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Does the Wechsler Intelligence Scale for Children / 3rd edition discriminate between LD and non-LD children, ages 9 to 16 years old?

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DOES THE WECHSLER INTELLIGENCE SCALE FOR CHILDREN / 3RD EDITION DISCRIMINATE BETWEEN LD AND NON-LD CHILDREN, AGES 9 TO 16 YEARS OLD?

By Matthew E. Dehmlow

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Running Head: WISC-III and LD

Does The Wechsler Intelligence Scale for Children / 3rd Edition (WISC-III)

Discriminate With

LD and Non-LD Children, Ages 9 to 16 Years Old

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Abstract

The primary purpose of this study was to determine whether the Wechsler's Intelligence Scale for Children / 3rd Edition (WISC-III) can discriminate between students with learning disabilities (LD students) and students without learning disabilities (non-LD students). Although the WISC-III has established itself as a valuable psychological instrument for measuring intelligence, the subtests of the WISC-III have been selected to examine possible differentiating patterns when examining a group of LD subjects and comparing their subtest results to a group of non-LD subjects. The current study proposes to examine the capability of the WISC-III's subtests to discriminate between a population of LD and Non-LD children, in West Virginia, ages 9 years to 16 years.

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Acknowledgments

First and foremost, I would like to thank Dr. Lawhon for allowing me to participate in this study. It has been interesting, informative, and fun. Secondly, I would like to thank Dr. Ranson for helping me with my statistics and for presenting them in an understandable way. Thank you! I would also like to thank all of my fellow students who participated in this group thesis. I know this hard work will pay off. Lastly, I would like to thank Dr. Fred J. Krieg, who believed in me from the very beginning. He has always been there for me and the knowledge and guidance he has offered has been immeasurable. Thanks Doc!

List of Tables

History of Learning Disabilities

The formal history of learning disabilities is relatively brief, and is often traced to a famous speech given by Sam Kirk in 1963 at the founding meeting of the Association for Children with Learning Disabilities. In reflecting on the history of learning disorders, Lloyd (1997) notes that there have been several recurring themes over the past 50 to 100 years that lead up to the legal recognition of learning disorders. These recurring themes are stated by Lloyd (1997) as follows:

1.) Learning Disabilities are recognized and treated in countries with well-developed systems of universal public education.

2.) In part, the field of learning disabilities emerged from the work of physicians who identified symptoms of known brain injury that were similar to manifest behavioral tendencies of individuals *with* learning disabilities (p.1)

The notion of LD, according to Lloyd (1997) is, in part, a social construct. In its extreme, the notion of LD as a social construct suggests that claims of learning disabilities are phenomena resulting from social contexts, such as the demands of school and employment; i.e. in effect learning disabilities have *no* psychological foundation. Lloyd states that societies construct concepts such as LD to facilitate dispensation of scare resources where they are most needed. Additionally, it is also important to note that the term "Learning Disorder" designates a heterogenous group of disorders, encompassing difficulties in such areas as reading, spelling, writing, mathematics, spoken language, socialization. In effect, no two individuals with learning disabilities are exactly alike.

Beyond the heterogenous nature of Learning Disabilities, it should further be noted that the different types of LD vary in severity and pervasiveness. In the early stages of the field, LD individuals (e.g. students) with severe difficulties were more often diagnosed, whereas individuals with more subtle pathology were not detected. More recently, thanks to research-based and technological advances, individuals with less severe manifestations of LD are being determined. Resulting questions about how severe problems must be before an individual qualifies for special education are related to other themes described above (e.g. the social construct of "LD") (See Lloyd, 1997).

Lloyd (1997) notes that "the hallmark of LD is intra-individual differences" (pp.1-2); this refers to observation of a highly uneven profile of development across the domain of ability [i.e. intelligence (IQ)] vs. the domain of achievement. This notion of an uneven developmental profile is a rather pervasive criterion both for purposes of defining and diagnosing LD (see constructual and operational definition of LD below, as pertains to the present study). Indeed, LD may coexist with other disabilities, and even with giftedness. Although at times coexisting with other disorders, LD seldom exhibits a pervasive influence over functioning in general. LD is much more difficult to diagnose in individuals who also have a diagnosis of mental retardation (MR) because of the general fact that the decline in achievement scores tends to more consistently parallel the decline in intelligence. In sharp contrast, LD is more often diagnosed in individuals who are identified as gifted, due to the greater probability of discrepancy between (high) intelligence and (low) achievement.

Students with LD's need to learn systematic approaches to tasks. Lloyd (1997) suggests that, "Most (if not all) individuals with learning disabilities often approach tasks in unsystematic, disorganized ways. Research on interventions has revealed that teaching LD students to handle tasks strategically (in a systematic manner) is very beneficial" (p. 2). Given the above, a primary responsibility of educators is to minimize the contribution of poor teaching to LD's. According to Lloyd (1997):

> Analysis of teaching and learning have long indicated that the apparent disabilities of children can actually be a consequence of teachers' failure to offer effective instruction. These analyses are based on the idea that what usually passes for effective instruction may actually compound difficulties students had prior to instruction. Until education can provide virtually flawless instruction, we may expect to have difficulty distinguishing between those students whose learning problems are the result of what is sometimes referred to as "dyspedagogia" and those whose problems stem from other factors (e.g. biophysical risk factors) (p. 2).

In an effort to further describe LD, Wenar (1994) and Lloyd (1997) suggest that learning disabilities are developmental disorders that persist over the life span.

