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UMI®
COGNITIVE, ACHIEVEMENT, AND BACKGROUND VARIABLES PREDICTING DIAGNOSIS OF THE COLLEGE STUDENT WITH A READING BASED LEARNING DISABILITY

DISSERTATION

Presented in Partial Fulfillment of the Requirements for

the Degree Doctor of Philosophy in the Graduate

School of The Ohio State University

By

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2000

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ABSTRACT

Historically, the discrepancy model has been used to diagnosis a learning disabled college student who comes to college without a previous diagnosis. The validity of this model has been challenged and many colleges have moved towards implementation of a clinical model, which includes the use of an intracognitive discrepancy and educational and developmental history as a basis for diagnosis. This has also been problematic because there is little agreement among researchers regarding cognitive profiles or developmental history specific to the adult LD population. This study proposes to examine cognitive, achievement, and interview data gathered at OSU’s office for Disability Services from 1992 to 1997 while testing college students for learning disabilities. The purposes of this study were to: 1) describe university students who have been experiencing academic problems due to self-reported reading problems and have been assessed; 2) determine how well the two discrepancy based models and interview information identifies reading LD from non reading LD among postsecondary students seeking learning disability support services for self-reported reading problems; and 3) determine if there is a significant difference in test scores between those diagnosed with a reading LD and those not diagnosed with a reading LD.

Data from 156 college students with reported reading difficulty who were evaluated for LD were analyzed. It was found that those who referred themselves for testing are generally male Caucasians with a history of academic problems and low average reading comprehension. Approximately half of those who were tested were found eligible for LD services. The majority of those who qualified for LD were also male Caucasians, slightly older than the average college student. The strongest predictor of eligibility for LD services was the presence of an aptitude/achievement discrepancy. Intracognitive discrepancy was a weak predictor and background variables were not correlated with eligibility for LD. It was
also found that LD students had significantly higher WAIS-R Full Scale, Verbal, and Performance IQ's. The LD group had significantly higher scores on a measure of crystallized intelligence and fluid reasoning. Finally, LD students scored lower on measures of basic reading skills, including word identification and decoding.
Dedicated to my husband,

Randall J. Ritter

and

In memory of my brother-in-law and friend,

Richard I. Mayo
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CHAPTER I

INTRODUCTION

Background

The concept of learning disabilities is a relatively new concept. It was developed less than 40 years ago in order to obtain services for children believed to have perceptual-motor impairments (Doris, 1993). Programs for the disabled in general, and for the learning disabled specifically, have not been common throughout the history of higher education. It was not until the late 1960’s and early 1970’s that the need for establishing programs for the learning disabled was recognized.

Colleges and universities are now facing increasing pressure to provide services for and accommodations for the learning disabled (LD) student. The percentage of disabled college students reporting learning disabilities as the primary disabling condition has grown the fastest of all disabilities (Henderson, 1995). Because of this growth, there is increased pressure to provide appropriate services to LD college students. At the same time that colleges are experiencing this increased pressure, they are being faced with the accusations of questionable diagnosis of LD and unreasonable accommodations for LD students. In a highly controversial case involving Boston University, the learning disability support services at that university were “decimated”, and support and accommodations are no longer being provided (Brinckerhoff, 1996). Despite being one of the most respected learning disability programs in postsecondary education, criticism regarding this program is centered on the lack of clarity and consensus for defining and diagnosing this “hidden” disability and the lack of research supporting many types of learning disabilities (i.e. “dysrationalia”-foreign language disability, “dysgraphia”-writing disability, and “dyscalcula”-math disability). In addition, there has been much criticism about the excess
of accommodations given to those with learning disabilities including extra time on tests, exemptions from foreign language and math requirements, and distraction-free testing environments. In an article about Boston University’s program in The New Republic, the author sums up this controversy by stating, “This is the new frontier, the learning disability as an opportunistic tautology. The fact that one displays a marked lack of aptitude for a particular intellectual discipline or profession establishes one’s legal right to ensure at least a degree of success in that discipline or profession” (Shalit, 1997, p.16). The controversy surrounding the diagnosis and accommodations of those with LD underscores the need to continue researching the validity of our present methods of diagnosis so that those in the business of working with the learning disabled will have consistent, defendable criteria with which to make learning disability diagnosis and accommodation decisions.

**Rationale for the Study**

The problem of defining and operationalizing the term *learning disabilities* has challenged the field since Sam Kirk’s first attempt in 1962 (Kirk, 1986, as cited in Shaw, Cullen, McGuire, & Brinckerhoff, 1995). Donald Hammill (1990, p. 74) stated that “few topics in the field of learning disabilities have evoked as much interest or controversy as those relating to the definition of this condition.”

Defining learning disabilities for the purpose of assessment and identification has also long been a challenge for educators. Despite its lack of specificity, the concept of specific learning disabilities enjoys support among professionals in the field. However, there is little agreement or consensus over how a learning disability is diagnosed. The practice of assessing learning disabilities in education today has been influenced mainly by the passage of federal legislation which provides a mandate and guidelines for identification and services for learning disabled students. The definition, outlined in the Individuals with Disabilities Education Act of 1990 (PL101-476) or IDEA, has been criticized because it is difficult to operationalize and has been interpreted inconsistently from state to state. In 1981, the National Joint Committee for Learning Disabilities (NJCLD) attempted to arrive upon a consensus for a definition and adopted a definition that says the individual must 1) have significant difficulties in the acquisition of listening, speaking, reading, writing, reasoning, or mathematical ability, 2) these must be intrinsic to the individual, and 3) it is
not a direct result of another handicapping condition or environmental influences (Hammill, Leigh, McNutt, & Larsen, 1981, p. 336). Although generally considered an improvement over other definitions, this definition still has been criticized because it does not specify the operations or procedures by which LD can be recognized and measured (Swanson, 1991b).

Assessment practices used under IDEA in elementary and high school have questionable relevancy for post secondary service providers. Of particular concern is the use of aptitude-achievement discrepancy formulas to identify a learning disability (Brinckerhoff, Shaw, & McGuire, 1993). While the use of this formula alone is of concern for all ages for many reasons (summarized in Shaw, et al., 1995), it is of particular concern for students at the post secondary level, where levels of development and life events have already had strong influences on the manifestations of a learning disability (Learning Disabilities Association of American, 1990; National Joint Committee on Learning Disabilities, 1985; Ryan & Heikkila, 1988).

In addition to the achievement/aptitude discrepancy, students at the college level may also be diagnosed based on an intracognitive discrepancy. This model examines discrepancies in performance on tests and subtests designed to assess cognitive abilities needed in acquiring, storing, integrating, retrieving and expressing information (Woodcock, 1984). The value in this approach is the focus on cognitive processing components of learning disabilities; however, the limited capacity of standardized instruments to assess isolated cognitive processes may be a weakness in this model (Brackett & McPherson, 1996).

Traditionally, the diagnosis of children with learning disabilities includes the exclusion of other factors as the primary cause of learning disabilities. This process is more difficult for adults since they bring a much more extensive history of academic and psychological problems and compensatory strategies. Identification of a learning disability
as the primary cause of an adult's difficulties depends on the diagnostician's ability to rule out other academic, physical, and social concerns that may manifest themselves in similar manners.

Despite the problems that exist, researchers agree that most state learning disabled eligibility guidelines rely on underachievement as the primary criterion for learning disabled identification in the public schools (Gregg, 1996, as cited in Gregg, Heggoy, Stapleton, Jackson, & Morris, 1996). Thus, most students who come to colleges and universities with a learning disability diagnosis were diagnosed using this criteria, with little other information about how their disability is now manifested cognitively or academically. For those who do not come to college with a diagnosis, the aptitude/achievement discrepancy model is still being utilized for postsecondary diagnosis, even though there is a lack of evidence for its usefulness at this level. As in the diagnosis of learning disabled children, even when other factors are considered, evaluators tend to give more weight to this discrepancy data then to other clinical data or evidence of academic problems (Kavale, 1987).

Finally, there is little agreement among researchers regarding cognitive profiles specific to the adult LD population. While patterns of particular academic strengths and weakness have been identified (e.g. reading comprehension problems), there is little agreement about the type of cognitive processes underlying these weaknesses (e.g. Hughes & Smith, 1990). A weakness of much of the research in this area has been an attempt to study learning disability groups as a whole, instead of breaking them down according to type of difficulty or disability (i.e. reading versus math problems).

Because of these issues, many researchers have recommended a clinical model (e.g. Brackett & McPherson, 1996; Gregg, et al., 1996) for diagnosing students at the postsecondary level. The clinical model integrates a) quantitative data, b) qualitative data, c) self-reported background information, and d) the clinical judgment of a team (Hoy, Gregg, Wisenbaker, Bonham, King, & Moreland, 1996). According to this model, learning disabilities should not be diagnosed by test scores or discrepancies alone, but the impact of clinical history, academic deficits, interpersonal attributes, and social situation is also weighed. This is the type of model utilized by the Ohio State University's Office of
Disability Services when assessing and qualifying students for learning disability services.

In studies regarding the identification of LD college students, little agreement was found across the different eligibility models as to who was identified as learning disabled (Hoy, Gregg, Wisenbaker, Bonham, King, & Moreland, 1996; Brackett & McPherson, 1996). This indicates that the type of eligibility model used to determine a learning disability directly impacts the types of students who are identified, thus highlighting the problems and issues of attempting to be both objective and consistent when diagnosing a college student with learning problems.

This study proposes to partially replicate, expand, and improve upon recent studies by 1) limiting the LD population to be studied to those who present reading problems, since it has been generally found that when using a heterogeneous LD group (comprised of those with different functional limitations) cognitive profiles are indistinguishable (Hughes & Smith, 1990), 2) analyzing intracognitive discrepancies using the Woodcock-Johnson, Revised Cognitive Cluster scores, which, compared to the WAIS subtests which have been traditionally used in research on LD, measure additional cognitive processing areas and, 3) analyzing and comparing cognitive and achievement test results of those diagnosed and not diagnosed LD to determine if there are differences between these two groups, both of whom are experiencing academic difficulty.

Researchers (Brackett & McPherson, 1996; Hughes & Smith, 1990) have also found that the regression and the ability-achievement models identified as LD more individuals with IQ scores higher than 100 than those lower than 100. This question has implications for those who score lower on intelligence tests due to the effect of LD, culture, language, or other disabilities, who may be at risk of being misidentified. This study will examine this question as well, in order to determine whether those with higher IQ scores are more likely to be diagnosed as LD because of the traditional over reliance on underachievement as a primary tool for identification of a learning disability.

Finally, no study has examined which interview questions may most reliably correlate with the presence of LD. Since self-report interview information is becoming increasingly recommended as a way to rule out medical, social, or psychological issues and to look for early learning problems (necessary for diagnosis according to DSM guidelines)
and possible genetic and developmental components, it is important to determine which questions most reliably predict the presence of a LD to help a clinical team weigh the importance of information when making a decision. This study will look at these questions and their predictive value.

**Purposes of the Study**

The purposes of this descriptive, associational study are to:

1. Describe university students who have been experiencing academic problems due to self-reported reading problems and have been screened and evaluated at the Ohio State University's Office for Disability Services (ODS) for LD services.

2. Determine how well discrepancy-based diagnosis models of LD identify reading LD from non reading LD among a population of post-secondary students seeking learning disability support services for self-reported reading problems. The relationship between discrepancy criteria used by the University and diagnosis of LD by ODS clinical model will be examined.

3. Determine how well background information data, gathered at initial screening interviews, identifies reading LD from non reading LD among the same population. The relationship between selected individual and family background variables and the diagnosis of LD will be examined.

4. Determine if there are significant differences in cognitive and achievement test scores and demographic characteristics between those identified by ODS with a reading LD and those who are not identified with a reading LD.
Research Objectives

1. Describe the selected test scores, background history, discrepancy scores, and demographic characteristics of college students with self-reported reading problems who have been evaluated to determine eligibility for LD services. Demographic characteristics include:
   
   age
   gender
   race
   college grade point average (GPA)

2. a. Examine the relationship between presence of significant ability/achievement discrepancy and determination of LD by ODS. Discrepancy will be defined by the method used by the OSU's Office of Disability Services as a discrepancy of at least one standard deviation (15 points) between reading achievement and ability. Ability to be measured by the WAIS-R Full scale (FS) standard score. Achievement to be measured by the Woodcock-Johnson Tests of Achievement-Revised (WJTA) Broad and Basic Reading Scores and the Nelson-Denny Reading Comprehension-timed scores.

   b. Examine the relationship between presence of significant intracognitive discrepancy and the determination of LD by ODS. Discrepancy will be defined as discrepancy of at least one standard deviation (15 points) between a Woodcock-Johnson Tests of Cognitive Ability -Revised (WJTCA) Cluster score and the WJTCA Extended Broad Cognitive score (BC).

3. Examine the relationship between presence of selected background and demographic variables and determination of LD by ODS. Background variables include:
   
   family history of LD (immediate family member with LD)
   previous academic problems related to reading decoding or comprehension
   significant medical history (i.e. head injury)
   significant developmental history (i.e. developmental delays in walking, talking)
4. Determine and describe the differences in cognitive and achievement data between those determined to be LD and those who were not determined to be LD. The following null hypotheses will be tested:

   a. There are no significant differences between the cognitive abilities of those who are eligible and those who are ineligible for LD services. Cognitive scores include WAIS-R Full Scale score, WAIS-R Verbal (V) and Performance (P) Scores, WJTCA Extended Broad Cognitive Score (BC), and WJTCA Cluster Scores, reflecting overall performances in seven cognitive areas: Long-Term Retrieval (LTR), Short-Term Memory (STM), Fluid Reasoning (FR), Auditory Processing (AP), Visual Processing (VP), Comprehension/Knowledge (CK) and Processing Speed (PS).

   b. There are no significant differences in reading achievement between those who are eligible and those who are ineligible for LD services. Achievement scores include the WJTA Broad Reading and Basic Reading Scores and the Nelson-Denny Reading score.

Definitions of Terms

ability scores: standard scores yielded by individually administered ability tests that indicate how well a child performs compared to peers in a standardization sample.

achievement scores: standard scores yielded by individually administered achievement tests that indicate how well a child performs compared to peers in a standardization sample. In this study, achievement scores reflect performance in general reading, reading decoding and reading comprehension.

auditory processing: (Ga): This is one of the nine broad abilities identified by factor-analytic research literature. This includes the ability to understand and process auditory information.
cognitive profile: patterns of strengths and weaknesses in measured cognitive processing areas. For the purposes of this study the cognitive scores of those found eligible for LD services by ODS will be compared with those who were not found eligible for LD services using differences between the two groups in the following standard scores: WAIS-R Full Scale, Verbal, and Performance standard scores, and WJTCA Cluster Scores (Long-Term Retrieval, Short-Term memory, Fluid Reasoning, Auditory Processing, Visual Processing, Comprehension/Knowledge and Processing Speed).

crystallized intelligence (Gc): This is one of the nine broad abilities identified by factor-analytic research literature. Also referred to as Comprehension-Knowledge, this factor represents the amount of already stored declarative and procedural knowledge and the ability to use this information.

discrepancy: operationally defined and calculated differently according to state law. Generally, indicates a difference between ability and achievement scores, as measured by a test of intelligence and achievement tests. In this study, also reflects intracognitive ability, or difference between expected cognitive ability as measured by a cognitive test, and cluster cognitive scores. The criteria used to determine eligibility for these subjects included a one standard deviation difference between significant scores.

fluid intelligence (Gf): This is one of the nine broad abilities identified by factor-analytic research literature. Also referred to as fluid reasoning or novel reasoning, this is the ability to reason, form concepts, and problem solve when faced with a novel problem that can not be solved automatically.

IDEA: The Individuals with Disabilities Act, formerly P.L. 94-142, a federal law that mandates school services for people with disabilities, including learning disabilities. Provides guidelines for states to use in operationally defining learning disabilities.

learning disability (LD): defined by IDEA as a disability characterized by difficulty with academic, language, or cognitive processing skills, presumed to be neurological in origin, and is evidenced by a severe discrepancy between achievement and ability.

LD student: defined in this study as a college student who has been identified by the college disability services office as being eligible for learning disability services.

long term storage and retrieval (Glr): This is one of the nine broad abilities
identified by factor-analytic research literature. It means the ability to store information in long-term memory and retrieve it later through association.

ODS: Office for Disability Services, The Ohio State University. This office oversees all testing, documentation, and authorized accommodations for OSU’s potential LD or documented LD students.

processing speed: $(Gs)$: This is one of the nine broad abilities identified by factor-analytic research literature. It is the ability to perform automatic cognitive tasks quickly under time pressure with focused attention and concentration.

short-term memory $(Gsm)$: This is one of the nine broad abilities identified by factor-analytic research literature. This is the ability to obtain and hold information in immediate awareness and use it almost immediately.

visual processing: $(Gv)$: This is one of the nine broad abilities identified by factor-analytic research literature. This refers to the ability to perceive and process visual information.

WAIS-R: (Wechsler Adult Intelligence Scale-Revised) The WAIS-R is used to measure intelligence in adults 16-0 to 74-11 years of age.

WJTA: (Woodcock Johnson Tests of Achievement-Revised) The WJTA is used to measure achievement in reading, writing, mathematics to children, age 2 to adults, age 95.

WJTCA: (Woodcock-Johnson Tests of Cognitive Ability-Revised) The WJTCA is used to measure cognitive abilities in children age 2, to adults, age 95.

WRAT-III: (Wide Range Achievement Test-Third Edition). This is a screening instrument for academic achievement. It includes short screening measures or word identification, spelling, and math calculation.

Limitations

1. This research is limited in that it is partially descriptive and exploratory in nature and no attempt is made to investigate causal relationships between selected student characteristics and background variables and LD eligibility.
2. This study is limited to those students with LD who were diagnosed at the postsecondary level and thus cannot be generalized to postsecondary students with LD who came to college previously diagnosed with LD.

3. This study is limited to those students who have presented themselves for testing due to presumed difficulty with academic requirements. Therefore, the comparison between LD and non LD students can be made only among those student who have been experiencing academic difficulty and completed testing. No assumptions can be made about the differences between these LD students and those without LD in the general college population.

4. This study is limited to those students diagnosed at a large Midwestern university, and thus generalization to those in different settings such as small colleges, community colleges and to those who have not attended college, must be made with caution.

5. This study is limited to the data collected and analyzed and it is recognized that examination of extraneous variables would provide additional information regarding factors affecting eligibility. Some extraneous variables include prior testing and academic remediation.

6. This study may have been limited due to differences among standardized administrations of tests. Individual scores are all subject to a margin of error to account for differences in test conditions.

Significance of Study

Generally, research has shown that the discrepancy model alone is not sufficient for determination of a learning disability, but there is no information about how to weigh the different types of data gathered by the clinical process. If background and present information is indicative of a learning disability, should the lack of discrepancy be overlooked? What if there is a severe discrepancy but little background evidence to support any problems? What background information should be given the most weight when
making the determination of a learning disability? Which discrepancies, intracognitive or ability/achievement, best predict diagnosis for learning disability services using the clinical model?

