reader
1	-17.2	1.4
2	18.2	-15.6
3	28.0	22.2
4	-27.6	-32.1
5	-19.0	- 1.8
	Σ = -17.6	Σ = -26.0

Table XLV.- Months' Deviation from Mean WISC Mental Age of Boys of Poor and Average Reading Achievement in the Experimental Group on Block Design.

Pairs	Months' Deviation		(D)	D^2
	Poor	Average		
1	- 9.8	13.0	-22.8	519.84
2	-11.6	- 2.6	- 9.0	81.00
3	- 5.4	- 7.6	2.2	4.84
4	38.0	1.8	36.2	1310.44
5	20.4	-14.2	34.6	1197.16
6	.8	3.8	- 3.0	9.00
7	- 1.4	-33.8	32.4	1049.76
8	12.8	-30.2	43.0	1849.00
9	30.4	-60.4	90.8	8244.64
10	15.6	-56.2	71.8	5155.24
	Σ = 89.8	Σ = -186.4	Σ = 276.2	Σ = 19,420.92
	M = 8.98	M = -18.64	Md= 27.62	

Table XLVI.- Months' Deviation from Mean WISC Mental Age of Boys of Poor and Average Reading Achievement in the Cross-Validation Group on Block Design.

Pairs	Months' Deviation	
	Poor Reader	Average Reader
1	1.4	- 5.2
2	20.4	- .4
3	- 1.8	-11.8
4	- 2.2	14.8
5	6.2	-56.2
	Σ = 24.0	Σ = -58.8

Table XLVII.- Months' Deviation from Mean WISC Mental Age of Boys of Poor and Good Reading Achievement in the Experimental Group on Object Assembly.

Pairs	Months' Deviation		(D)	D^2
	Poor	Good		
1	20.2	-37.8	58.0	3364.00
2	.4	-14.4	14.8	219.04
3	-17.2	-20.2	3.0	9.00
4	16.0	-15.2	31.2	973.44
5	8.4	28.8	-20.4	416.16
6	-11.2	-45.6	34.4	1183.36
7	-21.2	-18.6	- 2.8	7.84
8	22.8	- 7.6	30.4	924.16
9	46.4	10.0	36.4	1324.96
10	43.6	- 2.4	46.0	2116.00
	Σ = 108.0	Σ = -123.0	Σ = 231.0	Σ = 10,537.96
	M = 10.80	M= -12.30	Md= 23.10	

Table XLVIII.- Months' Deviation from Mean WISC Mental Age of Boys of Poor and Good Reading Achievement in the Cross-Validation Group on Object Assembly.

Pairs	Months' Deviation	
	Poor Reader	Good Reader
1	-10.6	-17.2
2	-15.6	6.2
3	-25.8	16.0
4	27.8	-27.6
5	38.0	-43.0
	Σ = 13.8	Σ = -65.6

Table XLIX.- Months' Deviation from Mean WISC Mental Age of Boys of Average and Good Reading Achievement in the Experimental Group on Digit Symbol.

Pairs	Months' Deviation		(D)	D^2
	Average	Good		
1	-15.0	-21.8	6.8	46.24
2	-22.6	-30.4	7.8	60.84
3	-15.6	-16.2	.6	.36
4	9.8	-27.2	37.0	1369.00
5	-22.2	-19.2	- 3.0	9.00
6	- 8.2	-21.6	13.4	179.56
7	2.2	-14.6	16.8	282.24
8	5.8	- 7.6	13.4	179.56
9	11.6	- 4.0	15.6	243.36
10	-24.2	-40.4	16.2	262.44
	Σ = -78.4	Σ = -203.0	Σ = 124.6	Σ = 2632.60
	M = 7.84	M = -20.30	Md= 12.46	

Table L.- Months' Deviation from Mean WISC Mental Age of Boys of Average and Good Reading Achievement in the Cross-Validation Group on Digit Symbol.

Pairs	Months' Deviation	
	Average Reader	Good Reader
1	- 3.2	- 5.2
2	-20.4	-13.8
3	8.2	-22.0
4	10.8	-33.6
5	-24.2	-55.0
	Σ = -28.8	Σ = -129.6

APPENDIX 12

TESTS SIGNIFICANT FOR GIRLS IN THE EXPERIMENTAL GROUP AND TRENDS OF THESE SAME TESTS IN THE CROSS-VALIDATION GROUP

Table LI.- Months' Deviation from Mean WISC Mental Age of Girls of Good and Poor Reading Achievement in the Experimental Group on Information.