They argue that there is increasing evidence that learning disabilities are developmental disabilities; that is, that they are evident early in many children's lives and that they persist into adulthood (Lloyd, 1997, p.2). To the extent that this is true, LD is probably not curable in the sense that a disease or unfortunate life circumstance might be (Lloyd, 1997).

In looking toward the future, Lloyd issues the following caveat: "Advances in the field of LD come through careful, persistent research; one should be cautious about claims of breakthroughs" (p. 2).

Prevalence of LD

The Diagnostic and Statistical Manual of Mental Disorders, 4th edition (DSM-IV) estimates that the prevalence of Learning Disorders ranges from 2% to 10% of the general population, "depending upon ascertainment and the definitions applied" (DSM-IV, 1994, p. 47). In addition, the DSM-IV (1994) notes a prevalence of "approximately 5% of students in the public schools in the United States as being identified as having a Learning Disorder" (p. 47). Wenar (1994) cites an even wider estimate of prevalence of LD (due to variations in definitions of LD), ranging from 1% to 40% of the general population, with other studies yielding estimates of prevalence from 10% to 15%, with prevalence of LD among boys outnumbering the prevalence of LD among girls ranging from 2:1 to 5:1.

General Definition of LD

Public Law 94-142 (i.e. the Education for All Handicapped Children Act: More recently IDEA) defines learning disabilities (LD) as "a disorder in one or more of the basic psychological processes involved in understanding or using language, spoken or written, which may manifest itself in an imperfect ability to listen, think, speak, read, write, spell, or do mathematical calculations." The definition further states that LD includes perceptual handicaps, brain injury, minimal brain dysfunction, dyslexia, and developmental aphasia. According to the law, LD does not include learning problems that are primarily the result of visual, hearing, or motor handicaps; mental retardation, or environmental, cultural, or economic disadvantage.

Operational Definition of LD

In addition to the above legal definition of LD, an operational definition is also required in order to be able to quantifiably differentiate between LD and non-LD individuals. Such a definition determines "a *severe* discrepancy between the child's potential (as measured by an individual standardized IQ test) and his or her current performance status" as being measurable by an individual standardized achievement test). The DSM-IV suggests that a "severe discrepancy" is "usually defined as a discrepancy of *more than* 2 standard deviations between achievement and IQ (DSM-IV, 1994, p. 46); whereas W.Va. Policy 2419 defines a "severe discrepancy" as a minimum of 1.75 standard deviations difference, taking regression and 1.0 standard error of measurement into account. For sake of the current study, it was determined to follow the above West Virginia Policy 2419 guidelines defining a severe discrepancy as achievement score(s) 1.75 (minimum) below IQ score(s).

Constructual Definition of LD

Learning disabilities is a general term that refers to a heterogeneous group of disorders manifest by significant difficulties in the acquisition and the use of listening, speaking, reading, writing, reasoning, or mathematical abilities. These disorders are intrinsic to the individual, presumed to be due to central nervous system dysfunction, and may occur across the life span. Problems in self-regulatory behaviors, social perception, and social interaction may exist with learning disabilities but do not by themselves constitute a learning disability. Although learning disabilities may occur concomitantly with other handicapping conditions (e.g. sensory impairment, mental retardation, serious emotional disturbance) or with extrinsic influences (e.g. cultural differences, insufficient or inappropriate instruction), they are not the result of those conditions or influences.

Causal Factors of LD

No one really knows specifically what causes LD's. In essence there are too many variables to be able to pin down the cause(s) of LD's with certainty; there also exists the possibility of various interactions involving multiple variables (NIMH, 1993).

Initially scientists thought that all LD's were caused by a single neurological problem. However, "research supported by NIMH (1993) has helped show the causes of LD's are more complex and diverse" (p. 7).

One modern theory proposes that LD's stem from subtle disturbances in brain structures and functions. In fact, some neuroscientists believe that, in many cases of LD, the disturbance begins before birth. Throughout pregnancy the fetal brain develops from a few all-purpose cells into a complex organism made of billions of specialized, interconnected nerve cells called neurons. During pregnancy, brain development is vulnerable to disruptions. If disruption occurs in the earlier phases of pregnancy, the fetus may die, or the infant may be born with widespread disabilities, and possibly mental retardation (NIMH, 1993).

In addition to fetal development, some other factors that affect brain development, which may be causal factors of LD, include: genetic influences, substance abuse, pregnancy problems, and toxins (either in utero or after the infant is born).

Yet another set of circumstances which can effectually mimic neurological LD is resultant from children being members of a social out-group and /or from the physiological effects (e.g. malnutrition) and /or psychological effects of poverty (e.g. a poor psychologically stimulating environment).

Another potential external influence or contributor to LD-like symptoms results from poor teaching, as was mentioned earlier, according to Lloyd (1997):

> Analysis of teaching and learning have long indicated that the apparent disabilities of children can actually be a consequence of teachers' failure to offer effective instruction. These analyses are

based on the idea that what usually passes for effective instruction may actually compound difficulties students had prior to instruction. Until education can provide virtually flawless instruction, we may expect to have difficulty distinguishing between those students whose learning problems are the result of what is sometimes referred to as "dyspedagogia" and those whose problems stem from other factors (e.g. biophysical risk factors) (p. 2).

Today, it is still assumed that organic factors play a major role in the etiology of LD, despite the fact that specific organic factors for LD's are yet to be determined. Despite this, according to Wenar (1994), we do know that "... a greater frequency of learning problems in natural parents and their blood relatives suggests a genetic component" (p. 180). In addition, Wenar (1994) notes that "... a history of increased prenatal and perinatal complications, developmental delays, the presence of neurological soft signs (i.e. subtle signs), and electrophysical abnormalities raises the suspicion of lack of organic intactness" (p. 180). Indeed, the presence of neurological damage significantly (negatively) affects prognosis of individuals with learning disabilities (See Taylor, 1988).