In summary this study will help to clarify which of three criteria (ability-achievement discrepancy, intracognitive discrepancy, background information) used by ODS most often predicts diagnosis. It will also help to examine if there are any cognitive differences between those diagnosed with LD and those not diagnosed with LD to determine whether cognitive processing deficits, rather than the symptom of underachievement or academic problems alone, can reasonably be used to assist with determination of a learning disability at the postsecondary level. This is not only important when interpreting testing data completed at the college level but for evaluating the quality of referral information coming into an office. This study will help to guide team members in weighing both the qualitative and quantitative information gathered during their assessment in order to make an educated and accurate diagnosis.
CHAPTER 2

REVIEW OF THE LITERATURE

Definition of Learning Disability

Defining learning disabilities for the purpose of assessment and identification continues to be a challenge for educators and psychologists. Despite its lack of specificity, the concept of specific learning disabilities enjoys support among professionals in the field. Tucker, Stevens, and Ysseldyke (1983), in a survey of 119 professionals, reported that 83% considered the category viable, and 88% believed that students with learning disabilities were clinically identified by specific symptoms that distinguish them from other students with problems in learning.

Defining a learning disability at the college level has been primarily influenced by the assessment and identification of learning disabilities at the primary and secondary school level. Therefore, issues regarding the assessment and identification of LD children must be explored before an understanding of issues related to college LD can be reached.

The assessment of LD children has been strongly influenced by the passage of federal legislation which provided a mandate and guidelines for identification and services for learning disabled students. The Individuals with Disabilities Education Act of 1990 (PL101-476) or IDEA, regulations define a learning disability as:

A disorder in one or more of the basic psychological processes involved in understanding or in using language, spoken or written, that may manifest itself in an imperfect ability to listen, think speak, read, write, spell, or to do mathematical calculations. The term includes such conditions as minimal brain dysfunction, dyslexia, and developmental aphasia. The term does not apply to children who have learning problems that are primarily the result of
visual, hearing, or motor disabilities, of mental retardation, or emotional disturbance, or of environmental, cultural, or economic disadvantage. (34 CFR 300.7 [a][10])

The criteria which must be met for a student to be found eligible are also spelled out in the IDEA regulations. A multidisciplinary team must find:

(a) That a child has a severe discrepancy between achievement and intellectual ability in one or more of the following areas:

(i) Oral expression;
(ii) Listening comprehension;
(iii) Written expression;
(iv) Basic reading skills;
(v) Reading comprehension;
(vi) Mathematics calculation; or
(vii) Mathematics reasoning.

(b) The team may not identify a child as having a specific learning disability if the severe discrepancy between ability and achievement is primarily the result of:

(1) A visual, hearing, or motor impairment;
(2) Mental retardation:
(3) Emotional disturbance; or
(4) Environmental, cultural or economic disadvantage (34 CFR 300.541).

Furthermore, the team must determine that because of the specific learning disability the child needs special education and related services (34 CFR 300.7 [a][1]).

These assessments must be based on assessment “in all areas related to the suspected disability, including, if appropriate, health, vision, hearing, social and emotional status, general intelligence, academic performance, communicative status, and motor
abilities” (34 CFR 300.532 [f]). The law further states that the comprehensive assessment must be made by a team comprised of at least four persons including “a specialist with knowledge in the area of the suspected disability”. (34 CFR 300.540).

Assessment of a Learning Disability in Children

According to Sattler (1990), the assessment for a learning disability in children has three major aims. The first is to obtain an estimate of general intelligence in order to determine whether a child has the ability for higher achievement despite past or present performance. The second goal is to determine areas of impaired functioning that may lend themselves to remediation. Finally, the third is to find areas of strength that may be helpful in remediation efforts. In order to provide a fair and objective evaluation, assessment techniques used in education for the diagnosis of childhood learning disabilities combine standardized testing of cognitive ability and achievement with interviews, observational and qualitative techniques and clinical judgment by the multidisciplinary team. In addition to these aims, an assessment battery must be able to provide evidence to rule out other handicapping conditions or environmental influences as causing the area of disability.

Typically, students with learning disabilities are expected to have uneven profiles in performance in academic and/or cognitive areas. The student’s performance on a task is judged to be “discrepant” or much weaker than expected given his or her performance on other tasks. It is on this premise that various discrepancy methods are devised in order to determine a learning disability and these discrepancy methods have become the primary marker of learning disability diagnosis. The methods most often used to identify a severe performance discrepancy can be grouped into four categories (Hoy et al., 1996). All four of these methods are controversial. They include (1) ability-achievement, (2) regression, (3) intracognitive and (4) intra-achievement. Researchers generally agree that the majority of kindergarten through high school state guidelines for identifying L.D. rely on the first method, discrepancy between aptitude and achievement, as the primary criterion for learning disability identification. (Chalfant, 1989; Cone & Wilson, 1981; Frankenberger & Harper, 1987; Frankenberger & Fronzaglio, 1991; Mercer, Hughes & Mercer, 1985, McNutt, 1986, as cited in Brackett & McPherson, 1996). Students who are low achievers in school, yet of average or above average intelligence, are candidates for identification based on this
criterion. Even within this category, there are major differences operationalizing or defining how this discrepancy is calculated. The three most commonly utilized methods cited by Wood (1991) are grade level deviation, percentage lag, and standard scores. All three methods have been criticized based on their statistical and psychometric limitations.

The standard score procedure, used by the Ohio Department of Education (Ohio Department of Education, 1982) and recommended for use by universities (AHEAD, 1996) involves comparing standard scores (i.e., z or t scores) on two tests. A criterion level for a significant discrepancy is set, such as a difference of one or two standard deviations between the achievement and ability test scores. While considering ability, grade in school, measurement error and variability across grades, this procedure does not take into account the regression of IQ on achievement and assumes a perfect correlation between ability and achievement (Wood, 1991; Sattler, 1990). The amount of discrepancy differs according to regulations. Whereas the Ohio Department of Education guidelines call for two standard deviations (30 standard score points), Ohio State University's Office of Disability Services recommends one standard deviation, or 15 standard score points, between aptitude and achievement test scores as a guideline. Sattler (1990) warns that any discrepancy formula that is used without regard to the absolute level of a student's performance may result in serious misclassifications. He states: "A discrepancy formula should never be applied without considering the child's actual scores—that is, the level at which he or she is functioning" (p. 608). For instance, a student with an IQ of 150 and a standard score of 132 on a reading achievement test is not likely to require remediation even though there is a discrepancy.

The use of the aptitude-achievement discrepancy model for assessment. The variety of operationalized definitions of learning disabilities underscores the complexity of determining psychometric definitions of these disabilities. The reliance on standardized tests to determine performance discrepancies is based on the assumption that these tests can assess individual differences and measure educationally relevant constructs (Swanson, 1991). Critical to the assumption of a discrepancy model is the notion that the achievement and cognitive tests utilized both have construct and statistical validity and that performance on one is weakly correlated with the other. It is assumed that a learning disability is an
isolated cognitive deficit that would not be predicted by overall cognitive ability. Several concerns based on construct validity, the use of IQ as a comparison to achievement, statistical validity, and professional and ethical concerns have been raised regarding the use of the discrepancy model for diagnosis of learning disabilities.

The question of construct validity of the discrepancy model in the use of diagnosing reading disabilities has been raised by Stanovich (1993). He believes that the critical assumption that has justified differential classification and treatment of LD has been that the degree of discrepancy from IQ is meaningful. The reading difficulties of a child with dyslexia should stem from different problems than those of the poor reader without a discrepancy (labeled the “garden-variety” poor reader). In Stanovich’s review and interpretation of the literature, he concludes that with subjects of different IQ levels, it has been difficult to differentiate discrepancy-based readers from “garden-variety” poor readers on tasks that tap critical components of reading such as word recognition, which is contrary to what is expected. Because intelligence is supposed to be the more encompassing construct, it is expected that IQ would separate subject groups more strongly on cognitive processes underlying reading. However, garden-variety poor readers and discrepancy based poor readers both have exhibited similar patterns of difficulties with cognitive processes underlying reading as their same aged peers. This evidence, according to Stanovich, threatens the construct validity of the IQ-based discrepancy measurement as a means of diagnosing reading learning disabilities.

The use of intelligence test score or IQ in comparison to achievement is criticized by many researchers and authors including Siegel (1988), Stanovich (1993), Swanson (1991) and Catts (1989). The choice of the IQ test as the baseline from which to measure achievement is seen as questionable because of the doubts raised recently by many about whether IQ tests measure potential in any valid sense. Standard texts in educational measurement and assessment warn against interpreting IQ scores as measures of intellectual potential separate from influence from past experience or cultural context (Sattler, 1990; Walsh & Betz, 1990). At their best, IQ test scores are gross measures of current cognitive functioning (Detterman, 1982).

Another faulty assumption regarding the use of intelligence tests for LD diagnosis
is that intelligence tests and achievement are highly correlated and that normal children's standard scores for IQ are expected to be similar to their standard scores for achievement. In the case of reading disabilities, this is not the case. In a review of the data from numerous investigations, Stanovich, Cunningham, and Feeman (1984) found that the median correlation between IQ and reading ability in grades 1-3 was .45 and in grades 4-8 it was .60. These findings indicate that a large proportion of the variance in reading performance is not accounted for by general intellectual abilities as measured by standard IQ tests (Catts, 1989). Therefore, a child's IQ may not be the most appropriate means of evaluating reading potential.

Shaw and colleagues, (1995) argue that in using the discrepancy model for diagnosis, the symptom is confused with the problem. That is, low achievement, relative to overall ability (the supposed outcome of a learning disability) is confused with a specific cognitive deficit (the supposed cause of the achievement delay). Meltzer (1994) argued that "product-oriented measures, including aptitude (IQ) and standardized achievement tests, have been the cornerstone for the diagnosis of learning disabilities" and that "these measures emphasize the end product of learning while largely ignoring the processes and strategies that students learn to approach various learning and problem-solving situations" (pp. 580-581).

It is also argued that the cause of the learning disability will also have an effect on the performance on tests of intelligence and that it is possible that performance on certain subtests of the IQ tests will be depressed as a result of the learning disability. This is referred to as the Matthew Effects (Stanovich, 1993). These effects can be both direct and indirect. For example, the cognitive processing limitations themselves that underlie a reading disability may influence performance on subtests. IQ test performance can also be influenced indirectly by lower academic achievement and experience that may result from this deficit. For example, world knowledge and vocabulary are important components measured by most IQ tests. Since a large amount of what individuals learn about vocabulary and the world around them may come from reading, reading-disabled individuals may not have as great an opportunity to acquire this knowledge, which may eventually lower performance on IQ tests. Taken together, the direct and indirect effects of the cognitive
deficits underlying the learning disability can have a significant effect on IQ test
performance and thus reduce the possibility of a severe IQ-achievement discrepancy (Catts,
1989).

Another concern with the use of the discrepancy model centers around their
"objectivity". There have been significant variations in discrepancy formulas utilized from
state to state, so that there is no uniform application of the discrepancy model (Shaw et al.,
1995). Sinclair and Alexson (cited in Wood, 1991) reported that an application of five
discrepancy formulas resulted in an identification of 4% to 28% of an LD population
(N=137) and that 64 % of the LD students were not identified by any of the formulas. This
variation means that the definition of a learning disability is not uniformly operationalized
and that a child who is eligible for services in one state may not be eligible in another. This
situation undermines the credibility and integrity of the profession because it is assumed
that because a learning disability is supposed to be permanent and intrinsic in nature, it
should not disappear in certain states.

An additional concern related to "objectivity" is that the degree of discrepancy
obtained depends heavily on the specific assessment instruments that are being utilized
(Catts, 1989). This is illustrated by Rudel (1985, cited in Catts, 1989) who found that a
sample of 50 subjects referred for reading difficulties had a mean discrepancy of 23.9
months between mental age and reading age using the Gray Oral Reading Test, which is a
timed test. In contrast, these same children had a mean discrepancy of only 8.6 months
using the Wide Range Achievement Test (WRAT), which measures the reading of single
words and is not timed. Therefore, using the common criteria of a two year discrepancy,
many of those diagnosed with a learning disability with the Gray Oral Reading Test would
not have been diagnosed using the WRAT.

Finally, arguments against the use of the discrepancy model center around
professional and ethical issues. Shaw et al., (1995) feel that the strongest criticism is that
the use of this model is predicated on school failure. In effect, these formulas require that
students fall significantly below their predicted potential before they can be identified and
provided with services. The discrepancy criteria make early identification difficult, requiring many students to experience significant academic failure before they are found to be eligible for services.

Another ethical concern regarding the use of the discrepancy model is that the formulas are too often utilized as the only criterion in the determination of a learning disability, with little emphasis placed on clinical judgment or educational history. In fact, Stanovich (1993) wrote that the assessment of discrepancy is the “key defining feature” (p. 276) in the diagnosis of a reading disability. This is contrary to the intent and the guidelines set forth in IDEA which calls for a multidisciplinary evaluation. As a result, many underachieving students have been inappropriately identified as having LD or students that may have compensated more adequately for their disability have been denied services (Macmann, Barnett, Lombard, Belton-Kocher, & Sharpe, 1989).

The use of intracognitive discrepancy model for assessment. The rationale behind using a pattern of cognitive strengths and weaknesses for diagnosis of a learning disability is based on the common belief that there is a distinct dysfunction in the central nervous system which plays a major role in performance deficits (Darden & Morgan, 1996). According to Feagans & McKinney (1991, as cited in Darden & Morgan, 1996), the majority of definitions of learning disabilities provide for deficits in cognitive processing that affect school learning. A weakness in this model is that there is no uniform method for determining which processes are affected and how to measure them.

Typically, the Wechsler Adult Intelligence Scale-Revised (WAIS-R, now WAIS-III) (Wechsler, 1981), had been most commonly utilized in assessing learning disabilities in college age populations. Cognitive processing profiles have been examined through focusing on analysis of patterns of strengths and weaknesses on WAIS-R subtests and scale scores (Darden & Morgan, 1996). Discrepancy between the three factors of the WAIS-R have been examined in an attempt to find similarities in profiles of LD students, as well as differences in subtest patterns of strengths and weakness. Profiles such as the ACID (weaknesses in Arithmetic, Coding, Information, and Digit Span) (Kaufman, 1990) profile and Bannatyne’s Model (1974) have typically been associated with learning
disabilities, although research supporting this association in LD adults is inconsistent. Research as it pertains to the WAIS-R and to college students and adult L.D. will be discussed subsequently.

The Woodcock-Johnson Tests of Cognitive Ability (WJTCA), part of the Woodcock-Johnson Psycho-Educational Battery (Woodcock & Johnson, 1989b), based on the Horn-Cattell theory of intelligence, is also frequently utilized to determine cognitive strengths and weaknesses. The WJTCA enables the analysis of intracognitive discrepancies through examining significant variability within the profile of seven different cognitive factors. It also provides several Broad Cognitive Scores depending upon which subtests are administered, which are measures of g or general intelligence from which to measure discrepancies in factor weaknesses. Research pertaining to the WJTCA and diagnosis of LD will be discussed later in this document.

The additional weakness in this model is that there is little consistent data with which to support learning disabilities as a distinct pathological entity. According to Darden & Morgan (1996), in addition to discrepancies between Verbal and Performance Intelligence scores, researchers have focused on differential patterns of information processing, abnormal neurological processing, or maturational delay. Single factor theories have focused on neurological or processing causality such as poor intersensory integration, delayed development in cerebral dominance, visual-perceptual deficits, inefficient attention, and deficient memory skills. Due to methodological problems, convergent validity has seldom been achieved in most research programs and none of the single-factor theories has been able to explain the many facets of learning disabilities.

Despite these limitations, indications of patterns of cognitive weaknesses continue to be utilized by practitioners when assessing and diagnosing a learning disability, especially at the post-secondary level. In their newsletter, AHEAD (Shaw & McGuire, 1996) recommended the use of evaluation of specific areas of information processing such as short and long-term memory, sequential memory, auditory and visual perception, processing speed, executive functioning, and motor ability.
Theories and Research with Reading Learning Disability

Phonological reading disorder. Dyslexia, (or specific reading disability) is the most common and most carefully studied of the learning disabilities. This type of disability affects 80 percent of those diagnosed as learning disabled (Lemer, 1989, as cited in Shaywitz, 1998). This disorder is also known as phonological reading disability (PRD) (Torgesen, 1993). Reading ability and disability fit along a continuum, with reading disability representing the lower tail of the normal distribution, with no difference between poor readers with IQ discrepancy (typically diagnosed as LD in the school) and those with no discrepancy (Stanovich, 1993). According to Shaywitz (1998), dyslexia is one of the most common neurobehavioral disorders affecting children, with prevalence rates ranging from 5 to 17.5 percent. Although it was previously believed that this disorder primarily affected boys, more recent data (Flynn & Rahbar, 1994; Shaywitz, Shaywitz, Fletcher, & Escobar, 1990, as cited in Shaywitz, 1998) indicate that girls and boys are affected at a similar rate. Longitudinal studies indicate that dyslexia is a persistent, chronic condition and not a developmental lag which improves over time (Shaywitz, Holford, & Holahan, 1995; Francis, Shaywitz, Stuebing, Shaywitz, & Fletcher, 1996; Scarborough, 1984; Felton, Naylor, & Wood, 1990; and Bruck, 1992, as cited in Shaywitz, 1998). According to Shaywitz (1998), dyslexia is familial and heritable; 23 to 65 percent of children with a parent with dyslexia are reported to have the disorder. About 40 percent of siblings of those with dyslexia have the disability.

The theory associated with this type of reading disability has been called the “Phonological Theory” (Torgesen, 1993) or the “Phonological-Deficit Hypothesis” (Shaywitz, 1998). Based on the work of many researchers (see Torgesen, 1993 for an extensive list of citations), the central academic problem for children with phonological reading disabilities or dyslexia involves difficulties acquiring fluent word identification skills in reading. In particular, they have difficulty with learning to apply the “alphabetic principal” or sound/symbol association in reading unfamiliar words. They are often unable to attain fully alphabetic reading skills, although with practice they can frequently acquire a
vocabulary of familiar words they recognize as whole. They still read relatively slowly. These children usually have average to high average intelligence and at least average mathematics ability.

Torgesen (1993), in describing the hypothesis underlying this type of reading disability, notes that since reading demands a much more explicit awareness of the internal phonological structure of words of the language than would be required in everyday listening and speaking, beginning readers with a weakness in phonological awareness are at risk for reading problems. This hypothesis has been supported by many lines of research that have found that children who have early reading difficulties are also delayed in development of phonological awareness. Other lines of research have also shown that children with PRD have subtle difficulties in speech perception, speech production, and naming and frequently show difficulty in short-term memory tasks involving verbal materials. These symptoms are generally regarded as symptomatic of a general and intrinsic disability in processing the phonological structures of language. Children with these symptoms do not, however, generally demonstrate difficulty with many other areas of language development, for example, the semantic aspect of language. In addition, all information processing of nonverbal material is generally relatively normal. The type of processing skill needed for phonological processing is located in the left temporal region of the brain (Damasio & Geschwind, 1984, as cited in Torgesen, 1993) and is thought to be the locus of brain dysfunction of children with PRD. Torgesen, in discussing the strengths of this theory, points to the fact that it has provided the link between an intrinsic weakness in phonological processing and early word reading problems and that this link has suggested effective intervention procedures. However, he notes that a major weakness in this theory is that it has not yet developed a developmental perspective. There is little knowledge about the course of development of these phonological problems, such as how it affects reading comprehension in adults, or the possibility of naming or short-term memory problems which have been associated with the syndrome and may persist into adulthood.
Non-verbal learning disability. A second type of learning disability which has been associated with problems with reading comprehension has been referred to as “nonverbal learning disability” (NLD), which has primarily been described in research by Byron Rourke (1989). Although these children were originally identified from among heterogeneous groups of children with learning disabilities because of consistent difficulty with mechanical arithmetic tasks, these children were also found to have difficulty with graphomotor skills, mathematical reasoning, science tasks involving problem solving and complex concept formation, and reading comprehension. Areas of academic strength include word identification skills in reading and spelling, and verbatim memory for oral and written material. These children have also been shown to have social/behavioral problems such as difficulties in adapting to new situations and low levels of social competence.