Pairs	Months' Deviation		(D)	D^2
	Good	Poor		
1	-27.0	-37.6	10.6	112.36
2	4.8	- 3.4	8.2	67.24
3	-15.2	-14.6	- .6	.36
4	- 3.2	- 8.2	5.0	25.00
5	-10.2	-28.4	18.0	324.00
6	- 5.8	-22.8	17.0	289.00
7	- 6.2	- 5.2	- 1.0	1.00
8	1.8	-28.6	30.4	924.16
9	-12.0	-13.6	1.6	2.56
10	12.0	- 7.6	19.6	384.16
	$\mathcal{E}$ = -59.2	$\mathcal{E}$ = -170.0	$\mathcal{E}$ = 110.8	$\mathcal{E}$ = 2129.84
	M = -5.92	M= -17.0	Md= 11.08	

Table LII.- Months' Deviation from Mean WISC Mental Age of Girls of Good and Poor Reading Achievement in the Cross-Validation Group on Information.

Pairs	Months' Deviation	
	Good Reader	Poor Reader
1	- 6.4	-32.8
2	-15.2	-25.8
3	28.0	-25.2
4	-15.0	-23.0
5	11.6	26.6
	Σ = 3.0	Σ = -80.2

Table LIII.- Months' Deviation from Mean WISC Mental Age of Girls of Average and Poor Reading Achievement in the Experimental Group on Information.

Pairs	Months' Deviation		(D)	D^2
	Average	Poor		
1	.4	-37.6	38.0	1444.00
2	- 8.0	- 3.4	- 4.6	21.16
3	-16.0	-14.6	- 1.4	1.96
4	.8	- 8.2	9.0	81.00
5	2.2	-22.8	25.0	625.00
6	- 8.0	-28.4	20.4	416.16
7	- .2	- 5.2	5.0	25.00
8	3.6	-28.6	32.2	1036.84
9	- .4	-13.6	13.2	174.24
10	- 6.2	- 7.6	1.4	1.96
	$\mathcal{E}$= -31.8	$\mathcal{E}$= -170.0	$\mathcal{E}$ = 138.2	$\mathcal{E}$= 3827.32
	M= -3.18	M= -17.0	Md= 13.82	

Table LIV.- Months' Deviation from Mean WISC Mental Age of Girls of Average and Poor Reading Achievement in the Cross-Validation Group on Information.

Pairs	Months' Deviation	
	Average Reader	Poor Reader
1	-19.2	-32.8
2	-28.2	-25.8
3	- 5.4	-25.2
4	9.4	-23.0
5	- 2.0	26.6
	$\mathcal{E}$ = -45.4	$\mathcal{E}$ = -80.2

Table LV.- Months' Deviation from Mean WISC Mental Age of Girls of Poor and Average Reading Achievement in the Experimental Group on Picture Completion.

Pairs	Months' Deviation		(D)	D^2
	Poor	Average		
1	6.4	-11.6	18.0	324.00
2	30.6	-36.0	66.6	4435.56
3	53.4	4.0	49.4	2440.36
4	25.8	40.8	-15.0	225.00
5	31.6	18.0	13.6	184.96
6	- 2.8	-37.8	35.0	1225.00
7	- .8	-14.2	11.4	129.96
8	-20.6	-20.4	- .2	.04
9	-17.6	-20.4	2.8	7.84
10	-11.6	-22.2	10.6	112.36
	$\mathcal{E}$ = 92.4	$\mathcal{E}$ = -99.8	$\mathcal{E}$ = 192.2	$\mathcal{E}$ = 9085.08
	M = 9.24	M= -9.98	Md= 19.22	

Table LVI.- Months' Deviation from Mean WISC Mental Age of Girls of Poor and Average Reading Achievement in the Cross-Validation Group on Picture Completion.

Pairs	Months' Deviation	
	Poor Reader	Average Reader
1	-26.8	-43.6
2	-10.2	- 4.2
3	- 5.2	-27.4
4	- 3.0	-10.6
5	-59.4	-38.0
	Σ = -104.6	Σ = -123.8

APPENDIX 13

ABSTRACT OF

WISC Patterns and Reading Achievement[1]

A review of the literature revealed that although the poor reader has been found weak in verbal tests and strong in performance tests, the researches upon which these conclusions were based showed weaknesses in design.

The subjects of the study, pupils of grades five and six, were matched for sex, age, number of years of schooling, unilinguality, and Full Scale I.Q. Other factors controlled because of their influence on WISC profiles were the absence of gross physical handicaps and of referal for personality problems. The uncontrolled factor was reading achievement. On the basis of their achievement results on reading tests, the subjects were grouped into the good, average and poor reader.

The WISC results of the 90 subjects, 60 in the experimental and 30 in the cross-validation group, were converted into equivalent test ages. Individuals of each group were compared in terms of months' deviations of sub-tests from obtained mean mental age.

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1 Jean-Marie Beniskos, Ph.D. thesis presented to the School of Psychology of the University of Ottawa, Ontario, 1959, xii-139 p.

The findings of the study revealed that although differences were found they were ascribable to sex differences on WISC scores rather than reading achievement. When each sex was studied separately, WISC sub-tests revealed significant differences between different reading achievement levels. Further research into this finding is required.