Beyond the above evidences correlated with the behavioral manifestations of learning disorders, additional empirical observations suggest that some LD's are due to central nervous system dysfunctions. Children with cerebral palsy and epilepsy show an elevated rate of reading disability even when their intelligence is in the average range. It is also known that children who have sustained a localized head injury, especially in the left cerebral hemisphere, are also likely to have difficulty reading (fortunately such cases are rare) (See Yule & Rutter, 1985).

An organic hypothesis originating as early as 1925 suggested that dyslexia results from a failure to establish cerebral dominance between the two halves of the brain. It was suggested that progressive lateralization takes place over the course of human development. However, despite revision and revival of this theory, the bulk of research shows no important differences between normal and reading-disabled children (Kinsbourne & Hiscock, 1978). In fact, according to Wenar (1994), research tends to suggest that brain functions are lateralized from birth and that language does not become increasingly lateralized as a child matures.

The fact that learning problems tend to run in families suggests a genetic etiology. However, since environmental influences are also present, one of the challenges of research becomes disentangling the two, as well as determining significant interaction effects (Wenar, 1994). Considerable research has been done on reading disabilities, with Snowling (1991) concluding that a significant amount of variance in reading is attributable to genetic effects. These effects can be general and specific. For example, there is evidence of a 40% risk to a son whose father is reading disabled, and a 35% risk if the mother is reading disabled. In daughters, the probability of having an affected parent of either sex is approximately 17%. There is also evidence that suggests a significant heritability for reading recognition, phonological coding, and spelling; although not for reading comprehension or for the reading related skills of digit span (See Snowling, 1991). Finally, there seems to be a stronger heritability factor to spelling than to reading. In all of the above cases, Wenar (1994) notes that " the mode of genetic transmission is not clear" (p. 181).

Neurological Assessment (and Evaluations for LD)

Lezak (1995) defines clinical neuropsychology as "an applied science concerned with the behavioral expression of brain dysfunction" (p. 7). The term clinical neuropsychology was first used in 1913, and began to become a regular part of psychological jargon by 1936 (Lezak, 1995). "By 1940 neuropsychology began to develop an identity of its own as psychology's looser intuitive, armchair constructs began to undergo re-examination in the cold light of more objective, statistical / actuarial techniques and quantifiable, operational definitions" (Lezak, 1995, p. 3).

Despite the logical sense that objective, quantifiable techniques make for neuropsychological assessments qualitative techniques are also very important; this is because sensitive, detailed observation of responses, which pay particular attention to the manner in which responses are defective, can add significantly toward more accurate interpretation of the more objectively quantified results. Lezak (1995) supports the above statement:

> To do justice to a field of inquiry as complex as brain-behavior relationships in human beings, requires an adaptable assessment methodology that incorporates the strengths of both quantitative and qualitative approaches (p. 4).

On the one hand, standardized procedures eliciting behavior that can be measured along empirically defined and scaled dimensions provide objectivity and potential to make fine distinctions and comparisons that would be unobtainable by clinical observation alone. On the other hand, objective examinations cannot be conducted nor can test scores be properly interpreted in a psychological or social vacuum. Judicious interpretation of examination data must take into account the client's history, present circumstances, attitudes and expectations regarding self and the examination and the quality of the patient's test responses and behavior in the examination. In addition, qualitative features of an assessment include circumstances surrounding the examination, examination issues, and clients' subjective interpretations of testing procedures. The qualitative part of a neuropsychological assessment is important in that each client is a unique individual, with his or her own subjective issue(s) some of which can be objectively measured, and some of which must be individually, subjectively interpreted to be able to make sense of the neuropsychological assessment in its totality.

According to Lezak (1995), "A thorough neuropsychological assessment includes a detailed examination of memory and attention, a review of academic skills and verbal and visuospatial functions, and tests of reasoning judgement" (p. 4).

Indeed, a thorough neuropsychological exam, such as described above, should include an instrument (such as the WISC-III) capable of measuring general intelligence ("g"), as well as having the capability to differentiate subtypes of intelligence. Beyond this, it has been reported that in its simplest manifestation, the WISC-III is able to distinguish LD children from non-LD children, when coupled with an achievement test [such as Wechsler's Individual Achievement Test (WIAT)], and comparing / contrasting Verbal IQ, Performance IQ, and Full Scale IQ with derived achievement scores from the WIAT (Wenar, 1994).

Development of the WISC-III

The genealogy of the Wechsler Intelligence Scale for Children-Third Edition began in the 1930's, when David Wechsler developed the original Wechsler-Bellevue Intelligence Scale in 1939. It later became just the Wechsler Intelligence Scale (WISC) in 1949. The (WISC-III) contains the same essentials as the original Wechsler Intelligence Scale for Children and its 1974 revision, the (WISC-R). The (WISC-III) was published in 1991 by the Psychological Corporation (Wechsler, 1991).

The (WISC-III) was standardized on 2,200 children, 100 girls and 100 boys in each of eleven age groups from 6 through 16 years of age (Sattler, 1992). This sample was based on age, race/ethnicity, parent education, and geographic region. The (WISC-III) probes intellectual functioning in many different ways and also measures many different abilities in children. It is an individually administered clinical instrument for assessing the intellectual ability of children aged 6 years through 16 years 11 months.