Rourke’s theory concerning the neurological impairment of children with NLD focuses on disturbances in the right cerebral hemisphere, specifically the destruction or disintegration of the white matter that is required for intermodal integration. The manifestation of NLD depends on the amount of white matter affected and the location and the stage of development at which the white matter is affected.

Torgesen (1993), in his analysis of this theory, points to a number of significant strengths. It is developed within a framework of the brain-behavior relationships and has a strong developmental emphasis, and it focuses on both the intellectual and social development of children with this disability. In addition, this theory contains elaborations of the way in which secondary characteristics develop from the primary disabilities. A weakness of the theory is that it does not clearly elaborate the ways in which the cognitive weaknesses of children with NLD produce the primary academic weakness of mechanical arithmetic tasks.

Cognitive model of reading disability. Spear-Swerling and Sternberg (1995) present a cognitive model of reading disability that does not look at reading disabilities according to subtypes and specific causes, but instead, looks at how the disability develops and changes across the age span and how it relates to the process of reading acquisition in normal achieving readers. Because of this developmental framework, this model seems to be the most relevant model for looking at reading LD at the college level. According to the
authors, this model uses the metaphor of a “road map”, which identifies the normal road to proficient reading through six phases: visual-cue word recognition, automatic word recognition, strategic reading, and proficient reading. They characterize reading disability as involving departures from the norm in one of the first four phases leading to four possible patterns of reading disability; non-alphabetic, compensatory, nonautomatic, and delayed. These patterns of reading disability do not necessarily have the same underlying causal deficit. This model also emphasizes that reading disability always involves the interaction between the child’s cognitive characteristics and environmental influences. Although some children may be born with vulnerability to reading disability, this vulnerability only develops in interaction with the environment and does not necessarily preclude learning to read. The authors cite the example of children who are born with phonological deficits, but are able, with appropriate instruction, to overcome this weakness and become proficient readers. This interactive view of reading disability suggests that a single underlying deficit such as phonological weakness might lead to a variety of performance outcomes depending upon how the weakness interacts with environment, temperament, and motivational variables.

The strength of this model is that it integrates a wide range of research findings including those on the importance of phonological processing (Torgesen, 1993, Stanovich & Siegel, 1994); the role of orthographic processes in reading acquisition (e.g. Barker, Torgesen, & Wagner, as cited in Spear-Swerling & Sternberg, 1995); the importance of automization of word recognition in reading comprehension (e.g. LaBerge & Samuels, 1974, as cited in Spear-Swerling & Sternberg, 1995); and the role of strategic processes in reading acquisition (e.g. Dole, Duffy, Roehler, & Pearson, 1991; Wong & Wong, 1986, as cited in Spear-Swerling & Sternberg, 1995). The authors of this model also distinguish it from other models because of the broad scope of the model, its developmental nature, and its interactive view. They emphasize that many of the cognitive deficits seen in reading disability change developmentally and that practitioners should understand that the kinds of deficits usually seen among adolescents and adults with reading disability, such as deficits in reading comprehension, may not be the main cause of the reading difficulty but are a result of the longstanding difficulties in other cognitive areas such as phonological processing and word recognition. Because of the developmental changes in the deficits, the
measures that are most useful in identifying reading disability vary with the pattern of reading disability.

*Woodcock-Johnson Psycho-Educational Battery Research and Reading*

Although several theories of intelligence have received increased attention recently, the Horn-Cattell fluid-crystallized ($Gf-Gc$) theory of intelligence has been recommended by many researchers as one of the most comprehensive and well researched frameworks of the structure of intelligence to date (McGrew, Flanagan, Keith, & Vanderwood, 1997). According to McGrew and his colleagues, after review of the empirical evidence, the Horn-Cattell theory and the Carroll theories (Carroll, 1993), which is similar to the Horn-Cattell theory, “represent the culmination of a lengthy and ongoing effort of many researchers who have attempted to specify a “complete” taxonomy of human cognitive abilities” (McGrew et al., 1997, p.191). $Gf-Gc$ theory has evolved through the analyses of several hundred data sets that were not restricted to the cognitive ability tests of any one intelligence battery. Following from early work by Cattell (1941, as cited in McGrew et al.), Horn's research has identified nine broad cognitive abilities (Horn, 1991): Fluid Intelligence ($Gf$). Crystallized Intelligence ($Gc$), Short-Term Acquisition and Retrieval ($Gsm$), Visual Processing ($Gv$), Auditory Processing ($Ga$), Long-Term Storage and Retrieval, ($Glr$), Cognitive Processing Speed ($Go$), Correct Decision Speed (CDS), and Quantitative Knowledge ($Go$). A brief description of these $Gf-Gc$ abilities is provided in Table 2.1. Support for these constructs has been documented extensively through many forms of validity evidence (Horn 1994, 1997, as cited in McGrew et al.). According to McGrew and colleagues, the $Gf-Gc$ theoretical model is based on a more comprehensive network of validity evidence than other contemporary multidimensional models of intelligence.
<table>
<thead>
<tr>
<th>Gf-Gc Ability</th>
<th>Symbol</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fluid Reasoning</td>
<td>$G_f$</td>
<td>Ability to reason, form concepts, and problem solve using novel information and/or procedures</td>
</tr>
<tr>
<td>Crystallized Intelligence</td>
<td>$G_c$</td>
<td>Breadth and depth of knowledge, knowledge of a culture including verbal communication and reasoning with previously learned procedures</td>
</tr>
<tr>
<td>Visual Processing</td>
<td>$G_v$</td>
<td>Ability to analyze and synthesize visual information</td>
</tr>
<tr>
<td>Auditory Processing</td>
<td>$G_a$</td>
<td>Ability to analyze and synthesize auditory information</td>
</tr>
<tr>
<td>Processing Speed</td>
<td>$G_s$</td>
<td>Ability to perform quickly automatic cognitive tasks when under pressure to maintain focused concentration</td>
</tr>
<tr>
<td>Short-Term Memory</td>
<td>$G_{sm}$</td>
<td>Ability to hold information temporarily in immediate awareness and then use it within a few seconds</td>
</tr>
<tr>
<td>Long-Term Retrieval</td>
<td>$G_{lr}$</td>
<td>Ability to store information and retrieve it later through association</td>
</tr>
<tr>
<td>Quantitative Knowledge</td>
<td>$G_q$</td>
<td>Ability to comprehend quantitative concepts and relationships and to manipulate numerical symbols</td>
</tr>
<tr>
<td>Correct Decision Speed</td>
<td>CDS</td>
<td>Quickness in providing correct answers to a variety of moderately difficult problems in reasoning, comprehension, and problem solving</td>
</tr>
</tbody>
</table>


Table 4.1: Gf-Gc Broad Cognitive Ability Definitions
Since the Wechsler scales have been the most commonly used measure of intelligence over the past sixty years, intelligence has been conceptualized as either general ability, verbal or non-verbal, or composed of four constructs (verbal comprehension, perceptual organization, freedom from distractibility, and processing speed), such as those underlying the WISC-III (Wechsler, 1991). When these interpretations of intelligence are considered according to \( Gf-Gc \) theory, it is clear that the Wechsler scales are limited in their ability to operationalize the more recent developments in intelligence. According to McGrew (1997) and McGrew and Flanagan (1996), their analyses indicated that the WJTCA, when compared to other currently commonly utilized intelligence batteries, assesses the most broad range of \( Gf-Gc \) abilities that are included in Horn’s (1991, 1994, as cited in McGrew et al., 1997) or Carroll’s (1993, as cited in McGrew et al.) models. McGrew and colleagues conclude that, although some of the abilities may be under represented, and \( Gq \) is not represented on the WJTCA, the breadth of coverage of \( Gf-Gc \) abilities provided by the WJTCA is thought to be the most complete measure of multiple abilities.

Based on this premise, McGrew and his colleagues (1997) conducted analyses at multiple grade levels to determine the relationship of both \( g \) (general intelligence) and the WJTCA seven specific abilities to reading achievement on the WJ-R Tests of Achievement. Across all analyses, the relationship of \( g \) to general reading was significant and strong across all developmental levels. However, a number of effects for specific \( Gf-Gc \) abilities were also found. \( Ga \) (Auditory Processing cluster) had significant effects on Letter-Word Identification and Word Attack (both measures of phonetic decoding ability) over and above the effects of \( g \) on reading. \( Gc \) (Crystallized intelligence or the subtests making up the Comprehensive-Knowledge cluster of the WJTCA) had significant effects on Reading Vocabulary and Passage Comprehension over and above the effects of \( g \) on reading. The researchers report that these effects are consistent with the literature that has reported significant relations between general language processing abilities and phonological awareness processing and reading. (Felton & Pepper, 1995; McBride-Chang, 1995; McGrew 1994; Wagner & Torgesen, 1987; Wagner et al., 1993; Wagner et al., 1994, as cited in McGrew et al.). The results seen for Passage Comprehension (the ability to
identify a key word missing from a reading passage) reflects an important developmental trend. Although the effects of \( g \) and \( Gc \) were all significant in grades 1 through 6, the general effects decreased in importance and became nonsignificant after grade 6, whereas the specific \( Gc \) ability effect gradually increased with age. \( Gc \) was the strongest effect on Passage Comprehension at all grades. These results highlight the fact that different abilities are needed for the different components of reading and that the developmental task for reading ability may change as a child ages. Whereas individual ability and auditory skills are needed in emergent and beginning reading, crystallized intelligence, or general language understanding is needed in order to master the task of reading comprehension as the child ages.

**Reading Learning Disabilities in Adults**

Research regarding adult reading LD is generally focused on examinations of the differences between poor readers and good readers and among poor readers with discrepant and non discrepant intelligence. Shafrir and Siegel (1994) found significant differences between adults with and without reading disabilities in phonological processing and short-term memory. The evidence is mixed for differences between poor adult readers with and without discrepancies, although numerous studies (cited in Darden & Morgan, 1996) did not find significant discrepancy group differences in a variety of component reading and cognitive skills. In a review of the literature related to reading disabilities, Johnson (1987) suggested that both visual and auditory processing problems affect reading, as do both simultaneous and sequential processing deficits. These results are consistent with results by Bruck (1990) and Siegel (1993) who both found that deficits in phonological processing and pseudo word reading persisted into adulthood. Other research reports memory deficits in readers with disabilities (Darden & Morgan, 1996).

**Learning Disabilities in College Students**

Although the IDEA legislation is only meant to cover the education of children with disabilities through high school, this legislation has influenced the way a learning disability is defined and diagnosed at the postsecondary level. However, since the IDEA definition is very child-oriented in its description, definitions proposed by The National Joint Committee for Learning Disabilities (NJCLD), The Learning Disabilities Association of America
(LDA, formerly ACLD, 1986) and the Interagency Committee on Learning Disabilities (1987) have evolved to focus on the life-span framework necessary for defining a more adult population. Hammill (1990), in a review of 11 different conceptual definitions of LD, identified five common elements: task failure, achievement-potential discrepancy, etiological factors, exclusionary factors, and dysfunctions in one or more of the basic psychological processes. After a careful analysis of these elements and of the concerns expressed in the literature regarding the various definitions, Hammill concluded that there is an emerging support for the NJCLD (1994, as cited in Hammill, 1990) definition of learning disabilities. This definition is the most recent and has been recommended by the Association on Higher Education and Disability (AHEAD) as the basis for establishing eligibility criteria for learning disability services (Shaw & McGuire, 1996).

Learning disabilities is a generic term that refers to a heterogeneous group of disorders manifested by significant difficulties in the acquisition and use of listening, speaking, reading, writing, reasoning, or mathematical abilities. These disorders are intrinsic and are presumed to be due to central nervous system dysfunction. Even though a learning disability may occur concomitantly with other handicapping conditions (e.g. sensory impairment, mental retardation, social, or emotional disturbance) or environmental influences (e.g. cultural differences, insufficient/inappropriate instruction, psychogenic factors), it is not the result of these conditions or influences. (Hammill et al., 1981, p. 336)

Programs for learning disabled college students. As stated previously, programs for the disabled in higher education had generally been scarce in the first half of the twentieth century. Jarrow (1986) notes that although Gallaudet College, established for the hearing impaired, was established in the 1860’s, other programs of support for disabled students at this level did not appear until the mid 1940’s. In her review of these services, Jarrow notes that between the years 1960 and 1970 there was an increased philosophical commitment to providing postsecondary opportunities, especially for learning disabled students, and in the early 1970’s the need for establishing programs for the learning disabled was recognized.
The first substantive paper on the topic of successful college programs for students with learning disabilities was published by HEATH Resource Center in 1981 and it listed only nine programs in the United States (Hartman, 1992, as cited in Brinckerhoff, Shaw, and McGuire, 1993). One of the earliest surveys of first year college students, The American Freshman: National Norms, was conducted by the American Council on Education (ACE) in 1978. At that time, only 2.6% of the full-time first year college students reported having any type of disability (Brinckerhoff et al., 1993). A follow-up survey by ACE in 1994 indicates that the percentage of first year students reporting a disability had more than tripled since 1978 (Henderson, 1995).

In the most recent edition of College Freshmen with Disabilities: A Triennial Statistical Profile (Henderson, 1995), data collected in 1994 indicates that between 1985 and 1994 the percentage of disabled college students reporting learning disabilities as the primary disabling condition has grown the fastest of all individuals with disabilities, from 15% to 32%. There were approximately 1.5 million first-time, full-time freshmen attending more than 3,100 institutions of higher education in 1994, therefore, it is estimated that approximately 46,000 postsecondary students reported having learning disabilities in the United States that year. The most recent edition of Peterson's Colleges with Programs for Students with Learning Disabilities (Mangrum & Strichart, 1995) lists over 800 institutions with services for students with learning disabilities in the United States.

Shaw, McGuire, and Brinckerhoff (1994) indicated that this upsurge of interest by postsecondary institutions is due to the increase in students with learning disabilities expecting services at this level. This increase is due to many factors. These include:

1. Public Law 94-142, implemented in 1978, which has required mandated special education services for students throughout their public school experience. These students have often succeeded in school and expect to continue to succeed in colleges with the help of support services.

2. The emphasis on placing students with disabilities in the least restrictive environment has resulted in many students with learning disabilities having taken the right course work to qualify for college.
3. Since the number of learning disabled who have graduated from high school with a diploma has increased, this cohort of students has become valuable as a viable student market, especially since the number of high school graduates has decreased in recent years.

4. The awareness of advocacy groups and publications of postsecondary guidebooks such as Peterson's has made parents and students more effective advocates for program development because they know their needs and rights.

5. The recent amendments to P.L. 94-142, now known as IDEA, have required transition plans for disabled students. This has helped students to focus early enough on the necessary prerequisite courses for college.

6. The increasing availability of computers and other compensatory technology has fostered academic success.

7. Increasing numbers of high school special education programs have moved away from remedial or content-tutoring models to instruction in learning strategies, metacognition, self-advocacy, and social skills necessary for college success.

8. In recent years, case law and decisions based on Section 504 of the Rehabilitation Act of 1973 have provided impetus for higher education institutions to revise admission policies, provide accommodations, and develop support services.

9. The Americans with Disabilities Act (ADA) (1990) expands accessibility beyond campus and into the private sector. Under ADA, college students with disabilities will be affected by policies regarding certification and job hiring practices after graduation. This has fostered the need for support programs for the disabled which will include this information.

Another factor that has contributed to the rapid expansion of services to college students with learning disabilities has been the availability of federal grant monies through the Office of Special Education and Rehabilitative Services (Brinckerhoff et al., 1993). During the 1980's, approximately 50 model demonstration projects for college students with learning disabilities and programs that promoted transition from high school to college for the learning disabled were federally supported (Hartman, 1992, as cited in Brinckerhoff
et al.). According to Brinckerhoff and colleagues, many of these model programs have served as blueprints for services that are now being offered in the United States and Canada.

These significant events have all contributed to the increase and improvement of service delivery at the postsecondary level for students with learning disabilities. As more colleges and universities, as well as other higher educational institutions, develop and publicize support services for students with learning disabilities, enrollment of this population is expected to grow despite demographic trends indicating a continual decline in the number of traditional college age students.

Demographic profile of college students with learning disabilities. The data from the most recent edition of College Freshmen with Disabilities: A Triennial Statistical Profile (Henderson, 1995) was tabulated from 237,777 students attending a cross section of 461 universities, four-year colleges, and two-year colleges. The responses were weighted to represent the national enrollment patterns of the total 1.5 million first-time freshmen attending over 3,100 such institutions in 1994.

Among the one in three (32 percent) who reported a learning disability, 41 percent were women and 17 percent were students of color. Slightly more than half (54 percent) attended two-year campuses, while another 44 percent were enrolled at universities or four-year colleges. Only 1 percent were attending HBCU's (Historically Black Colleges and Universities). A larger share of students with learning disabilities were enrolled at four-year institutions in 1994 than in 1991 (from 40 to 44 percent) and the share of students at two-year colleges decreased (from 59 to 54 percent).

Compared to other freshmen with disabilities, students with learning disabilities were most likely to be male, Caucasian, from families where the parents had earned graduate degrees, and the income exceeded $75,000. In terms of educational background, they were more likely to not have completed three years of high school math or two years of a foreign language, had earned C or D averages in high school, aspired to degrees that were less than a bachelor's degree, and ranked themselves lowest on math ability,
intellectual self-confidence, and academic ability. Special programs offered by colleges were particularly important to freshmen with disabilities, and they were the least likely to have been offered financial assistance as an incentive to enroll.

Hoy and Gregg (1986, as cited in Dunn, 1995) suggest that many individuals with LD are not identified until college. These students are often able to handle the work at the elementary and secondary levels and compensate more easily for their disability. However, when they reach the college level, when more abstract reasoning processes, more reading, and more extensive written work is required, they experience difficulty for the first time.

A major concern regarding college LD is the failure rate of these students (Vogel & Adelman, 1992, as cited in Dunn, 1995). Buruck, Rose, Cowen, and Yahaya (1989, as cited in Dunn, 1995) reported that for students in two and four year degree programs, there was a graduation rate of only 30 percent for students with learning disabilities, as opposed to a national graduation rate of 50 percent.

Issues Regarding Assessment and Diagnosis of College Students with Learning Disabilities

The assessment and diagnosis of traditional college age students and adults with learning disabilities is one of the most controversial topics in the area of postsecondary education service delivery. Concerns include the heterogeneity of the LD population, inconsistent criteria for defining learning disabilities, the complex nature of diagnosing adults with learning disabilities, and a lack of adequate tests and trained professionals. For LD service providers, most of whom do not provide diagnostic services on campus, the most significant concerns include the use of assessment information to determine eligibility under Section 504, the relevancy of data for assisting students to make appropriate program choices, and the utility of assessment for determining effective academic adjustments and/or auxiliary aids that are necessary to assure equal education and opportunity at the postsecondary level (Brinckerhoff et al., 1993).