There are thirteen subtests on the (WISC-III). Each subtest measures different things. The Information subtest requires the child to answer a broad range of questions dealing with factual information. This subtest measures the knowledge that average children with average opportunities should be able to acquire through normal home and school experiences (Sattler, 1992). The information subtest is the second-best measure of g intelligence. It is a great measure of an individual's general intelligence. The Similarities subtest requires the child to answer questions about how objects or concepts are the same or alike. It contains nineteen pairs of words where the child must state the similarity between the two items in each pair. This subtest measures verbal-concept formation, which is the ability to place objects or events in a meaningful group (Sattler, 1992). Success on this subtest may depend on cultural opportunities and a child's interest patterns. Initial success is dictated by the child's ability to understand the task at hand. The Arithmetic subtest requires the child to answer simple to complex problems involving arithmetic concepts and numerical reasoning. The emphasis of these problems focuses on mental computation and concentration. This subtest also measures numerical reasoning. Success on this subtest requires concentration as well as the ability to add, subtract, multiply, and divide. Arithmetic requires concentration and attention as well as the knowledge of numerical operations (Sattler, 1992).

The Vocabulary subtest is a test of word knowledge and includes the child's learning ability, fund of information, memory, concept formation, and language development (Sattler, 1992). This subtest is an excellent estimate of intellectual ability because the number of words known by a child correlates highly with his or her ability to learn and to accumulate information. The performance of this subtest is stable over time and is resistant to neurological deficit and psychological disturbance (Sattler, 1992). The Vocabulary subtest is the best measure of g intelligence on the (WISC-III) and requires the child to listen as the examiner reads words aloud and the child is asked to define them. The Comprehension subtest requires the child to explain situations, actions, or activities that relate to events familiar to most children. This subtest measures a child's ability to think practically and requires the child to draw from past experiences. This subtest is a great measure of social judgement and common sense and is a good measure of g intelligence. The Digit Span subtest is a supplementary subtest that requires the child to repeat numbers given orally by the examiner. It has two parts: Digits Forward and Digits Backward. Digit Span measures the child's short-term auditory memory as well as attention. Success can be affected by the child's ability to relax. Scores will be low if the child is anxious and nervous or has attention problems. This subtest is used to come up with a freedom from distractibility index that is used in diagnosing ADHD children. Digits Forward involves primarily sequential processing, whereas Digits Backward appears to involve both planning ability and sequential processing (Sattler, 1992). The Picture Completion subtest requires the child to identify the single most important missing part in drawings of common objects, animals, or people. The child is asked to point and identify the missing part in the picture that is presented to them by the examiner.

This subtest measures visual discrimination and the child's ability to distinguish between essential and non-essential details. Success on this subtest depends on concentration, reasoning, visual organization, and long-term visual memory. There is a time limit on this subtest. The Picture Completion subtest is a fair measure of g intelligence (Sattler, 1992). The Coding subtest requires the child to copy symbols paired with other symbols and is timed for two minutes. It measures a child's ability to learn an unfamiliar task. It also measures speed and accuracy of visual-motor coordination, attention skills, short-term memory, and handwriting speed. The subtest is sensitive to visual-motor perception. The Coding subtest is a poor measure of g intelligence (Sattler, 1992).

The Picture Arrangement subtest requires the child to place a series of pictures in logical order so that they make sense and tell a story. This subtest measures a child's ability to comprehend and evaluate situations. It also measures non-verbal reasoning, anticipation, visual organization, and the ability to interpret social situations. Picture Arrangement is a fair measure of g intelligence (Sattler, 1992). Block Design requires the child to reproduce designs using three-dimensional blocks. All items are timed. Success depends on the child's ability to have good visual organization and visual-motor coordination. It requires perceptual organization, spatial visualization, and abstract conceptualization. It can be affected by the child's rate of motor activity, as well as vision. The Block Design subtest is the best measure of g intelligence among the Performance Scale subtests (Sattler, 1992). The Object Assembly subtest requires the child to put jigsaw pieces together to form common objects. This subtest is a timed test. It is a good measure of the child's ability to put things together to form a familiar object. Success depends on good visual-motor coordination, and visual perception.

It also measures visual organizational ability in the child. This subtest is a fair measure of g intelligence (Sattler, 1992). The Symbol Search subtest is a supplementary subtest that requires the child to look at a symbol and then decide whether the symbol is present in a series of symbols. This subtest measures perceptual discrimination, speed and accuracy, attention and concentration, and short-term memory. Lastly, the Mazes subtest is another supplementary subtest that requires the child to solve paper-and-pencil mazes that differ in level of complexity. This subtest measures the child's planning ability and perceptual organizational ability. The child must also have good visual-motor control as well as speed and accuracy. This subtest is the poorest measure of g intelligence of the entire (WISC-III).

The (WISC-III) has outstanding reliability. Average internal consistency reliability coefficients are .96 for the Full Scale IQ, .95 for the Verbal Scale IQ, and .91 for the Performance Scale IQ (Wechsler, 1991). Because the (WISC-III) is a fairly new published test, little research has been done focusing on the validity of the test. Since the (WISC-III) was derived from the (WISC-R), much of the research on the validity of the (WISC-R) can apply to the (WISC-III).

The test is individually administered. One must study the instructions in the (WISC-III) manual and become familiar with the test materials before giving the test. It would be wise to practice the test on someone before the individual actually administer the test. The testing should occur in a quiet place and rapport needs to be established between the test giver and the child. To avoid administration and scoring errors, carefully review how you administer and score each subtest. The Record Form should be filled out completely and accurately. Each subtest is scored differently and again should be reviewed very carefully.

The most common scoring errors on the (WISC-R) were on the Vocabulary, Comprehension, and Similarities subtests (Sattler, 1992).

The (WISC-III) is interpreted to evaluate children's intellectual ability. Scores from the (WISC-III) can help distinguish groups of children with learning disabilities when they are compared to a child's achievement scores. Scores from the (WISC-III) are of little use when no other tests are given in the assessment process.

The Wechsler Scales are an integral part of any neuropsychological assessment. The (WISC-III) provides a series of tests for evaluating the cognitive and visual-motor skills of brain-injured children. The (WISC-III) subtests are sensitive measures of brain damage because they assess the ability to learn, to solve unfamiliar problems, and to think abstractly.

Purpose

The purpose of this study is to determine whether the WISC-III can discriminate between diagnosed LD students and non-LD students. A secondary purpose is to determine if the WISC-III can discriminate between neuro-based LD and non-neuro based LD.

HO: There will be no statistically significant difference in scores between the LD sample and the Non-LD sample on the WISC-III.

HA: There will be a statistically significant difference in scores between the LD sample and the Non-LD sample on the WISC-III.

Method

After obtaining informed consent from either a parent or legal guardian, sixty children ranging in age from 9 to 16 years were selected randomly from a stratified sample of learning-disabled (LD) children and non-LD children in West Virginia. All subjects obtained full scale IQs of at least 80, but no more than 120 on the Wechsler Intelligence Scale for Children– III (WISC– III) (Wechsler, 1991). Although we were told that LD children were LD (either by their parents or teachers), we were not certain if they meet the criteria of our operational definition of LD. Therefore, LD children were confirmed as having a learning disability by using criteria set forth by West Virginia Policy 2419. Policy 2419 defines LD children as being those children who have a "severe discrepancy" (in this case, a minimum of 1.75 standard deviations) between individual standardized achievement and IQ scores, taking regression and 1.0 standard error of measurement into account. We obtained IQ scores per administration of the WISC-III; and achievement scores per administration of the Wechsler Individual Achievement Test (WIAT), using only the Reading Composite (i.e. the Basic Reading and Reading Comprehension subtests) and the Math Composite (i.e. the Math Reasoning and Numerical Operations subtests) Wechsler, (1992).

Calculations to determine potential discrepancies between achievement and IQ scores were done using the West Virginia Learning Discrepancy Program, Version 2.0 (Szasz, 1999). Each subject's WISC-III scores (i.e. Verbal IQ, Performance IQ, and Full Scale IQ) were compared with his or her WIAT Reading Composite Score and WIAT Math Composite Score. If any of the IQ / Achievement Score comparisons (see above) resulted in the subject's Achievement Score being a minimum of 1.75 standard deviations lower than his or her IQ score (taking regression and 1.0 standard error of the measure into account), then he or she was placed into the LD group (In addition, note that we took into count the lower limit of a 68% confidence band). Another group of non-LD subjects, with a similar IQ range, was used as the control group. (Please refer to tables 1-A, 1-B, and 1-C)

Table 1-A

<table>
<tr><td colspan="3">Subject: Sample LD -A Data</td><td colspan="3">Date: 5/04/2000</td></tr>
<tr><td colspan="6">WISC-III</td></tr>
<tr><td colspan="2">Verbal IQ: 98</td><td colspan="2">Performance IQ: XXXXXX</td><td colspan="2">Full Scale IQ: XXXXXXXX</td></tr>
<tr><td colspan="6">WIAT</td></tr>
<tr><td colspan="3">Reading Composite: 92</td><td colspan="3">Math Composite: 80</td></tr>
<tr><td colspan="6"></td></tr>
<tr><td colspan="6">Predicted Achievement Scores / Discrepancy Scores / Lower Limit Scores</td></tr>
<tr><td colspan="2">Predicted Reading: 99</td><td colspan="2">Discrepancy Score: -0.63</td><td colspan="2">Lower Limit (68% confidence band)
-0.92</td></tr>
<tr><td colspan="2">Predicted Math: 99</td><td colspan="2">Discrepancy Score: -1.78</td><td colspan="2">Lower Limit (68% confidence band)
-2.09</td></tr>
<tr><td colspan="6"></td></tr>
<tr><td colspan="6">Note: Subject qualifies as LD per Verbal IQ / Math Composite comparative discrepancy.</td></tr>
</table>

Table 1-B

Subject: *Sample LD -B Data*	Date: 5/04/2000	
WISC-III		
Verbal IQ: XXXXXXXXXX	Performance IQ: 117	Full Scale IQ: XXXXXXXXX
WIAT		
Reading Composite: 92	Math Composite: 80	
Predicted Achievement Scores / Discrepancy Scores / Lower Limit Scores		
Predicted Reading: 108	Discrepancy Score: -1.23	Lower Limit (68% confidence band) -1.51
Predicted Math: 109	Discrepancy Score: -2.34	Lower Limit (68% confidence band) -2.65
Note: Subject qualifies as LD per Performance IQ / Math Composite comparative discrepancy.		

Table 1-C

Subject: *Sample LD -B Data*		Date: 5/04/2000
WISC-III		
Verbal IQ: XXXXXXXXXX	Performance IQ: XXXXXX	Full Scale IQ: 107
WIAT		
Reading Composite: 92		Math Composite: 80
Predicted Achievement Scores / Discrepancy Scores / Lower Limit Scores		
Predicted Reading: 105	Discrepancy Score: -1.14	Lower Limit (68% confidence band) -1.42
Predicted Math: 105	Discrepancy Score: -2.36	Lower Limit (68% confidence band) -2.66
Note: Subject qualifies as LD per Full-Scale IQ / Math Composite comparative discrepancy.		