It has been recommended that service providers at the postsecondary level should first adopt the definition of learning disabilities developed by the National Joint Committee on Learning Disabilities (NJCLD) (Hammill et al., 1981), which Hammill (1990) notes is the most relevant for adults, has obtained a high level of acceptance, and is the best one
presently available. However, because the NJCLD definition is not an operational definition (Swanson, 1991), and because guidelines for eligibility vary from state to state, (Shaw et al., 1995) there is a problem with inconsistency and misdiagnosis at the elementary school level which carries over to the postsecondary level. As McGuire et al. (1990, as cited in Brinckerhoff et al., 1993) states, "If misdiagnosis occurs at the postsecondary level, then it is predictable that colleges and universities may have identified grossly disproportionate numbers of students who may not actually possess specific learning disabilities" (p.70).

Under IDEA, students at the secondary level are only required to be reevaluated every three years; thus postsecondary institutions may not have access to recent information regarding the student’s disability. Furthermore, the information provided by the high school may not be the same as what is required at the postsecondary level (Brinckerhoff et al. 1993). Finally, students at the college level, because of compensatory strategies, may have placed out of special education and may not have been evaluated recently. If the student does not have appropriate documentation for the postsecondary institution, a new evaluation must be completed, often at the time, effort, and expense of the student with the possibility of the learning disability.

Those involved with the diagnosis and services for college LD students are questioning the relevancy of the assessment practices used for childhood LD by school personnel. Of particular concern is the use of aptitude-achievement discrepancy formulas to identify a learning disability, especially at the the postsecondary level, where the symptoms and problems associated with a learning disability can be expected to have changed by influences from different levels of development and life events (Learning Disabilities Association of American, 1990; National Joint Committee on Learning Disabilities, 1985; Ryan & Heikkila, 1988). Childhood difficulties may emerge in different situations or in different forms. Previous deficits in reading, writing, or attention may vary in intensity, duration or even frequency in young adulthood (Alley, Deshler, Clark, Schumaker, & Wagner, 1983). For instance, students with phonetic or word recognition problems in junior high may be identified as having a deficit in reading comprehension in college. In addition, Ryan and Heikkila point out that the postsecondary setting itself generates unique academic and social demands which may tap into a student’s previously unknown
weaknesses or strengths. A diagnostician evaluating adults must have some background in adult developmental theory to be able to determine, for example, the extent to which a learning disability may be the cause of the learning difficulties of a college student for whom it is the first time away from home and is having difficulties adjusting to his or her living situation.

Adult follow-up studies have been completed which document the long term effects of learning disabilities and point out the complexities of adult assessment. In a study regarding the problems and concerns of young adults, Blalock (1981) reported that while the processing deficits of adults appeared to be similar to those of children and adolescents with learning disabilities, they were often more subtle. Problems for this population were most frequently observed in the areas of metacognition and automaticity of skill integration. These problems strongly affected learning and employment situations. In addition, the information and tasks adults were asked to learn and the situations in which they had to function were different from those of younger individuals.

In a review of research on adult status of individuals with learning disabilities, White (1992) concluded that the effects of learning disabilities at that level were frequently not the same as for younger school children. While the majority of the adults in these studies still demonstrated or reported substantial deficits in basic academic areas, their learning disabilities more frequently caused difficulties in employment and social situations. Furthermore, Gerber, Schnieders, Paradise, Reiff, Ginsberg, & Popp, (1990) found that conditions worsened over time for many adults with learning disabilities. Since these studies covered adults from the ages 23 to 71 years, these data document the persistence and pervasiveness of learning disabilities throughout adulthood and the need for a unique diagnosis and support system to support these adults.

Traditionally, the diagnosis of children with learning disabilities includes the exclusion of other factors as the primary cause of learning disabilities. This process is more difficult for adults because of their developmental status, since they bring a much more extensive history of academic problems, compensatory strategies, physical constraints, and psychological concerns (Brinckerhoff et al. 1993). Identification of a learning disability as the primary cause of an adult's difficulties depends on the diagnostician's
ability to differentiate the learning disability from other disabilities that may manifest themselves in similar manners, including academic problems, social problems, language deficits, or functional limitations.

Two related concerns regarding the assessment of adults with learning disabilities are the scarcity of standardized, reliable, and valid diagnostic measures for use with college students and adults and the lack of adequately prepared professionals to diagnose or assist adults with learning disabilities. (Brinckerhoff et al., 1993). Vogel (1985) noted that most diagnostic tests used with this age group are inappropriate in format, content, and level of difficulty. Shepard and Smith (1983, as cited in Brinckerhoff et al., 1993) concluded that many evaluators were unaware of the technical inadequacy of the instruments they used or tended to select certain measures due to habit.

In terms of the preparation of professionals working with the adult LD population, there are a wide variety of educational levels and backgrounds of professionals administering LD assessments. Carlton and Walkenshaw (1991) reported that the backgrounds in those who are diagnosing LD varied significantly and included such fields as education, psychology, neuropathology, rehabilitation counseling, speech-language pathology, school psychology, clinical psychology, counseling psychology, special education, reading, and learning disabilities. Because of the wide variety of professionals providing diagnostic services, there is a concern about inconsistent findings, confusing reports, and a lack of useful recommendations. In addition, many of these professionals do not have the combination of training in adult development and learning disabilities, and clinical experience with this population. This raises serious concerns about the interpretation of diagnostic results and the application of these results to recommendations that are relevant (Brinckerhoff et al., 1993). The Learning Disabilities Association of American (1990) recommends that the responsibility for making the judgment be placed with the clinicians who hold advance professional degrees in generally accepted fields and who have two or more years of clinical experience with the relevant age group of the Specific Learning Disabilities population.
Research on Learning Disabled College Students

Miller and Cabell (1989) suggest that there are certain widely accepted characteristics of learning disabled adults, particularly in the postsecondary setting. In addition to academic difficulties, these include inadequate study skills, deficits in emotional and social development, short attention spans, time management difficulties, and spatial temporal difficulties. Hauser (1994) suggests that short term memory and metacognitive skills for planning for academic goals are also found in some learning disabled college students. These characteristics cluster around three main areas: academic skill deficits, difficulties related to academics (i.e. short attention span and study skills); and social-emotional disorders. Although one cannot generalize about the level of overall cognitive ability of the learning disabled college student, it has been found that generally, LD college students may have difficulty with many cognitive strategies that would help them to acquire knowledge and analyze and synthesize information. These include: (a) sequencing events and ideas; (b) understanding abstract concepts; (c) spontaneously employing cognitive strategies; (d) switching strategies when needed; (e) distinguishing important from unimportant information; (f) deductive reasoning; (g) perceiving cause and effect; (h) memory difficulties; (i) sustaining attention; (j) organizing ideas and information; (k) generalizing skills; and (l) learning from previous experience (Mangrum & Strichart, 1988).

These cognitive deficits may negatively impact a learning disabled college student’s ability to effectively develop study habits. Learning disabled college students have been described as generally lacking good work and study habits and typically have difficulty with the following: (a) organizing time, including getting work started and completing work on time; (b) sustaining effort on a task; (c) establishing short and long term goals; (d) identifying the essential requirements of a task; (e) integrating information from various sources; (f) using library resources and other reference tools; (g) note taking; (h) outlining important information in a text; (i) understanding and following directions; and (j) basic organization (Mangrum and Strichart, 1988). Mangrum and Strichart pointed
out that there is a lack of specific research on characteristics of learning disabled adults. The existing data on characteristics is mainly observational, taken from descriptions of students in existing programs.

There have been studies of cognitive and academic profiles of learning disabled college students, however, Hughes and Smith (1990) state that it is difficult to compare these findings because of the heterogeneous nature of learning disabilities and the many syndromes these disabilities may represent. Furthermore, data are difficult to interpret because diagnosis and identification of learning disabled students varies greatly across institutions. Many students may have been diagnosed in high school while some, not until college. In addition, institutions use a variety of testing instruments which may not have been normed on college students or which are not appropriate due to ceiling effects for this population. Finally, scores are often difficult to compare and interpret because they are presented in different forms (i.e. age or grade norms vs. percentile and standard scores).

Given these considerations, Hughes and Smith (1990) did attempt to review the literature pertaining to college students with learning disabilities to arrive at a profile of this population. They reviewed over 100 articles published over a twenty year time span. They report that less than 30 studies had been conducted that report on both the cognitive abilities and academic achievement of college students with learning disabilities. They found evidence that college students with learning disabilities may present unique problems which adversely affect academic performance.

A review of the literature by Hughes and Smith (1990) provides evidence that the LD college students' level of intellectual functioning is generally average or above. Although it has been suggested that a distinctive pattern of subtest scores on the Wechsler Intelligence scales are characteristic of children and adults with learning disabilities, Hughes and Smith found inconsistent evidence to this effect. For example, Bannatyne (1968, 1974, as cited in Hughes & Smith) proposed four combinations of subtests (Spatial, Verbal, Conceptualization, Sequential, and Acquired Knowledge) which differentiate children with and without learning disabilities. Deficits in the Arithmetic, Coding, Information, and Digit Span subtests (known as the ACID profile) have also been used for diagnosing children with learning disabilities (Rugel, 1974, as cited in Hughes & Smith). Hughes and Smith
found reports on the diagnostic validity of such cognitive profiles for college students to be inconclusive and contradictory. For instance, Salvia, Gajar, Gajria, and Salvia (1988, as cited in Hughes & Smith) found that although students with learning disabilities had more subtest scatter than the non disabled comparison group, WAIS-R (Wechsler, 1981) profiles overlapped considerably, making the groups indistinguishable. In contrast, Cordoni, O’Donnell, Ramaniah, Kurtz, and Rosenshein (1981, as cited in Hughes & Smith) found that of the cognitive profiles of the WAIS, 57 college students with learning disabilities differed from those of 17 controls.

Data are also inconclusive with regard to discrepancy between verbal and performance IQ (VIQ and PIQ) of the WAIS-R, another commonly used indicator of learning disabilities. Vogel (1986) hypothesized that VIQ in LD students may increase after a number of years of college education. She found VIQ and PIQ scores to be similar among 31 female college students with learning disabilities, the majority of whom were freshmen. In support of this hypothesis, other studies were reviewed by Hughes and Smith (1990), including one by Blalock (1987), who found that college graduates with learning disabilities had a mean VIQ approximately ten points higher than PIQ scores. Gajar, Murphy, and Hunt (1982, as cited in Hughes & Smith) noted the same ten point discrepancy among college students with learning disabilities. This is in contrast to other studies reviewed by Hughes and Smith, which found little difference between VIQ and PIQ. Among three studies cited by Hughes and Smith (Hayes, Hynd, & Wisenbaker, 1986; Hoy & Gregg, 1986; and Salvia et al., 1988), two studies found no significant difference between VIQ and PIQ for LD and non-LD college students, and one found discrepancies in favor of both VIQ and PIQ.

In a more recent investigation of college students with and without learning disabilities (Morgan, Sullivan, Darden, & Gregg, 1994, as cited in Darden & Morgan, 1996), it was found that the three scales of the Kaufman Adolescent and Adult Intelligence test (KAIT; Kaufman & Kaufman, 1993, as cited in Darden & Morgan) were highly correlated with the the scales on the WAIS-R, and that the subjects performed comparably well on the Crystallized and Verbal scales. However, both groups performed significantly poorer on the Fluid Scale of of the KAIT then on the Performance Scale of the WAIS-R.
Thus it was suggested that the Fluid Scale of the KAIT captured abilities that are different. No specific profile for students with learning disabilities emerged in this initial study.

According to these studies reviewed by Hughes and Smith (1990), the levels of intellectual functioning of college students with disabilities are comparable to those of non-disabled students. They do not recommend analysis of cognitive profiles for diagnosis of learning disabilities with this population, however, they do feel that analysis of subtest scores and observations of test taking behaviors are useful for predicting in which areas the students may be likely to experience difficulty in college. They caution against the use of intelligence scores alone for making judgments about an LD college student's true intellectual ability because, as recognized by the Council for Learning Disabilities (1986), intelligence test scores of many individuals with learning disabilities are depressed or uneven and may not be a true indicator of ability.

In a more recent study, Maller and McDermott (1997) examined the profiles of 194 college students with LD to determine whether they yielded unique and interpretable profiles when compared to the WAIS-R standardization sample. They found that nearly 94% of the profiles of students with LD were found to match the profiles found in the WAIS-R standardization sample. In addition, profile shapes were unable to explain a significant proportion of variation in student academic skills. The authors recommend that the use of profile analysis should be reconsidered for use as part of the psychological evaluation for LD college students since the evidence does not support the notion that college students with LD tend to have unique WAIS-R profiles.

Research regarding the use of the WJTCA with post secondary students is extremely limited. Only two studies using the WJTCA and a college age population could be located. Keogh (1986) studied two groups of learning disabled students utilizing this battery. One of her groups included students who identified themselves as LD when they applied to college while the other group consisted of students who were not labeled learning disabled until they enrolled in college. She found that students previously identified had significantly lower mean visual perceptual speed and math aptitude cluster yet significantly higher grade point averages than newly identified students.
In a doctoral dissertation, Delaney-Duggin (1992) compared patterns of intellectual functioning and levels of academic achievement among three different groups of college undergraduates, including previously diagnosed LD, those with LD diagnosed when they entered college, and those without LD, using the Woodcock-Johnson Psychoeducational Battery-Revised. The type of LD was not specified. She found that both learning disability groups were lower than the control non-LD group on the Comprehension-Knowledge Cluster, which measures verbal communication and oral expression. Previously diagnosed LD students were also significantly lower than the control group in Short-Term Memory, Processing Speed, and Fluid Reasoning. The Broad Cognitive Ability Score on both LD groups were weaker in comparison to the non-LD group.

Very few studies have looked specifically at reading achievement and difficulties for college students with learning disabilities. Hughes and Smith (1990) found that there were no systematic and or large scale studies undertaken to verify the assumption that reading difficulty is a prevalent characteristic of college LD students. Of the articles reviewed, none were written primarily to analyze specific reading achievement, but reading scores were included as data for the purposes of demographics or for comparing scores across tests. Hughes and Smith were therefore able to report data on reading characteristics which were global and offered limited insight into the nature and extent of reading difficulties with this population.

Based on the studies reviewed, Hughes and Smith (1990) concluded that college students with LD do not read as well as their non-LD peers. The areas of greatest difficulty appear to be comprehension and reading rate. The reading level of the 300 students included in Hughes and Smith's literature review was at about the tenth grade level, which is relatively low compared to non-LD college students. Similarly, in their clinical studies, Blalock and Johnson (1987) found that difficulties with reading comprehension surpassed the expected problems with decoding that many younger LD students exhibit. Bender (1994) found that most research indicates that among the 13 percent of LD high school graduates who enroll in four year colleges or universities, reading and academic scores tend to be low, and this results in difficulty reading the texts required by college courses.
Because of the high volume of course work in college, the slow reading rate and lack of comprehension can be a major barrier to success in many courses for college LD students.

Because of the difficulties with finding reading achievement tests with content validity for college students, Hughes and Smith (1990) feel that sole reliance on these tests for identification and programming is questionable. Instead, they recommend informal types of assessment, such as curriculum-based assessment, as a productive means of identifying specific problems.

Finally, there were only two studies located which looked at identification of LD with adults or college students comparing various identification methods. That is, few studies have addressed the issue of whether the discrepancy method, which is the most commonly utilized method, is the best predictor of identification of college LD. In two recent studies with adult LD, one with a group of individuals receiving vocational rehabilitation services (Hoy et al., 1996) and the other with a group of university students receiving college support services for LD (Brackett & McPherson, 1996), little agreement was found across cut-off, discrepancy and differential diagnostic eligibility models as to who was identified as learning disabled. Thus, the type of eligibility model used to determine a learning disability impacts on the differences in numbers and types of individuals identified. For example, Brackett & McPherson (1996) reported a research project in which they applied 5 different discrepancy eligibility models to the assessment of 169 college students identified as demonstrating a specific learning disability by a clinical model. They found very low correlations between all models with respect to those individuals identified by the clinical model as LD. They also found that all discrepancy models over identified students with above average IQ's and under identified students with below average intelligence. This highlights both the difficulty in objectively identifying LD and the limitations of the discrepancy models in differentiating academic problems and underachievement from LD at the postsecondary level. The authors point out that the finding of a severe discrepancy between achievement and aptitude identifies potential students with learning disabilities but is not sufficient for the differential diagnosis of LD.
Summary

Although the concept of LD is generally supported by educators and psychologists, there is little consistency in the method for identifying a learning disability. The generally accepted standard has been to label an individual as learning disabled if there is a pattern of uneven academic or cognitive performance, called the discrepancy method. This discrepancy method has been operationalized using a variety of methods, making consistent identification across jurisdiction and age difficult. Moreover, there is a body of research literature which has been critical of the discrepancy approach based on content validity, the lack of appropriate measurement tools, statistical, ethical, and professional issues. The identification of LD students becomes even more problematic at the adolescent and adult levels, where developmental, environmental, and psychological issues are often likely to impact a student’s performance.

Along with the increasing demands on colleges to serve students with learning disabilities, there is also an increased need for accountability and consistency when identifying those students with learning disabilities. However, there is little research to support the various discrepancy models currently used for identifying college LD students and most research on college LD has been on LD in general, not on specific academic weaknesses. For those universities attempting to implement a clinical model, there is no research comparing this model with more traditional models of defining LD, and there is no research to determine the best predictors of college LD. Although there has been limited research on reading LD in adults, there has been no research found on the processes and correlates of reading disability for the college student. Given these limitations in the literature regarding college students with reading difficulties, it is appropriate to not only examine which discrepancy method, demographic and background variables most consistently predict LD in those with reading difficulties, but to compare the cognitive performance of those who are identified as LD with those who are not to determine if there are substantial differences.
CHAPTER 3

PROCEDURES

Research Design

This descriptive, associational study was designed to describe variables, examine the relationship among variables, and identify differences among variables. The purpose of descriptive research is to portray the incidence, distribution, and characteristics of groups. One purpose of associational research is to “examine relationships which may have predictive or explanatory power” (Fraenkel & Wallen, 1993, p.547).

This study’s first purpose is to describe university students who have been experiencing academic problems due to self-reported reading problems and have been screened and evaluated at the Ohio State University’s Office for Disability Services (ODS) for LD services. The second purpose is to determine how well discrepancy-based diagnosis models of LD identify reading LD from non reading LD among a population of post-secondary students seeking learning disability support services for self-reported reading problems. The third purpose is to determine how well background information data, gathered at initial screening interviews, identifies reading LD from non reading LD among the same population. The last purpose is to determine if there are significant differences in cognitive and achievement test scores and demographic characteristics between those identified by ODS with a reading LD and those who are not identified with a reading LD.

Population and Sample

The target population of this study was all university students from a Midwestern university who have been evaluated by university personnel to determine eligibility for LD services. The accessible population was self referred university students who were screened and then evaluated for a learning disability with the Office of Disability Services at Ohio State University from 1992 to 1997 because of academic problems associated with reading.
The data collection was limited to those years because of the consistency of testing instruments utilized during that time period for testing and evaluation purposes. Of the 562 files of LD students who were evaluated for LD by university personnel, 156 cases were selected for analyses. The criteria for analysis included: 1) student presented with an academic problem related to reading; 2) student presented with an academic problem due to unknown circumstances and had previous problems with reading in school; 3) student presented with a present academic problem due to unknown circumstances and further testing indicated a weakness in reading comprehension or decoding. All students were tested by university personnel and were tested on the same instruments (as well as same versions). Of those who presented with the necessary criteria, only 16 were not included in the sample due to incompleteness of data. Therefore, this sample represents 90% of the accessible population.