After subjects were administered the WIAT and WISC-III and determined to be either LD or Non-LD, they were placed into two different groups relative to the discriminatory procedures delineated above.

Next, subjects were administered the following battery of neuro-psychological tests, with even numbered subjects being given the battery in one order and odd-numbered subjects being given the same battery of tests, in reverse order, so as to eliminate order of testing as being a potential confounding variable. (Refer to table 2-A.)

Table 2-A

Odd-Numbered Subjects Test Sequence	Even-Numbered Subjects Test Sequence
1.) Trails A & B	1.) Stroop Color & Word Test
2.) Children's Auditory Verbal Learning Test-2	2.) Benton Visual Retention Test-2
3.) Berry-Visual Motor Integration Test	3.) Children's Category Test
4.) Grooved PegBoard Test	4.) DCS Visual Learning Memory Test
5.) Children's Memory Scale	5.) Children's Memory Scale
6.) DCS Visual Learning Memory Test	6.) Grooved PegBoard Test
7.) Children's Category Test	7.) Children's Auditory Verbal Learning Test-2
8.) Benton Visual Retention Test-2	8.) Berry-Visual Motor Integration Test
9.) Stroop	9.) Trails A & B

Results

The study examined the (WISC-III) to determine if there are any aspects of this test that can differentiate from a group of (LD) students and (Non-LD) students. The first step in this process was to run a stepwise discriminate analysis. This included ten different variables. They were: Picture Completion, Information, Coding, Similarities, Picture Arrangement, Arithmetic, Block Design, Vocabulary, Object Assembly and Comprehension. All of these variables were examined by the discriminate analysis process to see which one of these variables would discriminate between the (LD) and the (Non LD) group. In other words, I was trying to identify a linear combination of quantitative predictor variables that best characterizes the difference among the two groups. The results of the discriminate analysis showed that of all ten variables there were three variables that separated the (LD) group from the (Non LD) group. They were the Arithmetic, Object Assembly, and Picture Arrangement subtests. The significance level was set at $p<.05$. The Arithmetic subtest was significant at the .0030 level. The Object Assembly subtest was significant at the .0138 level. The Picture Arrangement subtest was significant at the .0378 level. All three of these subtests were significant when compared to the p value.

Table 3-A shows some descriptive statistics for the means of IQ for both groups. As you can see, the means for the (Non LD) students were higher than the means for the (LD) students. This table shows the FSIQ, PIQ, and VIQ.

Table 3-A

Descriptive Statistics (Means) For IQ: LD vs. Non-LD Subjects

	N	Full Scale IQ*	Verbal IQ*	Performance IQ
LD	27	95.48*	93.67*	99.85
Non-LD	29	102.66*	101.90*	103.21

* Statistically Significant Differences exist between LD & Non-LD group means. $(p < .05)$

When we looked at the FSIQ, PIQ, and VIQ with analysis of variance (ANOVA) we did find that between the (LD) group and the (Non LD) group, there were differences in the FSIQ, PIQ, and VIQ, as we might suspect. The question becomes: were any of these differences significant? We did find significant differences with the FSIQ and the VIQ between the two groups.

Table 3-B

ANOVA Summary Table For Variable Full Scale IQ

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Square	F-Value	p<.05
Between Groups	1	719.547	719.547	4.385	0.041
Within Groups (Error)	54	8861.292	164.098		
Total Variation	55	9580.839			

At the p<.05 level, the obtained results for the FSIQ variable are significant.

Table 3-C

ANOVA Summary Table For Variable Verbal IQ

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Square	F-Value	p<.05
Between Groups	1	947.025	947.025	5.608	0.021
Within Groups (Error)	54	9118.690	168.865		
Total Variation	55	10065.714			

At the p<.05 level, the obtained results for the VIQ variable are significant.

Table 3-D

ANOVA Summary Table For Variable Performance IQ (Total Accumulative Correct Reproductions Over 6 Trials)

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Square	F-Value	p<.05
Between Groups	1	157.388	157.388	0.805	0.374
Within Groups (Error)	54	10558.166	195.522		
Total Variation	55	10715.554			

At the p<.05 level, the obtained results for the PIQ variable aren't significant.

A paired sample t-test was done to analyze within the LD group PIQ and VIQ. This test was done to find if there were any significant discrepancies among the two variables. The test showed that the mean for the LD students within the PIQ was 99.85. The mean for the same LD students within the VIQ was 93.67. The total number of subjects was 27. The results with this paired samples t-test showed the difference between the PIQ and the VIQ was statistically significant. The p-value was .05. After this test, the results showed a p-value of .045.

Table 3-E

Paired Samples Descriptives of LD Subjects on Performance IQ and Verbal IQ Measures

	N	Mean	Std. Dev.	SEMean
Performance IQ	27	99.85	14.40	2.77
Verbal IQ	27	93.67	14.18	2.73

Paired Samples T-Test Comparison of LD Subjects on Performance IQ and Verbal IQ Measures

	Mean	Std. Dev.	SEMean	95% Confidence Interval of the Difference		t	df	Sig.
				Lower	Upper			
Pair: Performance / Verbal IQ	6.1852	15.2946	2.9435	0.1348	12.2355	2.10	26	.045

Discussion

Early research suggests that Sattler and others had trouble finding patterns of subtest scores on the (WISC) test that discriminated between (LD) and (Non LD) students. Attempts to find specific and unique (WISC) patterns among learning disabled children have not been successful. Kavale and Forness (1984) reported that no recategorization of (WISC-R) scores, profiles, factor clusters, or patterns revealed a significant difference between the learning disabled and the normal group. These findings by Kavale and Forness are based on ninety-four (WISC-R) studies with learning disabled children (Sattler, 1992). No regrouping scheme was found to be useful in differential diagnosis even within the learning-disabled group. In this study, discriminate analysis of all ten subtests showed that of all these variables there were three that separated the (LD) group from the (Non LD) group. There was the Arithmetic subtest, which is a part of the Verbal domain of the (WISC-III), and Object Assembly and Picture Arrangement, which are a part of the Performance domain. This finding is not consistent with the research that has been done with the (WISC) tests. Why is this so? Could it have been this particular sample group? Or maybe the sample size was not big enough. Maybe the research needs to be updated and more current. Today, there could be different findings. Obviously, this is just one study. Many more could be done to see if these findings are accurate.

In the second part of this study, analysis of variance (ANOVA) was used to compare FSIQ, VIQ, and PIQ among the two groups and within the (LD) group. According to Kronenberger and Meyer (1996), LD children usually score in the average (90-109) range on Full Scale IQ. LD children also tend to have higher PO (or Performance) IQ scores than VC (or Verbal) IQ scores.

The results of this analysis showed that FSIQ, PIQ, and VIQ means for the (Non-LD) students were higher than the means for the (LD) students. The differences were significant in two areas: Full Scale IQ and Verbal IQ. There was not a significant difference among the Performance IQ scores. This study also showed that students within the (LD) sample had higher Performance IQ scores than Verbal IQ scores. These findings are consistent with past and current research. In this sample of (LD) students, the Performance IQ mean score was 99.85 as compared to the Verbal IQ mean score of 93.67. As mentioned earlier, (LD) students tend to have an average score on their Full Scale IQ. Within this sample, the (LD) students had a mean score of 95.48 on their Full Scale IQ.

In summary, the most interesting finding was from the analysis of the ten variables when comparing (LD) students and (Non-LD) students. It has been difficult to find differences within the subtests of the (WISC) between (LD) and Non-LD students. This study shows that the subtests Arithmetic, Object Assembly, and Picture Arrangement separated the (LD) group from the (Non-LD) group. More research needs to be done specifically looking for differences on these three subtests between these two groups. The other findings in this study are consistent with prior research.

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Literature Review

The (Wisc-III) is interpreted to evaluate children's intellectual ability. Scores from the (WISC-III) can help distinguish groups of children with learning disabilities when they are compared to a child's achievement scores. Scores from the (WISC-III) are of little use when no other tests are given in the assessment process. Attempts have been made to determine whether specific (WISC-R) or (WISC) patterns such as Verbal-Performance IQ discrepancies, pattern of subtest scores, and range of subtest scores can indeed distinguish learning disabled children from normal children (Sattler,1992).

In 1974, Bannatyne proposed that the (WISC) subtests should be recategorized so that it would aid in evaluating learning disabled children. They are as follows:

Spatial: Picture Completion, Block Design, and Object Assembly

Conceptual: Comprehension, Similarities, and Vocabulary

Sequential: Arithmetic, Digit Span, and Coding

Acquired Knowledge: Information, Arithmetic, and Vocabulary

According to Bannatyne, the Spatial category sampled the ability of a child to manipulate objects in multidimensional space, either directly or symbolically. The Conceptual category measured abilities related to language development. The Sequential category is the same as the Freedom of Distractibility Index score that is found on the (WISC-III) test.

This category measures the ability to retain and use sequences of auditory and memory stimuli in short-term memory. The Acquired Knowledge category represents abilities usually learned at home or school (Bannatyne, 1974). His recategorization was based on an inspection of the subtests, not on factor analytic findings (Sattler, 1992).

Bannatyne and his recategorization of the subtests were designed to aid in test interpretation. The pattern proposed to be characteristic of learning disabled children is Spatial > Conceptual > Sequential (Sattler, 1992).

Attempts to find specific and unique (WISC) patterns among learning disabled children haven't been successful. Kavale and Forness (1984) reported that no recategorization of (WISC-R) scores, profiles, factor clusters, or patterns revealed a significant difference between the learning disabled and the normal group. These findings were a result after Kavale and Forness studied ninety-four (WISC-R) studies with learning-disabled children (Sattler, 1992). No regrouping scheme was found to be useful in differential diagnosis even within the learning-disabled group. According to Sattler, the failure to find a unique (WISC-R) pattern for learning-disabled children is not surprising. Learning-disabled children represent a group that is too heterogeneous for one type of (WISC-R) profile to be typical of all or even most of it's members (Sattler, 1992). According to (Miller, Stoneburger, & Brecht, 1978), they found that the Bannatyne recategorizations have not been successful in differentiating children with visual-perceptual deficits or in differentiating learning-disabled children from (a) normal children with average intelligence (Mueller, Matheson, & Short, 1983), (b) emotionally disturbed or mentally retarded children (Henry & Wittman, 1981), (c) slow learners (Cooley & Lamson, 1983), (d) other types of exceptional children (Clarizio & Bernard, 1981). These results indicate that the child's (WISC-R) results should not be used to establish the diagnosis of a learning disability.