These students had all completed a formal, standardized screening interview with LD counselors, a screening battery of achievement and study habit assessments, and a multifactored evaluation for a learning disability at the ODS. The screening instruments and multifactored evaluations were administered by Learning Disability counselors from the Office of Disability Services and Graduate Research Associate (G.R.A.) students working in the office as evaluators and counselors. The G.R.A. students were students from graduate programs in School Psychology, Clinical, or Counseling Psychology from The Ohio State University, who had the necessary coursework in psychoeducational testing administration and interpretation.

The subjects were divided into those found eligible for LD services and those who were not found eligible for LD services by ODS staff clinical evaluation procedure. This clinical procedure consists of screening instruments (WRAT-III Spelling, Learning and Study Skills Inventory, Extended form of the Nelson-Denny Reading Test-Comprehension, and informal writing sample), a clinical interview by LD counselors or G.R.A.'s, administration of an intelligence test (WAIS-R), cognitive test (WJTCA), and achievement test (WJTA). Finally, the ODS staff, consisting of evaluators and LD counselors, reviews test and screening information to make a LD diagnosis. Clinical judgment and qualitative and quantitative data are incorporated into the study of an individual profile and no
diagnosis is supposed to be made on the basis of a single test score or discrepancy measure; rather diagnoses are based on academic achievement, cognitive processes and background information. Criteria used in determining the presence of a learning disability and eligibility for LD services include the following (The Ohio State University, 1995):
1) Individual demonstrates intelligence as measured by a general intelligence test which is equal to or greater than an average ability. Because the individual's tested ability level may be affected due to other factors such as tester rapport, minimal effort, or cultural differences, a specific score is not considered an absolute.
2) A significant scatter of inter/intra subtest scores and inter-cluster scores
3) Individual demonstrates a discrepancy which is found in less than 10% of the population between verbal and performance skills on the WAIS-R.
4) Recurring patterns of cognitive processing deficits in the areas of auditory processing, visual/spatial processing, logical sequencing, automaticity, intersensory integration, memory, attention, and concentration.
5) Individual demonstrates a discrepancy of one or more standard deviations (15 points) between general intelligence testing and achievement testing.
6) Informal measures indicate deficiencies not demonstrated on standardized assessments.
7) Atypical social and behavioral characteristics noted during assessment process.
8) Self-reported factors are considered but are not regarded as primary factors. These include family history of learning disability, previously diagnosed or received services for learning disability in elementary or secondary school, medical issues, emotional factors, behavioral disorder.

Data Collection

Data was collected by this researcher, a school psychologist, from the archival test files and active files of students still enrolled at the OSU. Each case was assigned an identification number and the following data were collected on a separate data sheet for each case: aptitude/achievement discrepancy data, intracognitive discrepancy data, presence of significant background variables (family history, previous academic problems, medical
history, developmental history), three WAIS-R scores (Full Scale, Verbal, Performance)
eight WJ-R Test of Cognitive Ability scores (Broad Cognitive and seven cluster scores),
three achievement scores, and the subjects' age, gender, race, and G.P.A.

Data on background variables were gathered from intake interview summary reports
or final diagnostic reports. This information was self-reported by the interviewee and no
attempt was made to verify the data. Data sheets were marked either yes or no for presence
of significant discrepancies and presence of significant background variables. The presence
of significant family history was indicated if the subject has an immediate family member
such as a parent, child, sibling, or grandparent who had been diagnosed with a learning
disability or who had a suspected learning disability or severe problem with academic
achievement. The presence of significant medical history was indicated if the subject had
problems which may have reasonably affected overall cognitive and physical development
such as neurological problems, mild head injury, chronic ear infections, visual problems,
diagnosis of a chronic illness, problem pregnancy of the mother, birth defect, problems with
delivery or premature birth, or attention deficit disorder (ADD). A significant
developmental delay was indicated if one of the major milestones of child development such
as walking, talking, or sitting was reportedly delayed. Finally the presence of significant
previous academic problems was indicated if the subject reported previous testing for LD,
eligibility for LD services, poor achievement in primary and/or secondary grades, a delay in
reading or writing, the need for additional services such as tutoring, Reading Recovery, etc.
in primary or secondary grades, or grade retention due to poor academic achievement.

Instrumentation

Wechsler Adult Intelligence Scale-Revised (WAIS-R) (Wechsler, 1981). The
WAIS-R is used to measure intelligence in adults 16-0 to 74-11 years of age. It has eleven
subtests, six verbal and five nonverbal. All eleven subtests of the WAIS-R were
administered to each member of the standardization sample. The standardization sample of
1,880 adults was representative of 1970 United States Census data which was updated as
more current population figures became available for the seven stratification variables.
Census data was stratified according to age, gender, race, geographic region, occupation,
education, and urban-rural residence. Average reliability for the Full Scale score is .97.
Average reliability for the Verbal Scale is .97 and for the Performance scale is .93. Reliability coefficients for the subtests range from .68 (Picture Arrangement) to .96 (Vocabulary). The Full Scale Score from the WAIS-R compared to Woodcock-Johnson-Revised Achievement Battery was used to calculate discrepancy scores.

Woodcock-Johnson Psycho-Educational Battery-Revised (WJ-R) (Woodcock & Johnson, 1989b). The WJ-R, revised in 1989, consists of the Cognitive and Achievement Battery. Both the Cognitive and Achievement batteries are normed on the same nationally representative sample of 6,359 subjects. The sample included 916 students from institutions of higher education. The WJ-R is based on the Horn-Cattell Gf-Gc theory of intelligence, discussed in Chapter 2, (a fluid/crystallized theory) which is considered a significant strength of the battery.

The data regarding intracognitive discrepancy were obtained from the seven cluster scores and Extended Broad Cognitive scores from the WJ-R Cognitive Battery -Revised (WJTCA). A description of the seven Cognitive Battery Cluster factors is presented in Table 3.1. The WJTCA was originally published in 1977 as Part 1 of the three-part Woodcock-Johnson Psycho-Educational Battery (Woodcock & Johnson, 1977). The WJ-R battery represented the first significant attempt to develop an individually administered, multi-faceted, wide-age range battery of tests of more than one domain of functioning (McGrew, 1994). The Cognitive Battery (WJTCA) consists of 21 subtests, divided into the Standard and Supplementary Batteries. Cluster scores are derived from results of the primary measures of the seven factors in the WJTCA. The secondary, or supplementary measures of the WJTCA are used to further support or explore findings. For assessment of a learning disability for this population, at least 18 of the 21 subtests were administered, and for all subjects the subtests which make up the primary measures of the Cognitive Clusters were administered. Median reliabilities are reported in the WJ-R Technical Manual (McGrew et. al., 1991). Median cluster reliabilities range from .82 to .95. The median reliability coefficient for the WJ-R Extended Broad Cognitive Ability is .97. Concurrent validity studies using the WJTCA demonstrated high correlations with the WISC-R, WAIS-R, K-ABC, and SB-IV, ranging from .614 to .747.
Long-Term Retrieval (Gl)

Involves the storing of information and the fluency of retrieving it later through association. The length of intervening time is not the essence of this cluster as much as that intervening tasks have engaged working memory during the interim and the information must be retrieved.

Short-Term Memory (Gsm)

Involves the apprehension and immediate use of information. It is often called working memory. An example of this ability is remembering a telephone number long enough to dial it.

Processing Speed (Gs)

This is the speed of automatic cognitive processing. This ability is usually measured by clerical-speed type tasks, particularly when the individual is under pressure to maintain focused attention. Typical tasks can be completed without error by most people if there is no time limit.

Auditory Processing (Ga)

Involves the comprehension and synthesis of auditory patterns (but does not require comprehension of language, which is Gc). This cognitive ability is important for achievement in music and language development.

Visual Processing (Gv)

Involves the perceiving and thinking with visual patterns and spatial orientation.

Comprehension/Knowledge (Gc)

Involves the person's store of declarative and procedural knowledge including metacognition, comprehension of communication, and the types of reasoning based on previously learned procedures. It is often called crystallized intelligence, and sometimes long-term memory. This is not synonymous with over-all school achievement.

Fluid Reasoning (Gf)

Involves the ability to reason with qualitative information. Manifested in inductive and deductive reasoning, the reorganization, transformation, and extrapolation of information. This is often called fluid intelligence in the literature.

Table 3.1: Woodcock-Johnson Tests of Cognitive Ability Cognitive Cluster Names and Descriptions
Reading achievement scores were obtained from administrations of the WJ-R Achievement Battery (WJTA) and the Nelson-Denny Reading Test. The WJTA subtests which were administered to the subjects were three subtests which make up the Broad Reading and Basic Reading clusters. These include Letter-Word Identification, Passage Comprehension, and Word Attack. Letter-Word Identification measured the subject's skill in identifying isolated letters and words on a page. Passage Comprehension measured the subject's skill in reading a short passage and identifying a missing key word that would fit the context of the passage, which required the subject to utilize both comprehension and vocabulary skills. Word Attack required the subject to use phonetic ability and decoding rules to read nonsense words and measured decoding skills. According to Woodcock (1984), Broad Reading is an aggregate measure of letter and word identification, reading comprehension, and vocabulary skills. Basic Reading is a measure of basic skills in letter and word identification and phonic and structural analysis skills. Median internal consistency reliability coefficients for selected reading subtests are .92 for Letter-Word Identification, .90 for Passage Comprehension, and .91 for Word Attack. Evidence of concurrent validity is provided by correlations of the WJTA with other measures of achievement such as the Kaufman Tests of Educational Achievement, the Wide Range Achievement Tests - Revised, and the K-ABC Achievement subtests.

Nelson-Denny Reading Test (Brown, Fishco, & Hanna, 1993a). This test is the latest edition of the test, initially published in 1929. This version was complete after a survey of users was completed in 1989. According to the authors (Brown, Fishco, & Hanna, 1993b), the primary purpose of the test is “to provide a trustworthy assessment of student ability in three areas of academic achievement: vocabulary, reading comprehension, and reading rate” (p. 1). This edition is composed of two subtests, Vocabulary and Comprehension. The untimed version of the Comprehension test (allowing 32 minutes) was administered to subjects during screening and the timed Comprehension portion (allowing only 20 minutes) was administered to these subjects during the follow-up psychoeducational assessment. The Comprehension subtest consists of seven reading passages and a total of 38 questions, each with five answer choices. For the purposes of this research, only the score on the timed portion was used because during the timed portion
testing conditions were individualized (as opposed to group sessions for extended time), the test was given only by trained research associates in Psychology or School Psychology, and therefore, standardization of procedures could be better assured. The test was standardized using four samples: a high school sample (grades 9 through 12), a two-year college population sample, a four-year college/university population sample, and a law enforcement academies sample. For the four-year college sample, a total of 38 institutions participated, the sample totaling over 5,000 students. Scores for college students tested using this instrument were calculated using the four year college norms. Scores for any graduate students tested were calculated using senior year norms for four year colleges.

Regarding technical data, the technical manual presents adequate reliability estimates. The authors recommend the use of alternate forms data as the appropriate estimate of reliability. These internal consistency estimates are acceptable for Comprehension where the reliability coefficient is .81. Test-retest reliability estimates are not presented. Validity is addressed by examining the test as a screening test and in predicting academic success. The authors summarize several studies by educational institutions. In these studies previous forms of the test have been used to support the use of cutoff scores from the tests and the scores have been correlated with students’ grades. In addition the test has been used in studies to predict academic success. Validity studies with the new version of the Nelson-Denny were not reported in the technical manual. Both reviewers for the Mental Measurements Yearbook (Conoley & Inapara, 1994) recommend the Nelson-Denny for use as a screening device for older students, best used in combinations with other reading indicators.

In addition to studies cited in the Nelson-Denny Reading Test Manual for validity evidence (Brown et al., 1993b), a review of the literature found most studies using the Nelson-Denny used the test as a tool to screen students for reading levels for placement into reading groups for research purposes. Other studies used the reading test as pre and post test measures for reading interventions. Few studies subsequent to the publication of the revised version used the reading test as predictor of academic success and there was no research found on LD students and the Nelson-Denny. All predictive validity studies completed since the publication of the revised version used the previous version of the test.
For example, in a comprehensive six year study investigating the results of the use of Form E (previous version of the Vocabulary and Comprehension tests) with six successive cohorts of freshmen entering a Midwestern state university (Wood, 1990) the authors found that Nelson-Denny scores correlated positively with ACT (American College Testing Program) Composite Scores, with SAT verbal scores, and to a lesser degree with college GPA and high school GPA, although the Nelson-Denny scores added no predictive value to equations already containing high school grades and SAT or ACT scores. Finally, the Comprehension test was not likely to provide much diagnostic value as a subscore. Of note is that the scores of higher-risk freshmen who entered in a special summer transitional program were significantly lower than the scores of the traditional fall entering freshmen, adding more evidence to suggest that the Nelson-Denny is a useful tool for screening for possible reading difficulty.

Data Analysis

Analyses were performed using SAS (Kennedy & Tam, 1989). Frequency distributions were used to describe nominal data which included: gender, race, eligibility status (LD vs. non-LD), presence of aptitude/achievement and intracognitive discrepancies, family history, previous academic problems, developmental history, and medical history. Relationships between nominal variables were summarized in contingency tables and the phi coefficient was used to describe relationships between categories. To make inferences to the target population, the chi square statistic was calculated. An alpha level of .05 was used for all statistical tests. Guidelines used to describe the strength of relationships were recommended by Elifson (1982):

<table>
<thead>
<tr>
<th>Coefficient</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>.71 or higher</td>
<td>Strong Association</td>
</tr>
<tr>
<td>.31 to .70</td>
<td>Moderate Relationship</td>
</tr>
<tr>
<td>.01 to .30</td>
<td>Weak relationship</td>
</tr>
</tbody>
</table>

Interval data included age, grade point average, IQ scores, cognitive cluster and subtest scores, and achievement test scores. Interval data were described with means and standard deviations. Pearson Correlation Coefficients were calculated for the relationships between interval data and LD category. T-tests were used to determine whether there were
significant differences between LD diagnosis groups on selected interval data. Type I error (the probability of rejecting a null hypothesis that is true) was considered throughout the subsequent analysis due to multiple univariate testing.
CHAPTER 4

RESULTS

The findings are presented according to the objectives of the study. First, Ohio State University students who were evaluated to determine eligibility for LD services from 1992 to 1997 are described. Second, the relationship between the presence of selected discrepancy data and eligibility for LD services will be examined to determine whether presence of this discrepancy predicts eligibility for LD services. Discrepancy data includes aptitude/achievement discrepancy and intracognitive discrepancy. Third, the relationship between the presence of selected background variables and eligibility for LD services will be examined to see whether any of these variables are related to eligibility for LD services. These variables include family history of LD, previous academic problems, significant medical history, and significant developmental history. Fourth, eligible and ineligible students are described and compared in order to determine whether groups differ on selected test scores and selected demographic characteristics. Selected demographic characteristics were age, gender, race, and college grade point average. Selected test scores were WAIS-R Full Scale Score, WAIS-R Verbal Scale score, WAIS-R Performance Scale Score, WJTCA Broad Cognitive Score, WJTCA Cluster Scores (Long-Term Retrieval, Short-Term Memory, Fluid Reasoning, Auditory Processing, Visual Processing, Comprehension/Knowledge, and Processing Speed), WJTA Broad Reading and Basic Reading scores, and Nelson-Denny Reading Comprehension.

Description of Students Evaluated to Determine Eligibility for LD Services

Data analysis was based on 156 students obtained from an original sample of 562 cases. Students who were not referred for reading difficulties or who did not have WAIS-R Full Scale, a reading achievement measure, or WJTCA Cluster Scores data were removed, since these data were necessary to answer the core objectives of the study. Selected
demographic variables were age, grade point average, race, and gender. The mean age was 22.9 years (SD = 6.5). The range was 18 years to 56 years of age. Fifty-four percent were between the ages of 18 and 21, the typical age for undergraduate college students. Fewer (34%) were between the ages of 22 and 29. The smallest percentage (10%) were over the age of 29 (ranging from 29 to 56). The age was unknown for only 1 subject (Table 4.1).
<table>
<thead>
<tr>
<th>Age</th>
<th>f</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>18</td>
<td>12</td>
<td>7.7</td>
</tr>
<tr>
<td>19</td>
<td>30</td>
<td>19.4</td>
</tr>
<tr>
<td>20</td>
<td>25</td>
<td>16.1</td>
</tr>
<tr>
<td>21</td>
<td>18</td>
<td>11.6</td>
</tr>
<tr>
<td>22</td>
<td>18</td>
<td>11.6</td>
</tr>
<tr>
<td>23</td>
<td>8</td>
<td>5.2</td>
</tr>
<tr>
<td>24</td>
<td>13</td>
<td>8.4</td>
</tr>
<tr>
<td>25</td>
<td>6</td>
<td>3.9</td>
</tr>
<tr>
<td>26</td>
<td>1</td>
<td>0.6</td>
</tr>
<tr>
<td>27</td>
<td>2</td>
<td>1.3</td>
</tr>
<tr>
<td>28</td>
<td>3</td>
<td>1.9</td>
</tr>
<tr>
<td>29</td>
<td>2</td>
<td>1.3</td>
</tr>
<tr>
<td>30</td>
<td>2</td>
<td>1.3</td>
</tr>
<tr>
<td>31</td>
<td>2</td>
<td>1.3</td>
</tr>
<tr>
<td>32</td>
<td>2</td>
<td>1.3</td>
</tr>
<tr>
<td>33</td>
<td>1</td>
<td>0.6</td>
</tr>
<tr>
<td>35</td>
<td>1</td>
<td>0.6</td>
</tr>
<tr>
<td>37</td>
<td>1</td>
<td>0.6</td>
</tr>
<tr>
<td>40</td>
<td>1</td>
<td>0.6</td>
</tr>
<tr>
<td>41</td>
<td>1</td>
<td>0.6</td>
</tr>
<tr>
<td>45</td>
<td>1</td>
<td>0.6</td>
</tr>
<tr>
<td>46</td>
<td>2</td>
<td>1.3</td>
</tr>
<tr>
<td>47</td>
<td>1</td>
<td>0.6</td>
</tr>
<tr>
<td>56</td>
<td>1</td>
<td>0.6</td>
</tr>
<tr>
<td>Total</td>
<td>155</td>
<td>99.6</td>
</tr>
</tbody>
</table>

Table 4.1: Number of students evaluated according to age
Approximately the same number of females (76) were evaluated as males (79). (For one student, no gender was identified.) The majority, 116 (76%) of the students evaluated, were white, compared to 13 (8.4%) who were black. The remainder of the students evaluated (5.8%) were either Hispanic, Asian, or identified themselves as “other”. A relatively large percentage (10.4%) did not identify their race (Table 4.2). For the 146 students for whom grade point average was available, the mean was 2.38 (SD = .99), or slightly above a C average. The range of G.P.A. averages was .99 to 3.84.

<table>
<thead>
<tr>
<th>Race</th>
<th>f</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Caucasian</td>
<td>116</td>
<td>74.4</td>
</tr>
<tr>
<td>African-American</td>
<td>13</td>
<td>8.3</td>
</tr>
<tr>
<td>Hispanic</td>
<td>2</td>
<td>1.3</td>
</tr>
<tr>
<td>Asian</td>
<td>2</td>
<td>1.3</td>
</tr>
<tr>
<td>Other</td>
<td>5</td>
<td>3.2</td>
</tr>
<tr>
<td>Unknown</td>
<td>18</td>
<td>11.5</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>154</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Table 4.2: Number of students evaluated according to race

In terms of background variables, less than half of the students evaluated indicated that they had either a significant family history (35.9%) or medical history (37.8%). Far fewer indicated that they had a significant developmental history (12.2%). In contrast, a majority of those evaluated had had previous academic problems or had received services for a learning disability or academic problem (71.2%) (Table 4.3).
Table 4.3: Presence of significant background variable according to type

<table>
<thead>
<tr>
<th>Background Variable</th>
<th>f</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Family History</td>
<td>56</td>
<td>35.9</td>
</tr>
<tr>
<td>Previous Academic Problems</td>
<td>111</td>
<td>71.2</td>
</tr>
<tr>
<td>Medical History</td>
<td>59</td>
<td>37.8</td>
</tr>
<tr>
<td>Developmental History</td>
<td>19</td>
<td>12.2</td>
</tr>
</tbody>
</table>

Approximately half of the students (77) evaluated (49.4%) were found eligible for LD services. Similarly, 46.2% (72) were found to have a discrepancy between aptitude and achievement when comparing their Full Scale WAIS-R scores and their scores on three tests of achievement (WJ-R Broad Reading, Basic Reading, or Nelson-Denny). A much lower percentage (38.5 % or 60 students), were found to have an intracognitive discrepancy, or a significant difference between their WJTCA Broad Cognitive score and a cognitive cluster area. Similarly, a slight minority of students had a significant discrepancy between the Verbal and Performance Scale scores on the WAIS-R (Table 4.4).

Table 4.4: Number of students found to have discrepancies according to type

<table>
<thead>
<tr>
<th>Type of Discrepancy</th>
<th>f</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aptitude/Achievement</td>
<td>72</td>
<td>46.2</td>
</tr>
<tr>
<td>Intracognitive</td>
<td>60</td>
<td>38.5</td>
</tr>
<tr>
<td>WAIS V/P</td>
<td>49</td>
<td>32.0</td>
</tr>
</tbody>
</table>

59
For the 156 students evaluated, the mean WAIS-R Full Scale Score was 101.59 (SD = 11.34). The scores ranged from 79 to 134. The mean WAIS-R Verbal score was 100 and the mean Performance score was 103.17 (Table 4.5). For the WJTCA Broad Cognitive Score, the mean was 99.28 (SD = 10.42). The scores ranged from 75 to 126. Mean WJTCA cluster scores ranged from 97.51 (Short-Term Memory) to 105.96 (Fluid Reasoning) (Table 4.6). Mean reading achievement scores ranged from 89.77 (Nelson-Denny) to 101.22 (Broad Reading) (Table 4.7). While the WJ-R Broad and Basic Reading score means were in the Average range, the Nelson-Denny score is in the Low Average range, approximately 10 points lower than WJ-R scores.

<table>
<thead>
<tr>
<th>Test Score</th>
<th>M</th>
<th>SD</th>
<th>n</th>
<th>range</th>
</tr>
</thead>
<tbody>
<tr>
<td>WAIS-R Full Scale</td>
<td>101.59</td>
<td>11.34</td>
<td>156</td>
<td>79-134</td>
</tr>
<tr>
<td>WAIS-R Verbal</td>
<td>100.00</td>
<td>10.81</td>
<td>155</td>
<td>77-133</td>
</tr>
<tr>
<td>WAIS-R Performance</td>
<td>103.17</td>
<td>12.27</td>
<td>155</td>
<td>76-144</td>
</tr>
</tbody>
</table>

Table 4.5: Means, standard deviations, and ranges of WAIS-R scores of students evaluated
<table>
<thead>
<tr>
<th>WJTCA Cluster</th>
<th>M</th>
<th>SD</th>
<th>n</th>
<th>range</th>
</tr>
</thead>
<tbody>
<tr>
<td>BC</td>
<td>99.28</td>
<td>10.42</td>
<td>156</td>
<td>75-126</td>
</tr>
<tr>
<td>LTR</td>
<td>97.87</td>
<td>9.93</td>
<td>156</td>
<td>75-125</td>
</tr>
<tr>
<td>STM</td>
<td>97.51</td>
<td>12.90</td>
<td>156</td>
<td>67-145</td>
</tr>
<tr>
<td>PS</td>
<td>99.94</td>
<td>14.41</td>
<td>156</td>
<td>56-143</td>
</tr>
<tr>
<td>AP</td>
<td>99.46</td>
<td>13.08</td>
<td>156</td>
<td>68-138</td>
</tr>
<tr>
<td>VP</td>
<td>104.71</td>
<td>12.09</td>
<td>156</td>
<td>75-135</td>
</tr>
<tr>
<td>CK</td>
<td>97.64</td>
<td>12.30</td>
<td>156</td>
<td>69-128</td>
</tr>
<tr>
<td>FR</td>
<td>105.96</td>
<td>13.11</td>
<td>156</td>
<td>79-136</td>
</tr>
</tbody>
</table>

Note. BC = Broad Cognitive, LTR = Long-Term Retrieval, STM = Short-Term Memory, PS = Processing Speed, AP = Auditory Processing, VP = Visual Processing, CK = Comprehension/Knowledge, FR = Fluid Reasoning

Table 4.6: Means, standard deviations, and ranges of WJTCA scores of students evaluated

<table>
<thead>
<tr>
<th>Test Score</th>
<th>M</th>
<th>SD</th>
<th>n</th>
<th>range</th>
</tr>
</thead>
<tbody>
<tr>
<td>WJ-R Broad Reading</td>
<td>101.22</td>
<td>9.91</td>
<td>156</td>
<td>79-128</td>
</tr>
<tr>
<td>WJ-R Basic Reading</td>
<td>99.67</td>
<td>12.40</td>
<td>153</td>
<td>69-140</td>
</tr>
<tr>
<td>Nelson-Denny</td>
<td>89.77</td>
<td>11.80</td>
<td>151</td>
<td>67-133</td>
</tr>
</tbody>
</table>

Table 4.7: Means, standard deviations, and ranges of WJTA scores of students evaluated
Relationships Between Presence of Aptitude/Achievement, Intracognitive Discrepancy and Eligibility for LD Services

Each of the discrepancy models (aptitude/achievement and intracognitive) was cross-tabulated with eligibility for LD services. Figures 4.8 and 4.9 show the results of those cross-tabulations. Of the 77 students who qualified for LD, 58 or 75% had an aptitude-achievement discrepancy and 38, or 49% had an intracognitive discrepancy. This is compared to the non-LD group, where only 14 of the 79 who were not identified LD (18%) had an aptitude/achievement discrepancy and 21 of the 79 (26%) had an intracognitive discrepancy. A chi-square test was used to determine whether eligibility for LD as determined by OSU differed significantly from either discrepancy model. According to Fraenkel and Wallen (1993), a chi square is a nonparametric test of significance appropriate when the data are in the form of frequency count, comparing frequencies actually observed with expected frequencies to see if the data are independent. Presence of aptitude-achievement discrepancy and LD eligibility were found to be dependent $\chi^2 (1, N = 155) = 52.06, p < .0000$. This means that more students with aptitude-achievement discrepancies than expected by chance were qualified for LD given the number of overall students in the sample. Similarly, the presence of an intra-cognitive discrepancy and LD eligibility were found to be dependent $\chi^2 (1, N = 155) = 7.617, p < .0060$. Again, this means that more students with intracognitive discrepancies than expected by chance were qualified for LD given the number of overall students in the sample.
### Table 4.8: Cross-tabulation of LD eligibility with aptitude/achievement discrepancy

<table>
<thead>
<tr>
<th></th>
<th>A/AD</th>
<th>no A/AD</th>
<th>Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td>LD</td>
<td>58</td>
<td>19</td>
<td>77</td>
</tr>
<tr>
<td>no LD</td>
<td>14</td>
<td>65</td>
<td>79</td>
</tr>
<tr>
<td>Totals</td>
<td>72</td>
<td>84</td>
<td>156</td>
</tr>
</tbody>
</table>

Note: A/AD = aptitude/achievement discrepancy

### Table 4.9: Cross-tabulation of LD eligibility with intracognitive discrepancy

<table>
<thead>
<tr>
<th></th>
<th>ICD</th>
<th>no ICD</th>
<th>Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td>LD</td>
<td>38</td>
<td>39</td>
<td>77</td>
</tr>
<tr>
<td>no LD</td>
<td>21</td>
<td>58</td>
<td>79</td>
</tr>
<tr>
<td>Totals</td>
<td>59</td>
<td>97</td>
<td>156</td>
</tr>
</tbody>
</table>

Note: ICD = intracognitive discrepancy;

Table 4.9: Cross-tabulation of LD eligibility with intracognitive discrepancy
Phi Coefficients were calculated for all discrepancy data and LD eligibility status. The intercorrelations between LD eligibility and discrepancy data are shown in Table 4.10.

<table>
<thead>
<tr>
<th></th>
<th>LD</th>
<th>A/AD</th>
<th>ICD</th>
</tr>
</thead>
<tbody>
<tr>
<td>LD</td>
<td>---</td>
<td>.58</td>
<td>.22</td>
</tr>
<tr>
<td></td>
<td>.00</td>
<td>.01</td>
<td></td>
</tr>
<tr>
<td></td>
<td>156</td>
<td>156</td>
<td></td>
</tr>
<tr>
<td>A/AD</td>
<td>---</td>
<td></td>
<td>.19</td>
</tr>
<tr>
<td></td>
<td>.02</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>156</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ICD</td>
<td></td>
<td>---</td>
<td></td>
</tr>
</tbody>
</table>

Note: A/AD = aptitude/achievement discrepancy; ICD = intracognitive discrepancy

Table 4.10: Intercorrelations between discrepancy data and LD eligibility

The strongest relationship, a moderate relationship according to Elifson (1982), was found between eligibility for LD and the presence of a discrepancy between aptitude and achievement. There was a weak relationship between the presence of an intracognitive relationship and LD eligibility. Finally, there was also a weak relationship between the presence of an intracognitive discrepancy and the presence of an aptitude achievement discrepancy, meaning that if a student had the first type of discrepancy, they were slightly more likely to have the second type. Of the 77 students who qualified for LD, 27 or 35% had both aptitude/achievement and intracognitive discrepancies.
Relationship Between Selected Background Variables and Eligibility for LD Services

Table 4.11 illustrates the number and percentage of those reporting significant background variables according to LD eligibility. The incidence of reports of the selected variables did not differ significantly according to LD eligibility. Of the 77 students who were found eligible for LD services, a majority of the subjects (65 or 84%) reported one or more of the selected significant background variables. This is similar to the number of non-LD students who reported significant background variables (68 or 86%). The most frequently reported variable by LD students was a history of previous academic problems (73%). Again, this is similar to the percentage of non-LD who reported previous academic problems (70%). Forty-two percent of those who qualified for LD services compared to 34% of those who did not qualify reported significant medical history. Family history was reported by 35% of LD students and 36% of the non-LD students. Finally, 10% of the LD students reported significant developmental history compared with 14% of those who did not qualify for LD.

<table>
<thead>
<tr>
<th>Background Variable</th>
<th>LD</th>
<th>%</th>
<th>non-LD</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Previous Academic Problems</td>
<td>56</td>
<td>72</td>
<td>55</td>
<td>70</td>
</tr>
<tr>
<td>Medical History</td>
<td>32</td>
<td>42</td>
<td>27</td>
<td>34</td>
</tr>
<tr>
<td>Family History</td>
<td>27</td>
<td>35</td>
<td>28</td>
<td>36</td>
</tr>
<tr>
<td>Developmental History</td>
<td>8</td>
<td>10</td>
<td>11</td>
<td>14</td>
</tr>
</tbody>
</table>

Table 4.11: Number and percentage of those reporting significant background variables according to LD eligibility
Phi Coefficients were calculated for all dichotomous background variables and LD eligibility. There were no significant correlations found between presence of family history of LD, previous academic problems, significant medical problems, or significant medical history and the eligibility for LD services.

**Relationship Between Demographic Variables and Eligibility for LD Services**

Chi-square test for proportions were completed to determine whether dichotomous demographic variables (gender and race) were independent from OSU LD eligibility. Gender was found to be dependent \( X(1, N = 155) = 19.54, p < .0000 \). This means that more men than expected by chance were qualified for LD given the number of overall men in the sample. Of those found eligible for LD services, 53, or 68.8% were male, compared to only 24 females who qualified (31.2%).

Phi Coefficients and Pearson Product Correlations were calculated for all demographic variables. The intercorrelations between LD eligibility and significant demographic variables are shown in Table 4.12.

<table>
<thead>
<tr>
<th></th>
<th>LD</th>
<th>Age</th>
<th>Gender</th>
</tr>
</thead>
<tbody>
<tr>
<td>LD</td>
<td>---</td>
<td>.21</td>
<td>-.36</td>
</tr>
<tr>
<td></td>
<td>.01</td>
<td>.00</td>
<td></td>
</tr>
<tr>
<td></td>
<td>155</td>
<td>155</td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>---</td>
<td>.08</td>
<td></td>
</tr>
<tr>
<td></td>
<td>.35</td>
<td>.35</td>
<td></td>
</tr>
<tr>
<td></td>
<td>155</td>
<td>155</td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td>---</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 4.12 Intercorrelations between selected demographic variables and LD eligibility
Two significant relationships were found. There was a moderate correlation between gender and LD eligibility. As discussed above, those who were diagnosed LD were more likely to be men. Second, there was a weak correlation between age and LD eligibility, meaning that generally, as age increases, the chance of being found eligible for LD services increases slightly. Of those who qualified LD, the mean age was 24, compared to 21 for those who did not qualify. A t-test was calculated on the difference of the mean ages, and the difference was found to be statistically significant ($t = -2.66$, $df = 153$, $p < .0087$). This means that, on average, those who qualified for LD were significantly older than those who did not qualify for LD.

**Differences in Cognitive and Achievement Scores and Between LD Eligible and Ineligible Groups**

Interval testing data included IQ scores, cognitive cluster and subtest scores, and achievement test scores. Interval data were described with means and standard deviations. T-tests were used to determine whether there were significant differences between LD diagnosis groups on selected interval data. Type I error (the probability of rejecting a null hypothesis that is true) was considered throughout the subsequent analysis due to multiple univariate testing. Results obtained for the hypotheses are as follows:

a) **Null Hypothesis 1**: These are no significant differences between the cognitive abilities of those who are eligible and those who are ineligible for LD services. Cognitive scores include WAIS-R Full Scale score, WAIS-R Verbal and Performance Scores, WJTCA Broad Cognitive Score, and WJTCA Cluster Scores, reflecting overall performances in 7 cognitive areas: Long-Term Memory, Short-Term Memory, Fluid Reasoning, Auditory Processing, Visual Processing, Comprehension/Knowledge and Processing Speed.

The mean scores and standard deviations of the cognitive testing scores for the LD and non-LD groups are presented in Table 4.12. Significant differences were found between LD eligible and LD non-eligible students for five of the eleven test scores: WAIS-R Full Scale ($t = -5.51$, $df = 154$, $p < .0000$); WAIS-R Verbal ($t = -5.40$, $df = 153$, $p < .0000$); WAIS-R Performance ($t = -4.48$, $df = 153$, $p < .0000$); WJTCA Comprehension/Knowledge ($t = -3.66$, $df = 154$, $p < .0003$); and WJTCA Fluid Reasoning ($t = -3.33$, $df = 154$, $p < .0011$). Because significant differences in cognitive ability were found, the null hypothesis is
rejected. These results show that the students who were found eligible for LD services had significantly higher scores on measures of general cognitive ability (WAIS-R Full Scale), and verbal and non-verbal ability (WAIS-R Verbal and Performance Scores). In addition, LD students had higher scores measuring fluid intelligence (gf) (Fluid Reasoning Cluster) and crystallized intelligence (gc) (Comprehension-Knowledge Cluster). Of note is that on all cognitive areas measured except Short-Term Memory (STM) and Auditory Processing (AP), the LD group’s means were higher than non LD group means. Again, the differences between LD and non LD group means were significant only in the five areas mentioned previously, and there were not significantly higher non LD scores than LD scores in any other cognitive area.
<table>
<thead>
<tr>
<th>Cognitive Test Score</th>
<th>Not LD n=79</th>
<th>LD n=77</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>WAIS-R FS*</td>
<td>97.06</td>
<td>10.44</td>
</tr>
<tr>
<td>WAIS-R Verbal*</td>
<td>95.72</td>
<td>8.89</td>
</tr>
<tr>
<td>WAIS-R Perf.*</td>
<td>99.03</td>
<td>12.03</td>
</tr>
<tr>
<td>WJTCA BC</td>
<td>98.02</td>
<td>10.21</td>
</tr>
<tr>
<td>WJTCA LTR</td>
<td>96.73</td>
<td>8.98</td>
</tr>
<tr>
<td>WJTCA STM</td>
<td>98.34</td>
<td>11.06</td>
</tr>
<tr>
<td>WJTCA PS</td>
<td>99.94</td>
<td>11.66</td>
</tr>
<tr>
<td>WJTCA AP</td>
<td>100.63</td>
<td>11.57</td>
</tr>
<tr>
<td>WJTCA VP</td>
<td>104.42</td>
<td>12.66</td>
</tr>
<tr>
<td>WJTCA CK*</td>
<td>94.26</td>
<td>11.21</td>
</tr>
<tr>
<td>WJTCA FR*</td>
<td>102.61</td>
<td>13.22</td>
</tr>
</tbody>
</table>


Note. * indicates mean differences that are statistically significant.

Table 4.13 Means and standard deviations for cognitive test scores by LD group

b) **Null Hypothesis 2**: There are no significant differences in reading achievement between those who are eligible and those who are ineligible for LD services. Achievement scores include the WJTA Broad Reading, WJTA Basic Reading, and the Nelson-Denny-Untimed scores.

The mean scores and standard deviations of the achievement testing scores for the LD eligible and LD ineligible groups are presented in Table 4.13. Significant differences
were found between LD eligible and LD non-eligible students for one of the three test scores. The mean score for WJ Basic Reading was significantly higher for the non LD group than for the LD group ($t = 2.52$, $df = 151$, $p<0.0128$). Basic Reading consists of subtests measuring word recognition and decoding skills, in contrast to the Broad Reading Cluster with subtests which measure both recognition, vocabulary, and comprehension skills. Both groups scored much lower on the Nelson Denny than on other tests of reading. The Nelson-Denny measures reading comprehension only. Because a significant difference in achievement was found, the null hypothesis is rejected.

<table>
<thead>
<tr>
<th>Achievement Score</th>
<th>Not LD</th>
<th></th>
<th></th>
<th></th>
<th>LD</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>n</td>
<td></td>
<td>M</td>
<td>SD</td>
<td>n</td>
</tr>
<tr>
<td>WJ Broad</td>
<td>102.38</td>
<td>9.58</td>
<td>79</td>
<td></td>
<td>100.03</td>
<td>10.16</td>
<td>77</td>
</tr>
<tr>
<td>WJ Basic *</td>
<td>102.18</td>
<td>11.09</td>
<td>76</td>
<td></td>
<td>97.22</td>
<td>13.19</td>
<td>77</td>
</tr>
<tr>
<td>ND</td>
<td>90.81</td>
<td>11.24</td>
<td>77</td>
<td></td>
<td>88.69</td>
<td>12.34</td>
<td>74</td>
</tr>
</tbody>
</table>

Note. * indicates mean differences that are statistically significant.