The (WISC-III) should only be used to assess the child's intelligence and should not be used in the absence of other tests and information to make a differential diagnosis of a learning disability. Back in the early 1980's, Sattler inspected thirty studies where scores of inadequate readers were studied. Sattler ranked the subtests of the (WISC) and put them in order from easiest to most difficult:

1. Picture Completion
2. Picture Arrangement
3. Block Design
4. Object Assembly
5. Similarities
6. Comprehension
7. Vocabulary
8. Coding
9. Digit Span
10. Arithmetic
11. Information

The four most difficult subtests form the acronym ACID (Arithmetic, Coding, Information, and Digit Span). In almost every study that compared Verbal Scale and Performance Scale IQs, Verbal Scale IQs were lower than Performance Scale IQs. This discrepancy is consistent with the rank order data that Sattler had found. The four easiest subtests were all on the Performance domain (Sattler, 1992). These trends are emerging from research and studies that rank order of (WISC) subtest scores in groups of reading-disabled children (Sattler, 1992). Of note is that the easiest four subtests all form the Perceptual-Organization (PO) factor of the (WISC-III) and that two of the hardest three subtests form the Freedom from Distractibilty Index Score (Kronenberger & Meyer, 1996).

More recently, in 1996 a study was done using the ability of the WDI (Wechsler's Deterioration Index) and whether it could serve as a distinctive measure of neurocognitive impairment in children with learning disabilities. The Wechsler's Deterioration Index (WDI) was originally developed as an indicator of cognitive impairment in adults but has recently been applied to children, because neuropsychological deficits have often been hypothesized to account for learning difficulties during the development period (Watkins, Marley, 1996). The WDI was composed of two groups of Wechsler subtest scores: hold subtests, which were considered to be insensitive to deterioration in brain injury (Vocabulary, Information, Object Assembly, and Picture Completion), and don't hold subtests, which were judged vulnerable to intellectual decline (Digit Span, Similarities, Coding, and Block

Design). These groups of subtest were later renamed the Wechsler Development Index because children's cognitive skills are not deteriorating but, rather assumed to be developing unevenly. Therefore this measure has been used to discriminate among groups of children with and without learning disabilities (Watkins, 1996). Students of this study were selected from special education records based on two criteria (a)their cognitive assessment included the (WISC-III), and (b) a diagnosis of learning disability (LD), emotional disability (ED), or mental retardation (MR). These selection criteria identified 724 students. Academic achievement levels in reading, math, and written expression were measured with the Woodcock-Johnson Tests of Achievement-Revised (Watkins, 1996). WDI scores were calculated for all subjects with complete (WISC-III) subtest data by applying this formula: WDI= (hold- don't hold) divided by hold. The subjects were categorized as impaired if their WDI exceeded .20 and nonimpaired if their WDI was .20 or less (Watkins, 1996). The study revealed that the WDI performed at chance levels when distinguishing 611 students diagnosed with learning disabilities from those diagnosed with emotionally disabled or mental retardation, as well as from 2,200 simulated random nondisabled cases (Watkins, 1996). It had been hypothesized that the WDI is an index of children's intellectual functioning that reflects development lags in important intellectual skills. This study found that a large group of children with learning disabilities had average WDI scores that were significantly higher than those of children with diagnoses of mental retardation. These statistics show that the WDI is incapable of assisting in the diagnostic decision-making process when students with learning disabilities are to be distinguished from students with other disabilities or from students without disabilities (Watkins, 1996).

A study was done in 1991 to determine if (WISC-R) Patterns of cognitive abilities in behavior disordered and learning disabled children. Both behavior disorder (BD) and learning disability (LD) are frequently diagnosed in the same children. This study comprises two parts. First, previously published data were examined to compare the Wechsler Intelligence Scale for Children-Revised (WISC-R) profiles of groups of children diagnosed as BD and to assess the fit of their scores to the Learning-Disability Index (LDI). Second, new data were secured from a total of 171 children, diagnosed as BD, LD, or both (BD-LD). All of these groups showed similar patterns of cognitive functioning, although they were clearly differentiated interms of their academic performance and by reports of behavior problems. These findings support the notion that there may be a common cognitive cause for both learning disability and behavior disorder (Longman, Inglis, & Lawson, 1991).

Bawden and Byrne, in 1991, used the Hobby (WISC-R) Short Form in a study with patients referred for neuropsychological assessment. The validity and clinical utility of the Split-Half Short Form of the Wechsler Intelligence Scale for Children-Revised were examined in four groups of children referred for neuropsychological assessment (general neuropsychological referrals, Tourette's disorder, spina bifida, and closed head injury). Long-and short-form estimates of intellectual ability and subtest scale scores were highly positively correlated for all groups. The average absolute difference between long-and short-form estimates of IQ was generally comparable to the standard error of measurement of the long form, irrespective of clinic population. Concordance rates for intellectual classification were significantly reduced and varied across groups. Patterns of strength-weakness profiles differed for long versus short forms for all groups. The short form generally overestimated intellectual ability, resulting in an increased frequency of diagnosis of learning disabilities (Bawden & Byrne, 1991).

In a study done by Meesters, Gastel, Ghys, and Merckelbach in 1998, they used factor analysis of the (WISC-R) and the K-ABC in a Dutch sample of children referred for learning disabilities. This study compared the (WISC-R) and the K-ABC looking for factors unique to the each separate instrument, as well as factors overlapping and / or common to both instruments. The study noted that the (WISC-R) tends to focus on the content of intelligence, whereas the K-ABC is more directed at mental processes. Given the similarities and differences between the two instruments, the study suggests that administering the (WISC-R) in complete form, combined with the Gestalt Closure, Spatial Memory, Hand Movements, and Word Order subtests of the K-ABC would make it possible to measure children's cognitive abilities in less time without losing relevant information, while reducing the burden of test time and test fatigue for both the child and the clinician, compared to administering both instruments in complete form. The relevant factors found were: Verbal Organization, Perceptual Organization, and Freedom from Distractibility (Meesters, Gastel, Ghys, & Merckelbach, 1998).

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