Note. WJ = Woodcock-Johnson-Revised Tests of Achievement; Broad = Broad reading; Basic = Basic Reading, ND = Nelson-Denny

Table 4.14 Means and standard deviations for achievement test scores by LD group
CHAPTER 5

SUMMARY, DISCUSSION, AND IMPLICATIONS

Purpose of Study

The purposes of this descriptive, associational study were to:

1. Describe university students who have been experiencing academic problems due to self-reported reading problems and have been screened and evaluated at the Ohio State University's Office for Disability Services for LD services.

2. Determine how well discrepancy-based diagnosis models of LD identify reading LD from non reading LD among a population of post-secondary students seeking learning disability support services for self-reported reading problems. The relationship between discrepancy criteria used by the University and diagnosis of LD by ODS clinical model was be examined.

3. Determine how well background information data, gathered at initial screening interviews, identifies reading LD from non reading LD among the same population. The relationship between selected individual and family background variables and the determination of LD was examined.

4. Determine if there are significant differences in cognitive and achievement test scores and demographic characteristics between those identified by ODS with a reading LD and those who are not identified with a reading LD.

Research Objectives

1. Describe the selected test scores, background history, discrepancy scores, and demographic characteristics (age, gender, race, college GPA) of college students with self-reported reading problems who have been evaluated to determine eligibility for LD services.
2. a. Examine the relationship between presence of significant ability/achievement discrepancy and determination of LD by ODS. Discrepancy was defined by the method used by the OSU's Office of Disability Services as a discrepancy of at least one standard deviation (15 points) between reading achievement and ability. Ability was measured by the WAIS-R Full Scale (FS) standard score. Achievement was measured by the WJTA Broad and Basic Reading scores and the Nelson-Denny Reading Comprehension-timed scores.

b. Examine the relationship between presence of significant intracognitive discrepancy and the determination of LD by ODS (Ohio State University's Office of Disability Services). Discrepancy was defined as discrepancy of at least one standard deviation (15 points) between a Woodcock-Johnson Tests of Cognitive Ability-Revised (WJTCA) cluster score and WJTCA Extended Broad Cognitive Scores (BC).

3. Examine the relationship between presence of selected background and demographic variables (family history of LD, previous academic problems related to reading prior to college, significant medical history, significant developmental history, gender, and race) and determination of LD by ODS.

4. Determine and describe the differences in cognitive and achievement data between those diagnosed with LD and those not diagnosed. The following null hypotheses was tested:

a. There are no significant differences between the cognitive abilities of those who are eligible and those who are ineligible for LD services. Cognitive scores include WAIS-R Full Scale score, WAIS-R Verbal and Performance Scores, WJTCA Broad Cognitive Score, and WJTCA Cluster Scores, reflecting overall performances in seven cognitive areas: Long-Term Memory (LTR), Short-Term Memory (STM), Fluid Reasoning (FR), Auditory Processing (AP), Visual Processing (VP), Comprehension/Knowledge (CK) and Processing Speed (PS).

b. There are no significant differences in reading achievement between the those who are eligible and those who are ineligible for LD services. Achievement scores include the WJTA Broad Reading and Basic Reading Scores and the Nelson-Denny Reading score.
Limitations

This study was limited in that it was descriptive and exploratory and did not investigate causal relationships between variables. It was also recognized that other variables such as previous remediation, previous testing, and overall quality of previous education may have provided additional information regarding factors affecting eligibility. This study was also limited in that findings may only apply to students in a large Midwestern university who were self-referred due to presumed difficulty with academic requirements. It is only with caution that assumptions may be made about these findings relative to students who came to college with an LD diagnosis, those at the university who did not present themselves for testing who may qualify for LD services, and those from different settings such as small colleges and community colleges. Finally, the individual subject scores may have been affected by different test conditions.

Procedures

Descriptive and associational research techniques were used to meet the objectives. The major threat to internal validity is the possibility that extraneous variables not included in the study may explain results. This study is strengthened because the sample used for the study constituted 90% of all students referred and evaluated for LD because of presumed reading related problems. Therefore, the large percentage of accessible population sample utilized helps to ensure that the subjects are representative of the target population.

Analyses were performed using SAS (Kennedy & Tam, 1989). Frequency distributions were used to describe nominal data which included: gender, race, eligibility status (LD vs. non-LD), presence of aptitude/achievement and intracognitive discrepancies, family history, previous academic problems, developmental history, and medical history. Relationships between nominal variables were summarized in contingency tables and the phi coefficient was used to describe relationships between categories. To make inferences to the target population, the chi square statistic was calculated. An alpha level of .05 was used for all statistical tests.

Interval data included age, grade point average, IQ scores, cognitive cluster and subtest scores, and achievement test scores. Interval data were described with means and
standard deviations. Phi Coefficients were calculated for the relationships between interval data and LD category. T-tests were used to determine whether there were significant differences between LD diagnosis groups on selected interval data. Type I error (the probability of rejecting a null hypothesis that is true) was considered throughout the subsequent analysis due to multiple univariate testing.

Summary of Findings

Description of Students Evaluated to Determine Eligibility for LD Services

When compared to the university population of that same time period, the demographic characteristics of college students seeking eligibility for LD were similar to those of the population at the Columbus campus of The Ohio State University (OSU). Table 5.1 compares the demographic breakdown of the sample used in this study with data from OSU's general population in the Columbus campus during the Spring quarter of 1997 (the end of the time period for data collection). As illustrated in Table 5.1, the same percentage of females (49%) and males (51%) were found as in the university population. Similarly, as in the general population where the numbers of those enrolled decreases gradually with age, there was a decrease in the numbers of those evaluated as age increased. There was a difference, however, in the percentage of those tested between the ages of 18 and 21. Although the university population has approximately the same percentage of those who are 18 to 21 compared to those who are 21 to 29, the population in the tested sample had a higher percentage of the younger age group. This is presumably because the university population included undergraduate, professional, and graduate students while the population tested was primarily an undergraduate population. As noted by Hoy and Gregg (1986, as cited by Dunn, 1995) many individuals are not identified until college as the nature and intensity of the work becomes more difficult. Most students are more likely to notice learning disabilities early in college as they are facing these new challenges for the first time. In terms of race, similar to the general OSU population, the overwhelming majority of those evaluated were Caucasian, with other racial backgrounds representing only a small percentage. Finally, when compared to the average G.P.A. of 2.92 for students at OSU for that same period, the students tested had a lower average of 2.38. This is to be expected since students who present themselves for testing are likely to be experiencing
academic problems. With the exception of G.P.A., when compared to the total OSU- Columbus campus population, the sample utilized in this study did not differ significantly. Thus this sample is assumed to be a representative sample for the OSU Columbus campus, and by extension, for Midwestern universities of this size.

<table>
<thead>
<tr>
<th></th>
<th>OSU</th>
<th>ODS Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>male</td>
<td>51%</td>
<td>51%</td>
</tr>
<tr>
<td>female</td>
<td>49%</td>
<td>49%</td>
</tr>
<tr>
<td>Caucasian</td>
<td>76%</td>
<td>74%</td>
</tr>
<tr>
<td>African-American</td>
<td>7%</td>
<td>8%</td>
</tr>
<tr>
<td>Hispanic</td>
<td>1%</td>
<td>2%</td>
</tr>
<tr>
<td>Asian</td>
<td>5%</td>
<td>1%</td>
</tr>
<tr>
<td>Race other or unknown</td>
<td>16%</td>
<td>15%</td>
</tr>
<tr>
<td>Age 18-21</td>
<td>42%</td>
<td>55%</td>
</tr>
<tr>
<td>Age 22-29</td>
<td>41%</td>
<td>34%</td>
</tr>
<tr>
<td>Age 30-64</td>
<td>16%</td>
<td>10%</td>
</tr>
</tbody>
</table>

Table 5.1: Comparison of percentages of students evaluated by ODS with OSU Columbus campus population on gender, race, and age

In terms of significant background history, it was found that out of those evaluated, 133, or 86% reported significant background variables. Many of those tested had more than one significant background variable. The most common background variable reported was that of previous academic problems such as retention, reading problems, previous testing, and grade retention. This is what would be expected of a group who would present themselves for testing for LD eligibility, since they are likely to have been struggling with learning issues for most of their academic life. Those students for whom learning problems are a relatively recent phenomenon would be less likely to be tested as they are likely to
have a higher degree of confidence when it comes to their academic ability and their ability to work through difficulties that may arise. Research in the area of achievement motivation may explain why many students who have had difficulty in the past look for a disability rather than towards their style of learning as an explanation for their difficulty. For example, Henderson and Dweck (1990), in describing a relationship between the beliefs that an individual holds and the coping model they display, found that those with mastery-oriented patterns believe that intelligence and achievement are flexible and not fixed traits, and they will have the confidence to turn academic setbacks into opportunities to learn and to discover ways in which they can be successful. Therefore, they will more often be successful even when faced with limited intelligence or ability. Conversely, those with a helpless approach may have seen failures as reflective of a fixed trait such as low intelligence or a learning disability. This will lead to more academic failure as they give up rather than work their way through difficulties. This premise may better be explored through a comparison of the academic background of the general college population with those seeking LD services.

Of the 156 university students in this study, almost half (77 or 49.4%) were found eligible for LD services. Approximately 46% of the total sample had a discrepancy between aptitude and achievement and a much lower percentage were found to have an intracognitive discrepancy. These findings are similar to the findings by Brackett and McPherson (1996) where, using a similar population and sample size, they found 59% of the sample to be eligible for LD services and 65% of the sample with aptitude/achievement discrepancies. In regards to intracognitive discrepancy, however, the present study found a much lower percentage overall of students evaluated with this type of discrepancy (38.5%) compared to approximately 64% found by Brackett and McPherson. This difference may be accounted for by the use in this study of the WJTCA Cluster scores measuring cognitive ability, which are more reliable (median reliability ranges from .82 to .95) than the WAIS-R individual subtests used by Brackett and McPherson (median reliability ranges from .68 to .89 with the exception of Vocabulary with a reliability of .96). Because of the higher reliability of the WJTCA Cluster scores, there is less
probability that differences will be found by chance. Brackett and McPherson's findings may have overestimated the significance of differences between subtests in identifying intracognitive discrepancy.

On standard measures of both $g$ and factor scores representing subfactors, the population tested did not differ significantly from the group on whom the tests were normed, and therefore one can presume the ability of those tested is representative of a normal population. All mean scores for measures of cognitive ability for the population tested were within the average range. This is surprising, since the students tested have all successfully completed high school and been accepted into a four year university. Because of their higher level of education, it is expected that their scores would be higher than the general population, since studies have shown that average WAIS scores for individuals with lower levels of education are lower than scores for individuals with higher levels of education (Wechsler, 1981). It is presumed that the average IQ scores may be a factor in many of the student's academic difficulties, rather than a specific learning disability. It could also be hypothesized that many of the student's IQ scores could have been negatively affected by direct and indirect effects of their learning disability. This will be discussed later in this chapter.

Finally, the mean standard scores for measures of reading achievement for the population tested varied. While the WJTA Broad and Basic Reading scores were within the Average range, the mean score on the Nelson-Denny was within the Low Average range. The lower Nelson-Denny means are to be expected since lower scores on the Nelson-Denny during the screening phase of the testing process at OSU are a prerequisite for further testing. This finding is also comparable to Hughes and Smith's (1990) finding that LD college students tend to have difficulty with speed and comprehension. The task required of the Nelson-Denny, that of reading longer passages and answering questions in a short amount of time, is more similar to what is required of colleges students than tasks required on WJ-R reading subtests. It is likely that those students who have difficulty with this type of task would present themselves for testing because of the academic challenges that poor reading speed and comprehension would present at the college level. Since there was no significant difference between LD and non LD students found in this study on this
measure, it is believed that this difficulty is what prompts the college students to seek help. It does screen for students at risk for reading problems but does not differentiate LD from non-LD students.

It is also not surprising that in this study the WJ-R reading scores were within the Average range, lower than what would be expected for reading achievement for college students who are expected to have at least high average skills to succeed in college. Again, the students who present themselves for testing generally described their difficulty in school as related to reading. They are likely to be struggling with reading tasks that include closure tasks, decoding, and word recognition tasks similar to those that are required on the WJ-R reading subtests. The differences between LD and non-LD groups on these measures will be discussed later as the LD students’ mean score on the WJ-R Basic reading subtest was significantly lower than the non-LD group. Therefore, it may give us more information about on what type of tasks LD students are likely to have more difficulty than their non-LD peers.

**Relationships Between Presence of Aptitude/Achievement, Intracognitive Discrepancy and Eligibility for LD Services**

This study attempted to determine which discrepancy model, if any, most strongly predicted eligibility for LD services using the clinical model. Even though the population found eligible for LD services at OSU had been identified using a clinical model, it was still the presence of the aptitude/achievement discrepancy, rather than the presence of an intracognitive discrepancy or any background variable, which more strongly predicted eligibility for LD. However, this was not used as the only criteria for eligibility, as the strict application of the aptitude/achievement discrepancy as the only means of identification would have identified fewer students for LD than did the clinical model used by OSU. Of the students tested, 49% of the students were found eligible for LD services, and 46% had an aptitude/achievement discrepancy. Seventy-five percent of those who qualified for LD had an aptitude/achievement discrepancy, and only eighteen percent of those who did not qualify for LD had a discrepancy.

How do these findings compare to similar studies? When compared to two similar studies, the findings are variable. In a study looking at eligibility of adults for LD in a
rehabilitation setting. Hoy and colleagues (1996) compared the clinical model to a regression aptitude/achievement model and found, similar to this study's findings, that the regression-based discrepancy diagnosis identified a smaller proportion of subjects as learning disabled than the clinical model. In that study, 67% of the total evaluated were found eligible through the clinical model, and only 46% would have been found eligible if discrepancy was the only criteria. In contrast to the present study, where a majority of those who qualified for LD through the clinical model had an aptitude/achievement discrepancy, for Hoy and colleagues, the number of those who had a discrepancy was the same as the number who did not have a discrepancy for those who were found to be eligible for LD services through the clinical model. In addition, a much larger percentage (38%) of those who did not qualify for LD through the clinical model had a discrepancy (compared to 18% in this study). Therefore, aptitude/achievement discrepancy was not correlated with clinical eligibility for LD in the Hoy and et al. study as it was in this study. Both methodological and population variations could account for these differences. In contrast to the college population used in this study, the Hoy et al. study utilized a much smaller population, from a vocational rehabilitation setting. Although information from cognitive tests was utilized in the clinical process, there was no information given regarding the relationship of this information to eligibility. Because the overall rate of those who had aptitude/achievement discrepancies was relatively high, the diagnosticians may have had to rely more on clinical information and intracognitive discrepancies to differentiate underachievement due to LD from underachievement due to background and personal variables.

In Bracken and McPherson's study (1996), four different discrepancy models were compared to a clinical model. Because there was little agreement between discrepancy models and eligibility found in this study, comparisons are made using a model similar to the one used in this study where standard scores on measures of achievement and ability are compared. In contrast to Hoy et al. (1996), and to the present study, the aptitude-achievement discrepancy method alone identified a larger proportion of students as disabled than did the clinical model (64% using aptitude/achievement and 57% using the clinical model). Similar to Hoy and colleagues, but in contrast to this study where a majority of those who qualified for LD through the clinical model had an aptitude/achievement
discrepancy, there was little difference in the number of those who had discrepancies compared to those who did not in the clinical LD model. Finally, Brackett and McPherson found a much larger percentage of those who did not qualify who had a discrepancy. When comparing presence of aptitude/achievement discrepancy and LD eligibility, Brackett and McPherson found a substantially lower correlation (.38) than was found in this study (.58).

In summary, when compared to similar studies, the relationship between aptitude/achievement discrepancy and LD eligibility in this study was generally stronger. Although this discrepancy was not always predictive of LD eligibility, it was a relatively strong predictor. There could be two reasons for this outcome. The first, as found by Kavale (1987), is that, even when other factors are considered, evaluators tend to give more weight to discrepancy data than to other clinical data or evidence of academic problems. As Stanovich (1993, p.276) states, discrepancy is "the key defining feature" in the diagnosis of reading disability, even within a clinical model of assessment.

The second reason may be that the aptitude/achievement discrepancy, or underachievement is a defining characteristic of college reading LD and it is on this basis that students with a learning disability can generally be differentiated from students without a learning disability. Despite the controversy surrounding the use of the aptitude/achievement discrepancy model (as discussed in Chapter 2), McGrew and colleagues (1977) did find that the relationship of $g$ (general intelligence) to reading achievement is significant and strong across all levels. Therefore, it could be reasonably expected that a discrepancy between $g$ and reading achievement is unexpected and therefore, a strong indicator of possible disability. Because it is not always a predictor of a learning disability, and because of the overwhelming research citing statistical and construct validity issues raised with using a discrepancy model, one can assume that finding a discrepancy is one clue to a possible reading disability, but it is not sufficient to diagnosis a reading disability with discrepancy alone. Because of that limitation, this study also looked at what other factors may be involved to help to differentiate underachievement from a reading disability.
In this study, it was found that the presence of an intracognitive discrepancy, another factor frequently utilized in determining a LD, is not a strong predictor of LD eligibility since there is a weak correlation (.22) between ICD and LD. Of the total tested, only 38% had an ICD. Again, the clinic model found more students eligible for LD services (49%) than would have been found using the ICD model alone (38%). A smaller percentage (49%) of those who qualified for LD had an ICD compared to the percentage of those who qualified who had an aptitude/achievement discrepancy (75%). Similar to what was found with the aptitude/achievement discrepancy, a relatively small percent of those who did not qualify for LD had an ICD (26%).

When this is compared to Brackett and McPherson's 1996 study using intracognitive discrepancy, at first glance, the results look somewhat different. While this study's clinic model found more students eligible for LD services than would have been found using only an ICD model, Brackett and McPherson's study found more students with ICD's than qualified for services. In their study, a larger percentage of both those who qualified (67%) and did not qualify (56%) for LD had an ICD than in the present study. Brackett and McPherson found a larger percentage of those tested overall had an intracognitive discrepancy, which would account for the differences in percentages in the LD population. What is similar is the correlation between ICD and LD eligibility in both studies. The correlation in the Brackett and McPherson's study was .24 compared to .22 in this study. Therefore, it can be assumed that the presence of intracognitive discrepancy alone using both the WAIS and the WJTCA is not a reliable predictor of LD in the college population.

Relationship Between Selected Background Variables and Eligibility for LD Services

When presented with discrepancies which may indicate a risk factor for LD, most clinical approaches attempt to further build a case for qualifying a student for LD by looking at background variables. In this study, there was no significant correlation found between those who were eligible for LD services and the presence of selected background variables. As discussed previously, the majority of those tested had previous academic problems, and this was similar for both LD and non-LD students. Similar percentages of both LD and non-LD students had a significant medical history. The rate of those who
reported developmental problems was also similar, and surprisingly, slightly less than for the LD group (10% for LD, 14% for non-LD). Finally, similar percentages of LD (35%) and non-LD students (36%) had a family history of LD.

The fact that the presence of previous academic problems was not correlated with LD is not surprising since, as discussed earlier, this is presumably what brought the subject for testing in the first place. For many of these students, this is part of a lifelong pattern of learning difficulties which may be exacerbated upon reaching college. Therefore, while the presence of previous academic problems is a risk factor for LD, it does not necessarily separate LD from non-LD in this population.

The finding that family history is not correlated with LD eligibility is not what is expected in light of what research has found regarding reading LD. According to Shaywitz (1998), developmental dyslexia is both heritable and familial. Family history is one of the most important risk factors, with a rate of 27% to 49% of parents and approximately 40% of siblings of affected children having been identified as having dyslexia. The lack of findings in this study may be a result of the older population and the relatively new field of learning disabilities. Many of those who were eligible for LD services may have had parents with learning disabilities who were not diagnosed, since little was known about LD and few services were available in the previous generation. Therefore, the lack of significant correlation with family history in this study should be interpreted with caution based on a substantial body of research which points to the heritable nature of LD (e.g. Pennington & Gilger, 1996, as cited in Shaywitz, 1998).

In terms of developmental history and medical history, at first glance, the lack of a correlation to diagnosis of LD is also somewhat surprising. A review of research points to many biological and early developmental markers which may predict later learning problems (Taylor, 1989). According to Taylor, the biological factor of the most direct relevance to learning problems is neurological history. Children who have had head injury, central nervous system infections or tumors, pre- or perinatal neurological problems, epilepsy, or central nervous system irradiation are at a higher risk for learning problems. Other medical problems having less direct effects on learning are chronic illnesses, defects in vision or hearing, and medication side effects. Indeed, many of the subjects in the study
who presented themselves for testing reported head trauma, birth problems, chronic ear infections, and early visual problems, however, the majority of those tested did not report medical problems. Moreover, the presence of medical history did not differentiate LD from non-LD eligibility. The incidence of those who reported developmental problems was significantly lower than for significant medical history, so one can presume that many of the medical problems reported had little obvious effect on the subject’s overall cognitive or motor development in their early years.

Taylor (1989) does caution however, that the relationship between biological markers and learning disabilities is a weak one since there are many disabled learners for whom no marker is present and there are many normal learners who have significant developmental and medical histories. Research points to the strong effect of environmental factors such as socioeconomic opportunity, cultural-familial make-up, and academic environment (Keogh, 1982, as cited in Taylor, 1989). Therefore, while early medical and biological factors may be a marker, the association is weak and the presence of these factors is not enough for differential diagnosis of LD. The lack of correlation in this study of these factors with LD is therefore, not necessarily an artifact of this study, but an illustration of the lack of clear association between these factors and LD. In addition, the lack of association may also have been impacted by reporting errors on the part of the subjects. The subjects were mainly relying on their memories or of anecdotal histories told to them by their parents. The association between early medical and developmental history and LD would have been better researched by obtaining medical records and questioning the subjects’ parents regarding medical and developmental history.

**Relationship Between Demographic Background and Eligibility for LD**

The strongest finding regarding demographic background and LD was that more males than would be expected by chance were found eligible for LD than woman. In this study, approximately 69% of those identified LD were men, compared with only 31% female. This is not surprising in light of research regarding gender and LD. According to Finucci and Childs (1981, as cited in Taylor, 1989) more males are identified LD than females by a ratio of between 2:1 and 5:1. Apparently, these differences are consistent for the college LD population, as according to Henderson, (1995), 59% of those with a reported
LD were male. Studies of the college LD population have consistently found that the majority of college LD students were male (Brackett & McPherson, 1996; Delaney-Duggan, 1992; Wilczenski & Gillespie-Silver, 1990).

While research and conventional wisdom holds that the majority of those who are LD are male, there is a separate body of literature on childhood LD (Vogel 1990, Hassitt & Gurrian, 1984, as cited in Ross-Gordan, 1996) which holds that teachers are more likely to place a priority on referring boys suspected of having learning disabilities than on girls presenting with similar profiles and that teacher attitude may play a significant role in the identification of learning disabilities among males and females. This referral bias may affect representation of LD in the adult population as well. The variable of gender in the adult and college LD literature has received limited attention. Vogel and Walsh (1987, as cited in Ross-Gordan, 1996) reported that a greater proportion of females were excluded from their study of college LD on the basis of IQ criteria. They also reported that the cognitive ability patterns for males and females were different and the cognitive profile for males most closely resembles research on samples of younger individuals with LD, which are typically predominately male. This caused Vogel and Walsh to question whether much of what is known about learning disabilities is primarily describing the male portion of the LD population. Therefore, there may be distinct cognitive patterns of functioning for females which may be affecting identification across the age groups. More research is needed to better understand the effect of gender on LD.

As to the finding that those who qualified for LD were significantly older than those who did not qualify, one can only speculate on why this occurred, since there are few studies which provided data on age at the college level and no studies with similar findings. It is hypothesized that since the majority of those who were tested were between the ages of 18 and 21 and not representative of the students who qualified for LD (with an average age of 24), many of the students who were tested for LD at younger ages were not found eligible due to factors surrounding underachievement, rather than actual learning difficulties. Many younger students are not used to the pressures of college life and may not have developed sufficient study skills to adequately meet the demands of academics at the postsecondary level. For these students, it is study skills and learning strengths and
weaknesses, rather than actual learning disabilities, which may be the crux of their difficulties. Even if discrepancies were found between achievement and aptitude, these students may not have been found eligible because poor study skills and effort were primarily impeding achievement and study skills intervention may have been recommended rather than LD eligibility. In contrast, the older student who has been in college a few years, has presumably been able to gain at least adequate study skills and may have tried interventions such as tutoring and study skills help; the diagnosis of LD may be more easily made as other explanations such as poor study skills and lack of interventions have been ruled out.

Differences in Cognitive and Achievement Scores Between LD and Non-LD Groups

There were several significant findings regarding the differences in cognitive scores among LD and non-LD groups. First, students who were found eligible for LD services had significantly higher scores on measures of general cognitive ability and both verbal and non-verbal ability as measured by the WAIS-R. Both verbal and non-verbal IQ are highly correlated with the WAIS-R Full Scale IQ, therefore it is expected that if general IQ is higher, verbal and non-verbal scores would be higher as well. LD students also had higher scores on the Fluid Reasoning (FR) and the Comprehension/Knowledge (CK), (a measure of crystallized intelligence) clusters of the WJTCA. For these scores, with one exception (the Fluid Reasoning score for non-LD was 103 and for LD, 109), the LD group mean was over 100 and the non-LD group mean was under 100. In fact, of all the cognitive areas measured, except short-term memory and auditory processing, the LD group mean was higher than the non-LD group mean. This finding is similar to the findings of many researchers (i.e. Brackett & McPherson, 1996, Hughes & Smith, 1990) that ability-achievement discrepancy models at the college level identify as LD more individuals with IQ scores higher than 100 than those lower than 100. Given that discrepancy theory is based on the degree of difference between IQ and achievement, it is expected that the greater the IQ for those struggling academically, the greater the chance of being identified LD. The concern however, as discussed in Chapter 2, is that this method of identification generally tends to ignore those with lower IQ’s for whom the discrepancy may not have been as great but who may also have specific learning disabilities. For these students, at first glance, it
would be assumed that they are working at the same level as their ability, and therefore it is a general cognitive limitation, rather than a specific LD which is negatively impacting achievement. However, this does not take into effect the Matthew Effects discussed by Stanovich (1993) which holds that the effects of the LD may depress overall IQ. These students may have specific processing deficits or the overall effect of the LD may have pervaded many areas such as vocabulary and verbal expression which in turns, lowers IQ.

When the LD and non-LD group WAIS-R Full Scale scores are compared to the group Extended Broad Cognitive Scores (BC) on the WJTCA, (another measure of g), more credence is given to the finding that the clinical method utilized to diagnosis LD for this population may have overidentified those with higher IQ's. When looking at these average scores for all subjects who were tested, there is little difference. While there are differences in the WAIS-R Full Scale score between LD and non-LD groups, there is not the same difference between groups on the BC. For both LD and non-LD groups, the BC score is almost exactly at the Average range (98 for non-LD, 101 for LD), similar to the average BC score for all subjects tested. The reason for this similarity between groups may be because of the method used to diagnosis LD. Because the WAIS-R FS, rather than the WJTCA BC score was the aptitude score from which achievement was measured, the WAIS-R and not the BC reflects the finding of over identification of those with higher IQ's in determining LD. Because the BC score was used only for comparison with WJTCA cluster scores for intracognitive discrepancies, and was not the score from which achievement was measured, little difference in ability was found between LD and non-LD groups using the BC scores as a measure. This may be a more accurate reflection of the actual ability of both groups. It may be that groups are actually similar when it comes to ability. One wonders if the use of the Broad Cognitive Score rather than the WAIS-R score for discrepancy determination, would have resulted in a significantly higher Broad Cognitive average for LD than non-LD students.

While it may also be hypothesized that the lower WJTCA BC score for the LD group compared to the WAIS-R FS score may be a result of content differences between the two instruments, analysis of data presented by McGrew does not support this contention. When McGrew (1994) compared the Wechsler scales with the Woodcock-
Johnson scales (WJTCA) he found that the WJTCA content contains seven of the eight Gf-Gc factors. The only factor missing is Gq (quantitative). The Wechsler scale includes only five of the factors. Although there has been a misconception that the WJTCA Revised has more achievement content, it actually has three to four times less achievement content than the WAIS-R, therefore it would logically be expected that the LD group would have a lower WAIS-R score than BC score given that there is so much more achievement content. Since this is not the case, it may expected that the additional aptitudes measured by the WJTCA may be lowering the score. Clusters reflecting these aptitudes are Long-Term Retrieval (LTR), Fluid Reasoning (FR), and Auditory Processing (AP). Again, this contention is also not supported, since no significant differences were found between groups on LTR and AP, and the FR was significantly higher for the LD group.

In summary, it is suspected that the finding of higher Full Scale, Verbal and Performance WAIS-R scores for the LD group was affected by the method of determining discrepancy, rather than any inherent differences in IQ between LD and non-LD groups. The lower Extended Broad Cognitive Score from the WJTCA for the LD group may be because this score was not used to determine the degree of discrepancy. This finding is disturbing and in need of further exploration since it illustrates the potential for disregarding many bright students with seemingly average ability when determining the presence of a learning disability.

Another finding regarding IQ scores is that although the difference between Verbal and Performance IQ scores in both the LD and non-LD groups was not significant, for both groups, the Verbal IQ’s were somewhat lower. This finding may be illustrative of the fact that all of the students tested were having difficulty with reading, which is often correlated with verbal expression and vocabulary. Again, the “Matthew Effects” (Stanovich, 1993) related to the reading difficulty may have been lowering Verbal IQ scores.

Differences between groups on two relatively strong predictors of reading achievement, Auditory Processing and Short-Term Memory, failed to achieve significance, although the LD group average was lower than the non-LD group average. It is surprising that the Auditory Processing difference failed to achieve significance given the significantly lower Basic Reading skills for the LD group. McGrew (1994) found that auditory
processing abilities have clear relationships with reading achievement, particularly with Basic Reading Skills. However, this relationship is strongest in the early years and gradually decreases with age until age 30, when it begins to increase again. This may account for the lack of significance. Although the relationship between auditory processing and basic reading is not as strong for the college age population, the effects of difficulty with auditory processing may be indirect at the college level as the cognitive model described by Spear-Swerling and Sternberg (1995) suggests. The college age student's difficulty with comprehension may be a result of early difficulties with phonological processing and word recognition which has affected reading fluency, and thus comprehension, in the present.

Although McGrew (1994) also found that Short Term Memory, Processing Speed and Comprehension-Knowledge WJTCA Clusters are strongly related to reading skills, the differences in this study between LD and non-LD groups do not reflect these relationships. There was no significant difference found between groups on Processing Speed and Short-Term Memory. Surprisingly, the LD group's Comprehension-Knowledge (CK) score was significantly higher than the non-LD group. This is in contrast to the finding by Delaney-Duggin (1992) that CK Cluster scores for the both newly and previously diagnosed LD groups was lower. The results in the present study are particularly surprising in light of the increasingly strong relationship between CK and both basic reading skills and reading comprehension with age. One would expect CK to be strongly related with reading as prior knowledge and verbal abilities are important in the development of reading comprehension (Lohman, 1989; Mather, 1991; as cited in McGrew 1994). Because this finding is so contrary to what research would support it is worth exploring in more depth in subsequent studies.

A significant difference between groups was found on the Fluid Reasoning (FR) subtest of the WJTCA with the LD score significantly higher than the non-LD score. This is in contrast to Delaney-Duggin's (1992) findings in which FR for the non-LD group was significantly higher than FR for both newly diagnosed and previously diagnosed LD. This difference may be due to the fact that Delaney-Duggin's population included all types of LD, not just reading LD. The Fluid Reasoning Cluster measures the ability to solve non-
verbal problems in novel situations. According to McGrew (1994), performance on this subtest is moderately related to Reading Comprehension from age 5 to 30 because of the use of reasoning to understand concepts and to organize and classify ideas in text (Mather, 1991, as cited in McGrew, 1994). It is unrelated to Basic Reading skills. McGrew states that the decreased association between Fluid Reasoning and reading comprehension along with the information about the association with Comprehension-Knowledge and reading comprehension suggests that "prior verbal knowledge becomes more important than fluid reasoning abilities for reading comprehension beyond this age" (p. 118). Fluid Reasoning is most strongly related to mathematics achievement. Therefore, it is also likely that the LD group has better developed mathematics achievement than reading achievement. This is consistent with the fact that students with specific reading disabilities usually do not have commensurate weaknesses in mathematics, unless language-based problems are having an effect. For this cluster, neither subtests required the use of language, both used non-verbal cues.

Finally, differences between groups in this study were found on the average score for the WJTA Basic Reading Test, a measure of word identification and decoding. The score for the LD group was significantly lower than the score for the non-LD group. This finding indicates that the students who qualified for LD generally had more difficulty with their basic reading skills. Within the context of Cognitive Model of Reading Disability (Spear-Swerling and Sternberg, 1995), this makes sense. For those who have been struggling with reading difficulties, the origin of these difficulties can be found in the initial difficulty with phonological processing and decoding skills. Although all of these students learned to read adequately enough to complete high school, these basic skills are impacting their achievement.

No significant differences were found between groups on the Broad Reading Cluster (combines reading comprehension and basic reading skills) or the Nelson-Denny, a measure of reading comprehension and speed. This is in contrast to Hughes & Smith's (1990) and Blalock and Johnson's (1987) finding that the area of greatest difficulty for college students is comprehension and reading rate. The lack of differences between Broad Reading scores may be a result of the type of test utilized for reading comprehension. The
Passage Comprehension subtests uses short passages where students are asked to fill in the missing word based on their understanding of the passage, a task that requires the use of context cues and vocabulary. The other test of reading comprehension requires the subject to give antonyms and synonyms to words, requiring adequate vocabulary. These tasks are unlike the longer and more complex reading required at the college level, where students must read a large amount of material within a short time. Successful college students must be able to remember the major points of what is read, draw inferences from the material, and apply what is learned through reading to problem-solving. These skills are not tested well by the WJTA. Therefore, even with problems with reading comprehension, college students are able to score in the average range on the reading measures of the WJTA. On the only measure of reading comprehension which is somewhat similar to what is expected at the college level, the Nelson-Denny, both groups scored significantly low, in the Low Average range, indicating that this type of reading task is difficult for the majority of the students tested. However, the groups did not differ on this measure. As stated previously, this measure is a good screening instrument for reading difficulty, but does not differentially diagnose reading LD at the college level.

**Implications and Future Directions**

This study finds that those who refer themselves for testing for a reading learning disability at The Ohio State University are generally male, Caucasian students with C averages. A majority of the students have had previous significant academic problems and may be feeling overwhelmed and helpless when attempting to develop new strategies for success in college. Thus, they turn to LD testing as a possible explanation for their lack of academic success. Of those who are tested, however, only about half are found to be eligible for LD services. Again, about half of these students have a discrepancy between aptitude and achievement and it is this type of discrepancy, over and above intracognitive discrepancy and background variables, which predicts whether a student is found eligible for LD services. While this may be indicative of underachievement in reading, many other factors still need to be considered when determining whether this underachievement is the result of a learning disability.
Of primary concern, the finding in this study regarding the over identification of those with higher IQ’s, needs to be considered. Although OSU uses a clinical model and considers other background information, based on these data, it is presumed that the aptitude/achievement discrepancy was given more weight than other data about the student. Moreover, there is a strong concern that those with high IQ’s were overidentified as LD and those with lower IQ’s may have been left without needed services for their reading disability. This means that when using discrepancy model, those with higher IQ’s and presumably better compensatory skills may be getting services and unfair advantages with accommodations over those who have fewer compensatory skills and for whom their disability has a pervasive impact over many cognitive areas.

Because it has been found that the type of eligibility model has a direct impact on who is identified as LD, the discrepancy model used at OSU needs to be further explored to determine its validity. The OSU model utilizes comparisons of performances on tests which have not been co-normed which also impacts the validity of the approach. Since the use of the WJTPA is highly recommended over the WAIS-R for ability testing because of the depth and breadth of abilities measured, and because the WJTPA relies less on academic content, it is recommended that this measure, rather than the WAIS (now WAIS-III) be utilized for the aptitude/achievement discrepancy. This alone, however, does not solve the other problems inherent with aptitude/achievement discrepancy nor the tendency for diagnosticians to overuse this criteria when determining a learning disability.

McGrew and his colleagues (1997) make several recommendations which are germane to the practice of assessment for learning disabilities in the college population, address some of the weaknesses of present models of diagnosis, and fit well with the clinical model. First, they recommend that practitioners may need to broaden assessments beyond the typical intelligence test to those measures that are designed to specifically measure the breadth of Gf-Gc abilities such as the WJTPA or to utilize more than one battery, a "cross battery" assessment approach (Flanagan & McGrew, 1997). Second, practitioners should consider more focused and selective intellectual assessments. For example, since there has been no effect found in the reading research of Gv (Visual Processing) on reading achievement, this calls into question the value of spending much
time assessing $Gv$ for reading-related referrals. Third, the focus on interpretation of abilities should not be on specific subtests which focus on the smallest portion of a test's reliable variance, but should be replaced with cluster interpretation, which utilizes two or more strong indicators of each broad $Gf-Gc$ ability and is more reliable. This is a strength of the OSU models, since it uses the WJTCA Cluster scores which increases the validity of the constructs measured. Fourth, practitioners should recognize that valid interpretation should take into account the function of curriculum and developmental stages. For example, they should pay close attention to $Gc$ abilities as they relate to reading comprehension skills in older students.

A cross-battery approach such as described by Flanagan & McGrew (1997) can be easily fit within the clinical model of assessment. Standardized instruments can also be supplemented with curriculum-based assessment to be more accurate about where the area of difficulty is. The use of a convergence of evidence towards a conclusion which is well-grounded in theoretical support, should be the hallmark of assessment for LD at any level, but particularly, when assessing adults for LD. This, rather than a formulaic approach with rigid boundaries for diagnosis, will lend itself to a more accurate and reliable diagnosis.

Finally, the contradictory nature of the results regarding test score differences between groups in this and other studies points to the strong need to continue to research the field of college LD. Since the numbers of those seeking LD services is likely to continue to rise, more research is needed about what, if any, are the consistent and more reliable predictors of LD. At this point, there has been no consistent evidence of a reliable "LD profile" separate from the normal population, which can be identified through testing. This is probably because of the many differences between those with LD, but it is also likely that it is use of instruments for diagnosing LD which are not designed for that purpose. At this point, there are no instruments which can reliably measure LD, and there may never be such instruments. Instead of focusing on formulas and distinct profiles, it is important to examine patterns of functional academic strengths and weaknesses, and to focus research on smaller subtypes. Continuing to separate reading LD from other LD groups is imperative, as reading LD is generally a distinct subgroup, with different functional manifestations and underlying causes. Research with students with reading
Difficulties should be further broken down by subgroups such as decoding and word identification difficulties compared to reading comprehension difficulty, following the generally accepted theories of reading disabilities, in order to learn more about the separate correlates of these difficulties.
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